DOCTOR OF PHILOSOPHY

Development of a framework for building cost information management in Nigeria

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Award date:
2022

Awarding institution:
Coventry University

Development of a Framework for Building Cost Information Management in Nigeria

By

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A thesis submitted in partial fulfilment of the University's requirements for the Degree of Doctor of Philosophy

School Energy, Construction and Environment

Faculty of Engineering and Computing

FEBRUARY 2022

Certificate of Ethical Approval

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Project Title:

DEVELOPMENT OF A FRAMEWORK FOR BUILDING COSTS INFORMATION MANAGEMENT IN NIGERIA

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Date of approval:

03 April 2019

Project Reference Number:

P89781

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ABSTRACT

There are various factors that influence successful delivery of building construction projects such as cost, quality, time, project objectives etc. As such the success of a project should not only be based on quality output but also on project cost objectives and time. Review of literatures in the study area revealed that one of the main issues of building cost management in Nigeria is inaccurate building cost estimation due to unreliable cost information. To address these inherent limitations of building cost management, several studies have recommended the development of a database for building cost information that better addresses the demands for reliable and accurate building cost information. The thesis presents the development of a robust building cost information management framework to aid building cost estimation and project cost management processes in the Nigerian construction industry by exploring current cost management practices and investigating the underlying factors affecting building cost variances.

The methodology adopted for this study involved literature review and mixed method approach combining qualitative, quantitative, and documented building cost data. The quantitative data was obtained using an online questionnaire survey from 37 respondents to determine the underlying factors influencing building cost variances across different regions in Nigeria. In addition, semi-structure interviews were used to investigate current building cost estimation issues and perceptions of quantity surveyors on building cost management practices in Nigeria. Finally, documented building cost data from eleven completed building projects across the six geo-political regions in Nigeria were used to investigate impact of types of clients on final building costs.

The combination of quantitative survey data and qualitative interview data enabled the use of a range of analysis strategies and statistical techniques such as T-test analysis, Pearson correlation analysis, inferential statistics, and content analysis.

Emerging findings revealed that the Nigerian construction industry currently has no reliable building cost information database for cost estimation and appraisal.

A building cost information framework was developed based on the identified functional cost requirements from historical building cost data and no other aspect of construction, hence cost of other aspect of construction was not explored.

This thesis attains a significant contribution to knowledge by the identification of factors affecting building cost management and development of a framework to address some of the issues of building cost variances in Nigeria.

Keywords: Cost information, Management, Estimation, Nigeria, Cost Variance, Building Cost Information Management.

DEDICATION

This thesis is dedicated to my beloved husband, Olatunde Banwo, my precious children, Nathan and Jesse, my parents Mr and Mrs Ahutu, and my siblings. I love you all and I do appreciate your love, care, and support throughout my research journey and beyond. God bless you all immensely.

ACKNOWLEDGEMENTS

Sincerely, I am grateful to God almighty for his mercies and grace that saw me through this doctoral research journey. It has indeed been a challenging yet interesting journey. I am thankful to have been surrounded by caring and supportive people that made the journey worthwhile. I am sincerely grateful to everyone who has been part of this well-meaning experience.

I wish to express my gratitude to Dr George Agyekum-Mensah, my former director of studies for his meticulous supervision and constructive criticisms that help shaped my thesis throughout my first and second year of research. I would also like to thank my friends and colleagues for their support.

My special appreciation goes to Dr Andrew Arewa, my Director of Studies for tirelessly guiding me and supporting me through the meandering path of this study and not giving up on me. I am eternally grateful to you. God bless you immensely.

This study has been emotionally and financially demanding and many thanks to my darling husband, Dr Olatunde Banwo and my adorable children, Nathan, and Jesse for standing with me and making the research worthy, your smiles and appreciations have really been my motivation through this PhD journey. You all are my life treasure and I love you.

To my Mum and Dad, thank you for always standing with me in prayers and always encouraging me that I can do this, thank you mummy for calling me almost every day throughout my research journey, those calls meant a lot to me. To my beloved mum in-law, Mrs Adeboyin Banwo, thank you for your love, support, and prayers, I can't thank you enough.

I would like to appreciate Avosuahi Ahutu, thank you so much for your relentless prayers and encouraging words, thank you for always cheering me on. God bless you.

I would also like to thank my exceptional sister in-law, Folake Banwo-Jayeola for being there through this journey. I love you and God bless you. To all my siblings, friends, and colleagues, I truly appreciate your support and love. You all have been incredible. God bless you all.

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Introduction to the study

1.0 Introduction

This chapter presents the background to the study and the problem under review. It provides an overview of the work done, methodology adopted, study justification and intended contribution to the existing body of knowledge in the field of construction management. It also outlines the research objectives; research aim and research questions. The significance of the study, rationale for the study, scope and limitation, research process and structure of thesis are all discussed in this chapter.

1.1 Background to the Study

The construction industry plays a vital role in the development and economic improvement of a country (Malkanthi et al. 2017). Hence it is an essential component of any economy. It is imperative that building construction projects are delivered according to their set goals and objectives (i.e., in terms of cost quality and time). However, given the complex nature of the construction industry, it is faced with several challenges, one of which include cost overrun (Abdul-Rahman, Memon and Abd Karim 2013). According to Allahaim and Liu (2012), cost overrun, and high cost of building projects are common problems in building construction projects both in developed and developing countries. They evaluated construction project across 20 nations in 5 continents which all revealed significantly high cost overrun. Similarly, Flyvbjerg, Holm and Buhl (2004) reported that majority of construction projects are completed at a higher cost than originally estimated. However, in many cases, cost of building projects in most of the developing countries have been observed to exceed initial budget by 100% (Memon *et al.* 2013). A report by Saidu and Shakantu (2017) revealed a wide gap comparing the rate of cost overrun in developed countries such as the United Kingdom and USA to similar projects in developing countries such as Nigeria and Ghana. One of the key factors responsible for this gap is the absence of a reliable cost information at the early stage of building projects (Elinwa and Silas 2013).

Several studies have been carried out in the field of cost estimation and cost management for construction projects in Nigeria; a major outcome of which is identifying the underlying factors influencing cost performance of building projects. Also, some studies have examined the reliability of the sources of building cost data and their respective degree of influences on building cost management.
All these discoveries have spurred an argument among professionals and stakeholders in the construction industry on how to reduce high cost of building projects.

Also, Fagbenle *et al.* (2018) suggested that one of the major challenges faced by construction professionals is the inaccurate estimation of building cost which could be linked to the use of unreliable sources of cost information. They argued that most of the building cost estimation are prepared by independent quantity surveyors/contractors and there appears to be significant disparity in building cost information of projects of similar sizes and shapes. This is because cost estimators often have no sufficient cost information required that will enhance strategic cost decision to reduce cost-related risks to an acceptable level in conceptual cost estimation (Hoon An, Cho and Lee 2010). Several contemporary authors have argued that obtaining reliable building cost information for planning and cost management is not just a pre-tender estimation but also offer a control technique during building design stage (Ashworth 2004; Ashworth and Hogg 2007; Kirkham 2007; Smith and Jaggar 2007; Ashworth 2008).

Given the opinions of the authors so far, it is obvious that there is a consensus in literature suggesting that almost all construction projects will experience cost variance and/or cost overrun. Also, from the foregoing, the developing countries have been perceived to have higher percentage of cost overrun due to many factors some of which include inaccurate building cost estimation, level of information available to estimators etc. For instance, Akintoye (2000) and Aibinu and Pasco (2008) stated that pre-tender cost estimating in Nigeria have been impacted significantly by the insufficient cost information and lack national building cost information database, clients' expectations etc. These are fundamental evidence of factors influencing building cost variance in Nigeria recognized by this study.

There are various factors that influence successful delivery of building construction projects such as cost, quality, time, project objectives etc. (Yu & Shen 2005). Also, Silva *et al.* (2016) identified building construction success factors as client satisfaction, profitability, cash flow management etc. However, one of the most effective elements of project success is a reliable and accurate cost estimate of projects using available information and resources (Jaggar *et al.* 2002). This is to enhance accurate prediction of contract sum of building projects. However, Adafin *et al.* (2016) assert that in spite of several cost planning measures put in place, variations are usually observed between budgeted and final cost of building projects. Similarly, several construction management literatures have also indicated that it is difficult to find a building project with the final cost same as initial budgeted cost (Akintoye 2000; Aibinu and Pasco 2008; Odusami and Onukwube 2008; Enshassi *et al.* 2013). However, contractors, clients and other stakeholders in building construction are often aware of the fact that final cost of project may not be same as initial contract sum. Same goes for variance between estimated cost of building and actual cost (Gambo *et al.* 2012; Hammad *et al*. 2008; Hendrickson 2008; Ugulu and Ikwuogu *et al.* 2011). Furthermore, the issue of cost management remains one of the key issues in the Nigerian construction industry which attracts research interest in appraising the main cause of these cost related issues; as well as determining mitigating measures to minimize or avoid some of these issues (Anigbogu *et al*. 2007; Inuwa, 2014). Indeed, several research evidence have revealed more cases of building cost overrun and poor cost management in the Nigeran construction industry.

However, most of these studies were mainly centered on investigating factors influencing building cost estimation/cost overrun. Despite this long history of research in assessing building cost performance and cost estimation in Nigeria, there has been limited study assesses validity and reliability of building cost information from various sources as a way of ensuring that the right information is available for making strategic building cost management decisions. Akintoye, Ajewole and Olomolaiye (1992) posited that one of the greatest limitations identified against adequate management of building cost information management is the unavailability of relevant cost database. Likewise, Dalu (2012) opined that obtaining the right information is essential in project cost control being an essential ingredient for a successful project. It is therefore

significant to note that availability of reliable cost information will enhance project cost control as means of recognising cost variance, updating project costs and managing cost changes to meet project cost baselines (PMI 2013). With the growing need for building constructions cost management and client satisfaction on a tight budget, construction practitioners in Nigeria are constantly burdened with the task of ensuring that building projects meet cost baselines which is sometimes far-fetched (Fagbenle *et al.* 2018). Hence, it is essential to obtain a reliable cost database to enhance project planning and enhance project cost control for the successful delivery of projects.

Also, there has been recent improvement in information technology for construction management such as Building Information Modelling (BIM) and Building Cost Information Services (BCIS). It is therefore essential for construction practitioners to progress from the traditional paper-based cost estimation practice which several studies have found to be unreliable and take advantage of the new information technology for construction cost management. This will go a long way in enhancing project cost accountability, improve reliability of cost estimates and reduce building cost overrun.

1.2 Statement of Problem

Estimating building cost is no doubt very crucial and effective in delivering projects on time and within budget (Akintoye 2010). While Ogunsemi and Jagboro (2005) opined that cost estimation in construction has continued to be a problem of great concern and interest for both contractors and researchers in the Nigerian construction industry, Alumbugu *et al*. (2014) asserted that one of the most significant factors responsible for the inaccuracies in building cost estimation is unreliable cost information. Also, previous research has revealed the existence of inherent inaccuracies in building cost estimation in many Nigerian projects which is down to several factors such as: inexperience of consultants, corruption, as well as poor design and specifications (Akintoye, 2000; Aibinu and Pasco 2008). For instance, Ade-Ojo and Babalola (2013) suggested that a good number of building contractors indulge in corrupt and unethical practices in building contracts procedures. They opined those prospective contractors are more concerned about their personal financial gains and their competitive bidding

strategy is to always be the lowest bidder. As such, they tend to make claims for additional costs which eventually leads to cost overrun. With such situation the authors emphasized that obtaining a reasonable cost performance cannot always be assured. Hence, efforts geared towards improving building construction efficiency by means of cost-effectiveness would be worthwhile and most certainly enhance build cost accountability. Oghenekevwe *et al.* (2014) and Anyanwu (2013) emphasized the need to have cost data available from the earliest stages of a building project to encourage the development of methods of "cost planning" and to enhance effective cost management and control as a solution to project abandonment. Ekung *et al*. (2015) also argued that one of the major underlying problems in construction contracts in developing countries, particularly Nigeria is the issue of poor cost management of building projects. This is due to lack of cost information database, corruption, ignorance, and poor information management culture. Nigeria is one of the biggest economies in the continent of Africa and the construction industry is important to its social and infrastructural development; hence the need to improve cost information management in the construction sector is highly essential. In any modern organisation, data and reports reflecting cost and organisation budget must be well detailed and should be obtained from a reliable source. Jibrin *et al.* (2014), asserted that many developing countries lack a systematic approach of cost record management especially in construction. It is argued that detailed and readily accessible cost records of past projects lessen the potential for unlawful manipulation of building costs, corruption and cost overrun in construction projects in Nigeria.

Cost management of building projects is a fundamental part of project management; therefore, adopting and implementing a robust cost database that will ultimately strengthen the cost information management of building projects becomes a major requirement. This will present an opportunity for curtailing possible effects of economic/financial crisis in the delivery of building projects (Ekwekwuo 2017).

One of the essential elements of any good governance is having a robust information management system which can provide an affirm audit trails as well as manage and control accessibility to the right information Muhammad *et al.* (2020). Also, having a vigorous data administration framework is an indispensably part of accomplishing administration best standard in any organisation including the construction

organisation. Hence, the need for a reliable building cost information management framework in the Nigerian construction industry becomes imperative.

1.3 Rationale for the Study

Variances between estimated and actual cost, as well as initial and final contract sum in construction is a global occurrence. The effects extend beyond just project delays to abandonment of projects and project failure on occasions where there are no provisions for extra funds to mitigate overruns (Oboirien 2019). The importance of building cost has both philosophical and human interfaces. Access to right cost information comes with numerous benefits. Cost information is very essential in building projects, and it plays a significant role in all stages of building projects such as project initiation, planning, monitoring, and controlling, execution etc., (Olaniran 2015). Alternatively, lack or inadequate access to robust cost information is dicey because it could lead to cost uncertainties, suspicion, corruption, inflated prices, underestimation, overestimation, etc. Arguably, these negative tendencies concerning costs are often commonplace in building projects in Nigeria. There has been overwhelming evidence of many building projects in Nigeria that failed or were abandoned because of lack of robust building cost information database (Adewuyi and Anigbogu 2006). This argument can be corroborated by widespread of abandoned building projects in Nigeria and by extension developing countries. Indeed, abandoned building projects in these countries is a common hallmark.

Jibrin *et al.* (2014) stated that the success of a project is largely dependent on the cost performance. Similarly, Gambo *et al.* (2016) opine that the importance of building cost information cannot be overemphasized, because having the right cost data is a game changer for both cost managers and stakeholders in the Nigerian construction industry. Ezeh (2013) assert that “out of every N1.00 (Naira) spent by the Government on building projects, 60k (Kobo) was lost to underhand practices and contracts awarded to unqualified and unsuitable contractors (sic)”. The reason for this is not farfetched as there is little or no cost regulation where individual quantity surveyors and cost managers have every reason to inflate cost data to benefit their individual needs.

In addition, to the problem previously stated above, Craig and Sommerville (2016) opine that many of the problems of delays, losses and errors faced in construction projects can be linked poor information management or the lack of it. This may be since several construction professionals still adopt the traditional and outdated manual methods of cost information management which is sometimes time consuming and unreliable. The lack of cost information management database can often result in improper storage or loss of important information. This means that others who may wish to access the information are deprived, as accessing information on paper can take a significant amount of time (Sun *et al*. 2000).

Similarly, Gambo *et al.* (2016) noted that poor cost performance of building projects in Nigeria can be linked to the poor management of cost information or the lack of it, as well as fraudulent practices in the construction environment. Nigerian construction industry is characterized by inherent weaknesses, resulting to the system being ineffective and non-responsive to critical procurement needs of organisations and government alike (Azis *et al.* 2013; Angelo 2002)

In recent years, the story of construction contracts particularly government construction projects in Nigeria had degenerated to that of a breeding ground for mismanagement and corruption (Oraegbune, 2008). Before 1999, some government officials and that of public institutions viewed public building projects as an opportunity to partake in the national cake due to cost mismanagement and unethical procurement policy in Nigeria (Shosanya 2014). Besides, there is reason to believe that there is relationship between building cost and nature of clients. Ubani and Ononuju (2013) argue that government projects are more expensive compared to private clients and they are more likely to be abandoned compared to private projects. Indeed, the role of clients and cost information are intrinsically linked; because it is natural for clients to seek for low-cost contract value for their projects and the contractors vice visa. However, this is not always the case with public projects, as there are number of high-profile construction projects in Nigeria, where clients (government) were accused of inflating overall project cost. For example, Nnamdi Azikiwe International Airport Abuja refurbishment project initial cost N64 billion (i.e., £496,000,000). Subsequently, the

volume of work was reduced; yet the cost of the project was increased to N48 billion (i. After public outcry and rejection by the Nigerian senate, it was successively reviewed by the National Assembly and the contractor reduced the cost to N6 billion (i.e., £372,000,000). (Oyedele 2016).

Similarly, Iwobi (2014) argues that often time, perpetrators of construction project crime deliberately delay acting on contract documents or files to the very last minute to resort to fire brigade approach as a ploy to circumvent due process, thereby whipping every other person to submission.

Arguably, the Nigerian construction industry does not have a comprehensive building cost database, perhaps, due to the nature of clients.

In response to a realistic and better understanding of building cost information management in the Nigerian construction industry, it is imperative to critically investigate the inherent factors responsible for cost variance of building projects in Nigerian and further examine the impact of client type on building cost performance and management. The research therefore seeks to explore the significant factors militating against building cost information management in the Nigerian construction industry with the aim of developing an effective and reliable building cost information framework to enhance the building cost management in Nigerian construction industry.

For example, the Building Cost Information Service (BCIS) was developed in the UK in 1962 to enhance cost planning of constructions projects within the surveying profession (Corbett and Rowley 1999). This approach is assumed to also help reduce the open abuse of rules and standards in the award and execution of public contracts e.g., inflation of contract costs, over invoicing, white elephant projects and diversion of public funds through all manner of manipulations of the contract award process (Ezeh 2013).

In Nigeria, many individuals, groups, and organisations are actively involved in construction and various aspects of the procurement system. The enactment of Public Procurement Act (PPA) has made Nigeria's public procurement guidelines accessible to the public for the sole aim of ensuring that all public procurements and government construction projects are conducted in a transparent manner and to enhance social

and cost accountability in construction. However, identifying corruption from construction cost padding can be exposed by introducing a standardized cost database which will encourage accountability and review of contract where necessary. Although, this may be extremely difficult to achieve in Nigeria given the inconsistency in government policies (Nyeck 2016). Policy inconsistency in this case refers to frequent changes and/or discontinuation of existing program and project due to change in leadership. Fortunately, this challenge can be resolved overtime with continuous reform and improvement in building cost estimation procedures.

Despite issues regarding building cost management discussed above and the significance of cost information system in minimizing some of these issues; there is limited research on building cost information management in Nigeria and the need to benchmark cost details. Hence, the aim of this study is to develop building cost information framework for the Nigerian construction industry to enhance the management of building costs.

1.4 Research Aim and Objectives

1.4.1 Aim

The aim of the study is to develop a building cost information management framework for the Nigerian construction industry. The study will enhance performance and efficiency of cost information management.

1.4.2 Research Objectives

To achieve study aim, the following specific objectives are set:

1. To examine the impact of types of clients on building cost information management.
2. To investigate the underlying cause(s) of building cost variance around different geographical regions in Nigeria.
3. To critically examine factors that affect building cost information management in the Nigerian construction industry.

4. To investigate reliability of building cost data in the Nigeria construction industry.
5. To comparatively analyze building costs in the UK and Nigerian construction industry.
6. To develop a strategic framework for building cost information management for the Nigerian construction industry.

1.5 Research Questions

The research questions were formulated from the research aim and objectives as follows:

1. Does the management of cost information impact the delivery of building projects in Nigeria?
2. What are the factors influencing cost of building construction in Nigeria and the impact of socio-cultural issues in Nigerian construction industry?
3. What are the existing Cost Information Structure available in Nigeria to facilitate cost estimation of building projects and construction project cost management?

1.5.1 Research Hypothesis

The study variables are anticipated to generate some forms of numerical data (quantitative data obtained through questionnaires) and non-numerical data (qualitative data obtained through semi structured interviews). The likely hypothesis to arise from the study include:

H_1: Type of client greatly influences the final cost of building projects in the Nigerian construction industry.

H_0: Type of client does not influence the final cost of building projects in the Nigerian construction industry.

H_2: The Nigerian construction industry and the UK construction industry are significantly different.

H_0: The Nigerian construction industry and the UK construction industry are not significantly different.

1.6 Research Methodology

Overview

It is always essential to select the right research methodology when undertaking research. This is to ensure that specific research questions, aim and objectives are met and to ensure the validation of the research findings.

According to Richard (2010), most theories in the field of construction management are centered on ontology (i.e., existence of knowledge), which is presumes an objective and systematic view of reality that can be identified and revealed through research. The philosophy underpinning this study is based on objective reality. And with regards to the nature of knowledge, validation, and the rationality of beliefs (epistemology), this study is based on the empirical knowledge that exists independent of the researcher (Ruddock 2008; Pham 2018).

Selecting the right methodology in a research project is essential to ensure specific research questions, aims and objectives can be met as well as ensuring that research findings are validated. The main purpose of this study is to critically evaluate and analyze a social phenomenon in cost information management in the construction industry to enhance best practice. Therefore, this study adopts pragmatism as the research epistemology where mixed methods strategy is used. The study utilized both qualitative and quantitative research data collection methods so that both methods are complimentary using interviews and questionnaires as the main data collection tools. The methods explored in this study have progressed from both natural science and social sciences. This led to an in-depth understanding of several research methods which have been successfully used to contribute to knowledge. Also, several considerations have been considered when selecting the research methods. Nevertheless, the suitability of these methods and the assumptions thereof cannot be assessed solely on philosophical grounds but on the suitability of these research

methods and research design applied to evaluate the research problems in its entirety, which is key.

Table 1.1 Relationship between Research Aim, Objectives, and Methodology

Research Aim: **The aim of the study is to develop a building cost information management framework for the Nigerian construction industry.**			
	Research Objectives	**Research Questions**	**Research Methodology**
1.	To examine the impact of types of clients on building cost information in Nigeria.	Does the management of cost information impact the delivery of building projects in Nigeria?	Extensive literature search and Knowledge elicitation from industry practitioners.
2.	To investigate the underlying causes of building cost variance in different geographical region in Nigeria	What are the factors influencing varying cost of building/ construction projects in Nigeria and the impact of socio-cultural issues in Nigerian construction industry?	Extensive literature search and Knowledge elicitation from industry practitioners.
3.	To critically examine factors that affect building cost information in the Nigerian construction industry.	What are the factors influencing varying cost of building construction in Nigeria and the impact of socio-cultural issues in Nigerian construction industry?	Critical analysis of current industry practices, as well as theoretical best practices.
4.	To investigate reliability of building cost data in the Nigeria construction industry.	Does the management of cost information impact the delivery of building projects in Nigeria?	Critical examination and analysis of current industry practices, as well as theoretical best practices.

5.	To comparatively analyze building costs in the UK and Nigerian construction industry. .	Does cost management in the UK construction differ significantly from the Nigerian construction industry?	Synthesis and analysis of results gathered from Objective 1, 2, 3 and 4 to develop a strategic cost information framework.
6	To develop a strategic framework for building cost information management for the Nigerian construction industry.	Does the management of cost information impact the delivery of building projects in Nigeria?	Synthesis and analysis of results gathered from Objective 1, 2, 3 and 4 to develop a strategic cost information framework.

This study is however centered on building cost information management, using methodological ideas drawn from several philosophical and methodological paradigms. The focal point of this research would be the scientific study of exactly how research is carried out. The research methodology reflects the various steps generally implemented by researchers in studying research problems along with the logic behind them (New Age 2013).

1.6.1 Preliminary study

The preliminary study involves sourcing of information in through the review of literature and previous related studies. This is to enable the researcher to cover a wide range of the study area as well as have a better understanding of the area and identify the existing knowledge gaps. It also involves pilot survey with the use of questionnaires distributed to a few numbers of the professionals in the Nigerian construction industry. This is to test the validity and reliability of the questions for data collection.

1.6.2 Data collection and analysis

To collect data, the study will use survey, interviews, and archival data as the main sources of data collection. This includes the use of semi-structured interviews of

professionals (predominantly quantity surveyors) in the Nigerian construction industry, the use of online survey through the administration of questionnaires as well as the use of archival data of past completed building projects from the six geo-political regions in Nigeria.

The proposed method of data analysis will be the concurrent triangulation mixed method. The is due to the study's proposed different methods of data collection. The concurrent triangulation mixed method is deemed appropriate compared to other method because of its ability to accommodate the use of different methods of data collection in the same study (Creswell, 2011). This will enhance validity and create a more in-depth picture of the research problem Nightingale (2020).

1.6.3 Framework development and validation

The proposed framework presents a unique platform for building cost information management, linking historical cost data with various cost indices such inflation, location etc. to provide a framework for realistic building cost budgeting and estimation.

Development of the proposed framework will involve sourcing data of past completed projects from professionals in the Nigerian construction. This will only include projects of not less than 5,000,0000 (5 million naira) which is an equivalent of £6,756.80.

The framework aims to examine and organize these sourced data from construction professional by standardizing it using cost indices to bring the data to an updated version for cost benchmarking and estimation.

Further benefits of the proposed framework relate to its flexibility in its configuration as well as its applicability to other stages of project cost management. For instance, the framework can be configured to provide cost feedback in all stages of projects, including the monitoring and control stage. However, it may be extended beyond the stages covered (pretender stage/ contract stage) addressed in the study to provide a more robust cost management platform.

The developed framework is validated by a carefully selected professionals in the Nigerian construction with high level of experience in building cost management and project management.

Feedback from the professional validation is measured to update the framework for better applicability of the framework in the Nigerian construction industry.

1.6.4 Research Process

The following briefly describes the stages of the research process

Phase 1: This stage establishes the present state of the knowledge in the study area and the gap. Stage one presents a comprehensive literature, examining technical and academic journal, textbooks, conference proceeding, articles, historical building cost data and professional guidelines.

Phase 2: Preliminary study was conducted using an online survey (see copy in appendix) to ascertain the current practice and more essentially streamline the research by identifying key areas of interest and conceptualizing building cost information management process in Nigeria.

A total of 15 survey was conducted among quantity surveyors in the Nigerian construction industry. Building information management especially in the UK are clearly publicized through RICS and the use of BCIS and this is covered in the literature review. Hence it was not deemed necessary to interview quantity surveyors in the UK. The survey questions were designed to investigate the respondents' knowledge and understanding of some key areas associated building cost information management in Nigeria. This is to ascertain professional and perspective understanding of the research area as well as to investigate if the existence of national building cost database, if any.

The survey revealed that there is no existing national building cost database in the Nigerian construction industry.

Phase 3: During analysis, it was discovered that certain questions could not be generalised as they are case-focused and thus other construction stakeholders needed to be examined to complement some of the results. For instance, a question was developed to investigate underlying causes of building cost variances from quantity surveyors, however it was discovered that further information was required from other building

construction stakeholders such clients, builders have the balanced perspective understanding of the underlying causes of building cost variances one of which is the type of client (i.e., private clients or government clients. Hence, some questions were further developed more specifically in the main survey and interview to address these causes.

Phase 4 Deducing from the initial three phases, the researcher explored and developed a building cost information management framework (BCIM). During analysis, the task flow, the requirements for populating the building cost information and their relationships were identified. The indices were integrated by adapting the template of the BCIS used in the UK construction industry. The technique is based on case studies from case studies of archival building projects from both public and private construction projects in Nigeria, some sample projects extracted from the BCIS and experts' perspectives in the industry, thus potentially a representative of the industry.

This study therefore adopts a pragmatic paradigm using concurrent triangulation mixed method. Several scholars have come up with various definitions that integrate various elements of research philosophy and design. Research methods are various tools and techniques used for diverse types of findings. They represent the apparatus of research finding and provide methods to assembling categorize and analyse information arising from findings (Walliman 2011).

1.6.5 Justification of Research Method

To this study, a combination of research designs i.e., mixed method which includes quantitative and qualitative research methods. One of the key justifications for adopting this method is to address the different research questions to make the study more comprehensive. Also, another justification for the use of mixed method approach is that the combination of qualitative and quantitative research helps to enhance understanding of the dynamics in the Nigerian construction industry and the built environment in general.

The research provides a detailed explanation of the current cost information management practice in the Nigerian construction industry, and the significance of cost information management practices in procuring public building projects in Nigeria in comparison with the UK project cost information management practices. This study is based on extensive literature research of secondary information on building cost information management practice in Nigeria.

This study also investigates the various factors militating against building cost information management in the Nigerian construction industry that has resulted in building project cost overrun and project abandonment. The research further seeks to explore the strengths, weaknesses, opportunities, and threats associated with managing building projects and the effect of limited cost information for building cost estimation with the aim of ultimately developing and implementing reliable building cost information framework for building/construction projects in Nigeria.

1.6.6 Research Strategy

There are various research strategies with their advantages and their disadvantages. However, due to the nature this research, four different strategies will be considered as described by Hunter and Kelly (2008). This includes action research, quantitative survey, qualitative interviews, and historical evidence. Selected strategies will enable researcher to systematically conduct the research within the defined scope and practical limitations of the research such as access to data, time, constraints etc.

1.6.7 Contribution to Knowledge

Cost estimation is an essential part of building/construction projects. The Nigerian construction industry is said to be growing fast and contributes greatly to the Nigerian economy with an average GDP of N578,279,000.12 (£863,102.99) from 2010 until 2019, reaching an all-time high of N752,833,000.66 (£1,123,631.34) in the second quarter of 2019 (National Bureau of Statistics Nigeria 2019). Consequently, an effective building cost information framework that will enhance building cost estimate is imperative. This study presents a systematic approach to identifying the basic principles of building cost information sourcing and management.

Also, it essentially contributes to construction knowledge by qualitatively and quantitatively exploring the basic operational problems in building cost information management and the use of building cost information management system in the Nigerian construction industry for best practices.

This research will be beneficial in the following ways:

1. It will enhance advanced knowledge about building cost information sourcing and management for construction practitioners in the Nigerian construction industry.

2. Output from this study will act as a cost verifying tool for construction professionals such as quantity surveyors, cost managers etc. as well as clients and the Nigerian government.
3. Findings from this study will act as a benchmark for costing and managing of building projects in future.
4. It will help minimize building expenses and manage building cost information in Nigeria in a sustainable way.
5. It will help to checkmate corrupt practices in the Nigerian construction industry.

1.7 Significance of the Study

The research aims to contribute majorly to building construction and procurement knowledge by thoroughly examining the procedural problems in estimating building projects.

The research output will also enhance the management of building costs in Nigeria.

The research proposes to be useful to the following stakeholders in diverse way:

- The Nigerian Construction Industry Practitioners
- The Nigerian Public Procurement Sector
- The populace
- Academic society

1.8 Scope and Limitation

The scope of the study covers the cost information management of building construction in Nigeria, identifying the problems of cost information sourcing, storing and management in the Nigerian construction industry, alongside the associated factors impacting the sourcing of appropriate information for the estimation of building costs. It also investigates the current practice of cost estimation for building construction projects in Nigeria.

The literature demonstrates the theoretical standpoint of building cost management from different scholars' perspective, while also identifying the knowledge gap. For wider understanding and to keep up with the current trend in the subject area, the literature review spans through from beginning of this thesis to the analysis and writing up. This will specifically help in the development of an effective cost information framework for building projects in Nigeria. It essentially aids the development of a central building cost information database in the Nigerian construction industry.

The research embodies the study of building cost information management practices and its impact on the Nigerian construction industry. However, the research scope is delimited to building projects in the Nigerian construction industry only.

1.8.1 Research Position

This study is centered on the development of building cost information management framework for Nigerian construction industry. The study also reviews potentials benefits of cost information management in procuring building contracts. This has been widely acclaimed by many scholars. According to Yang *et al.* (2011), information management is one of the key factors influencing project performance in terms of schedule, cost, quality, and safety performance. Also, Bretschneider (1990) emphasizes the importance of information management system in organisations. He establishes that access to accurate information in timely fashion can enhance decision making and in turn can influence the efficacy of an organisation.

In other words, they all emphasize the importance of information management system in the execution of projects building construction projects inclusive. This research is however concerned with developing an effective building cost information framework for construction projects in Nigeria and more generally contributing to the rapidly growing public information management system and construction management.
Figure 1.1 bellow illustrates a pictorial representation of the research position and the factors influencing building cost information management in Nigeria. This further emphasizes the need to introduce an effective information system in the Nigerian construction industry.

Studies have reviewed factors affecting building costs in Nigeria and poor management of building cost information. The list of these reviewed factors was observed to be repetitive among authors, however, this study further regrouped and compressed these factors in order similarities and came with eight (8) specific factors affecting building cost information management which forms the basis for the research position.

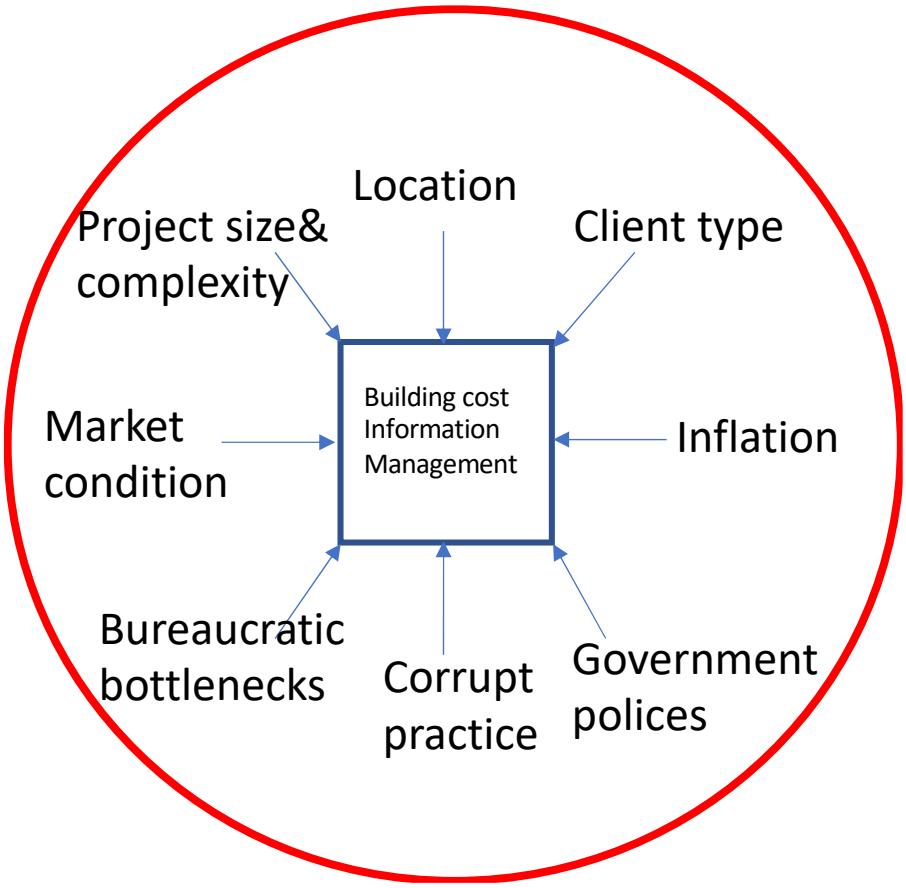

Fig 1.1 The research position and its influencing factors

The scope of the study covers building cost information management in the Nigerian construction industry, identifying the underlying issues bordering on the building contract processes in terms of building cost estimation and sourcing the right information for building cost management through the entire phases of building project execution. It further investigates factors responsible for cost variances and discrepancies in the estimation of building across the different geopolitical zones in Nigeria.

These factors are represented in Fig 1.1 as compassing the research position. Each of these factors significantly affects the management of building cost information management in the Nigerian construction industry. Hence, the focal point of this study is to investigate building cost information management practices by examining the causative influencing building cost variances in Nigeria with the aim of developing a robust building cost information management framework (BCIMF).

The literature review spans through the thesis phases from the initial stage to the analysis and writing up stage of this study, hence the literature review is not limited to only the initial stage of the research. This is to ensure and in-depth and broader understanding of the subject area as well as be up to speed with the current studies in the research area. It particularly aids the development of building cost information management model as presented in figure 1.2.

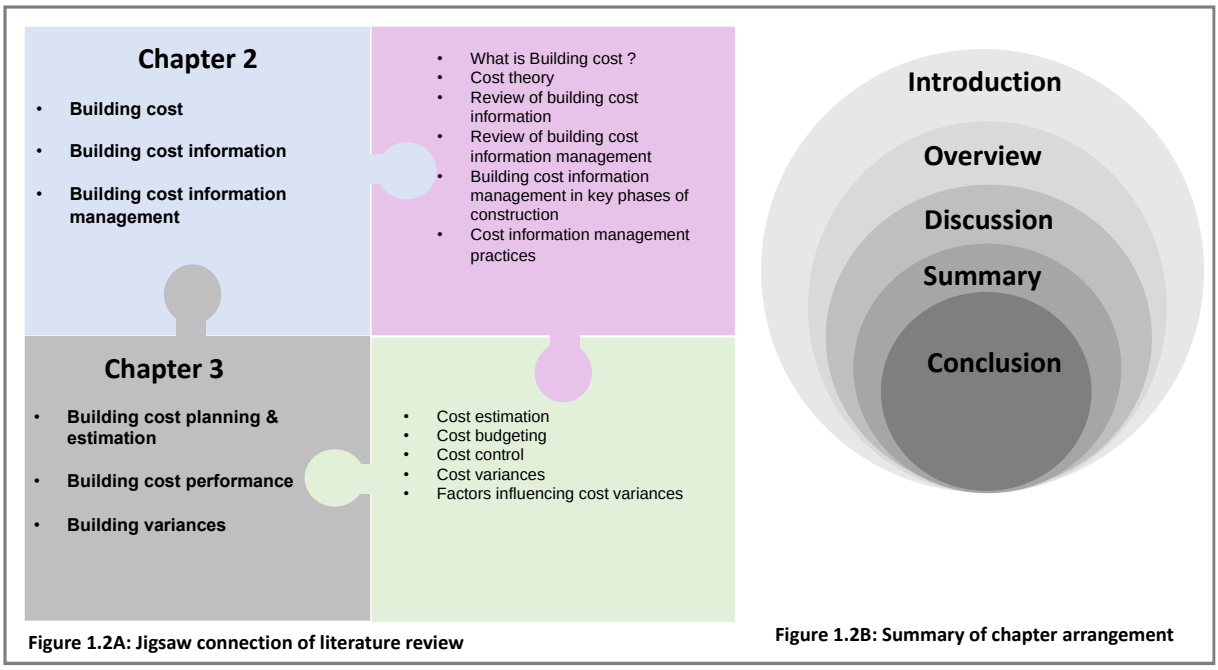

Figure 1.2 Jigsaw Connection of Literature Review

Likewise, the critical review of various literature in the subject area enhanced the philosophical assumptions and the research methodology. An initial preliminary online survey was conducted to establish the research assumptions and streamline the research scope. This was later followed by the actual online survey and semi structured interview, as well as historical cost data from previous building projects executed in Nigeria and the UK respectively. The research process is clearly explained in the research methodology section of this study.

1.9 Organisation of the thesis

The thesis covers 10 chapters which are presented in a chart illustrated in figure1.3 below.

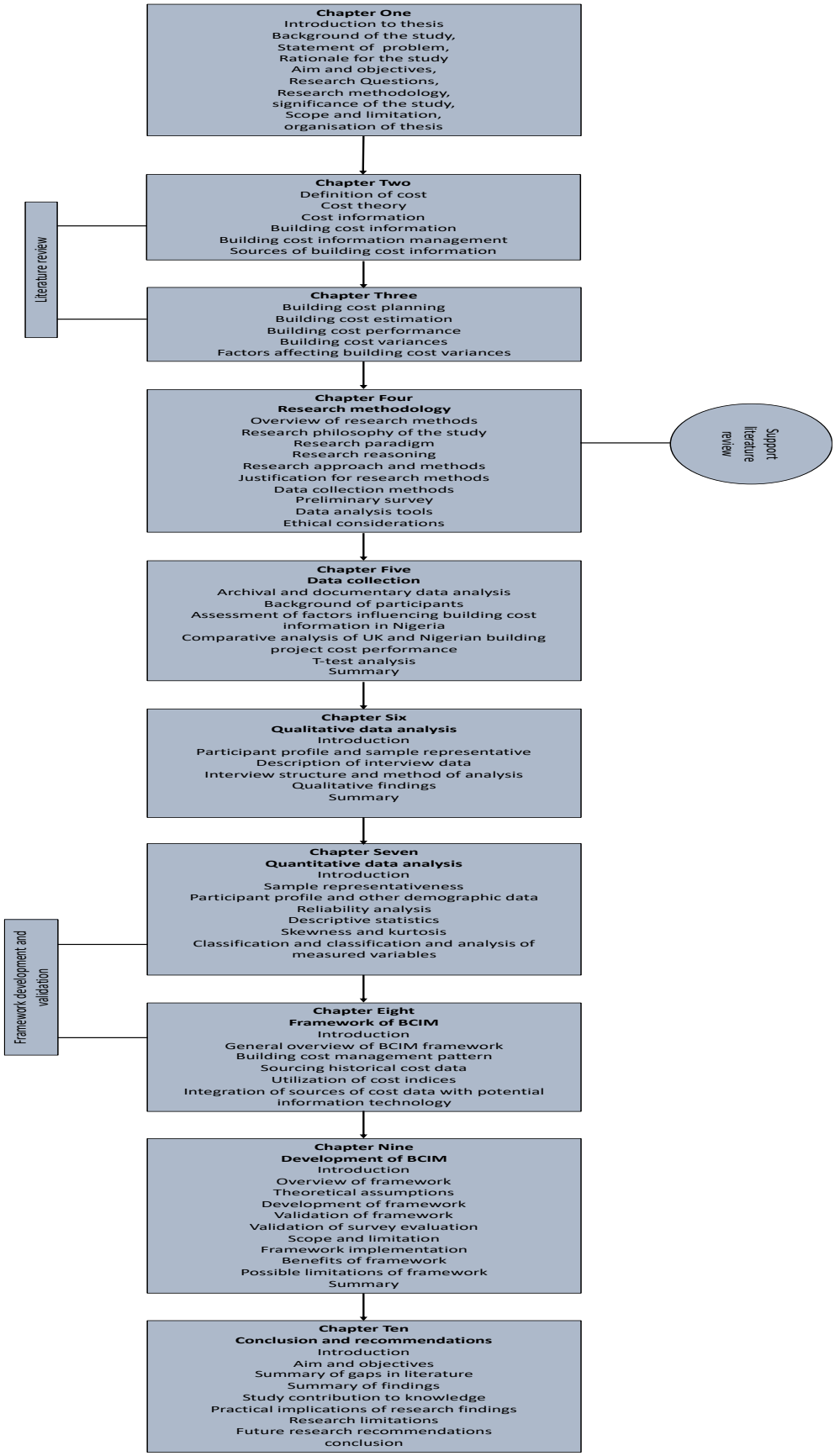

Figure1.3: The flow of research organisation

Chapter one presents the introduction to the thesis, the general overview of the study background, study aim and objectives overview of methodology etc. it also presents the statement of problem, contribution to knowledge in the field of construction management, scope, and limitations etc. This chapter concludes with structure of the thesis.

Chapter two presents definition and discussion of terms in relation to the background of study. Sources of cost information are discussed with causation factors and their influences on building cost objectives. The nature of building clients and their effect on building costs are also discussed. This chapter further discusses the nature of cost factors and their relationship with final building costs as well as cost theories

Chapter three presents a recap of the Nigerian construction industry in terms of cost performance and management, cost estimation procedures and causative factors influencing inaccuracies in cost estimation, cost overrun etc. The discussion identifies the current gap in knowledge that culminates the conceptual framework of the study.

Chapter four discusses the adopted methodology comprising method of data collection and the procedures for data collection, the research philosophy, question design, criteria for determining sample size etc. Also, this chapter discusses methods of data analysis. the chapter concludes with discussion on validity, reliability and ethics observed in conducting this research.

Chapter five, **six and seven** describes the presentation and analysis of the research data (i.e., the archival data, qualitative and quantitative data respectively). It also presents discussion of research results and findings relative to the research aim and objectives. Furthermore, the chapter analyses the key factors influencing building cost variances as well as the significant view of each respondent on these factors. It presents a comparative analysis of building cost performance in the UK and Nigeria using data from the BCIS and archival building cost data from similar Nigerian projects etc.

Chapter eight presents an overview of Building Cost Information Management Framework (BCIMF), the management pattern of the framework as well as the possible integration of the developed BCIM framework with current information technology. It reviews the various cost indices to be considered in analyzing historical building cost data to provide an updated cost information for cost estimation and forecasting.

Chapter nine; this chapter discusses development and validation of the BCIM framework, the impact, and benefits of the framework. The framework application, accessibility, and limitations are also discussed in this chapter. The chapter concludes with the result from professional validation of the developed the Building Cost Information Management Framework.

Chapter ten explains the general summary of findings from empirical research and literature, practical implications of research findings, contribution to knowledge, conclusions, recommendations, and area for further studies on research problem.

1.9.1 Summary

Building project cost performance and success performance indicators of building project (i.e., cost time and quality) were discussed, as well as the prevalence of building cost overrun and their causative factors in both developed and developing nations were briefly discussed. Previous literature on construction cost estimation and cost performance were highlighted alongside the identified gap yet to be addressed around the study. The statement of the research problem consequently elicited from the foregoing, whereupon the research question, aim, objectives and hypothesis are based. Furthermore, the scope and limitations, the significance of study with an over of the methodology adopted were discussed. The chapters conclude with the structure of thesis and summary.

Chapter Two
Building Cost Information Management

2.0 Introduction

This chapter begins with discussing building cost information management terminology, definition of cost, types of cost and concepts of costs. The chapter also focuses on discussing elements of costs and cost theory in relation to building construction.

This chapter explains the general background of building cost information management and global practices. The study further discusses the concept of building cost, types of building costs and various cost theories as it relates to building construction. This chapter also reviews the background of building cost information management practices in Nigeria, types of building clients and their impact on building costs variances in Nigeria. This chapter further discusses the main issue of cost information as it affects building cost estimation in the Nigerian construction industry. It examines and ranks these factors considered by the construction professionals to build up their rates in the Nigerian construction industry.

This chapter also discusses the background of sources of building cost information in Nigeria, and factors responsible for building cost variance across the country. This is discussed in relation to materials, labor, and equipment etc. Issues relating to sources of building cost information, validity and reliability of building cost information, and the critical success factors are also discussed. This chapter also presents and explains a theoretical framework building cost information upon the research assumption is drawn. Other definitions of cost information management within construction and procurement literatures were also reviewed.

2.1 Overview of Building Cost Information Management

Building projects are becoming progressively large and complex given the new and advanced construction technologies and the rapidly developing building project

methods (Lee 2018). As a result of these advancement complexity and construction technology, efficient management of building cost information generated is becoming increasingly essential.

Building cost information management is an activity involving obtaining building cost information, planning, cost control, analyses, and evaluation for the purpose of project cost control (Zhen 2008).

Due to the importance of information management in building construction, the construction industry deploys a number cost information management system for collecting, transferring, storing and application of cost information.

Cost can be generally regarded as monetary value disbursed to provide product or services. Hence, it is essential to understand how to appraise costs before asserting whether its high or low and how to effectively reduce the cost.

Cost is an essential component in every development. It is essential in both government projects and other private building construction projects as well as all stakeholders in the construction industry. According to Nnadi (2012), effective cost information can help clients decide on the type and magnitude of projects and resources to be expended out of available options. Construction cost has always been always considered as one of the benchmarks for evaluating efficiency and performance of building construction projects (Ogunsemi and Jagboro 2006). Completing a building project within the budgeted cost and estimated time is usually the key aim of both client and the contractor as cost and time overrun translates to loss of profit for both parties. Hence, the poor cost performance of a building project affects the profitability of such project from all stakeholders' perspective.

Deviation form initial cost plan has been a global construction issue (Adam *et al.* 2014; Flyvberg *et al.* 2014). Several world banks projects have also recorded poor cost performance with 63% of the 1778 construction projects exceeding cost budget at an average of 40% (Zujo *et al.* 2010 and Ameh *et al.* 2010). Hence, cost variance in construction projects is an issue encountered in both developed and developing countries. However, the trend is more prevalent in developing countries where these construction cost deviation from initial cost sometimes exceeds 100%.

Despite problems associated with construction cost management, the contribution of construction to the economy is vital to achieve social-economic development goals of providing shelter, infrastructure, and employment. Hence, an overview of the building construction cost performance and its contribution to sustainable development of the economy in Nigeria is crucial. It is also imperative in this chapter to critically review the understanding and definition of cost in relation to building construction.

2.2 Costs in Economic Terms

What is Cost?

The term ‘cost’ is commonly used to describe a value or price placed on something before it can be done or acquired. However, several literatures have defined cost from different perspectives. For instance, Khan and Jain (2000) defines cost as the 'value' of an offer made to obtain goods and services, quantified in monetary terms, the acquisition of properties or incurring liabilities at the time benefits are obtained.

Cost from an economic point of view cost can be described as an expense made to receive something. Whereas in business, cost is usually the monetary value of all labor, resources, materials, time, and services consumed and the delivery of goods and services (Nwokoye and Ilechuckwu 2018). However, cost in building construction largely refers to the amount incurred during development of a building project. More explicitly, building costs will be those incurred by the actual building construction works themselves. Nonetheless, there are some building costs that might be considered hard cost in themselves such as profits, fees, overhead etc.

Cost is an important part of many activities in cost engineering (i.e., process of managing costs associated with construction projects) such as cost forecasting, cost control, cost estimating etc. (Lavinia 2004). Many building construction costs however may also include costs that are not possible to determine at the point of contract award (e.g provisional cost sums and prime cost sums) (Ogunsemi 2006). Hence, a building contract is likely to make provision for the adjustment of contract sum because of variations, losses and expense, variation, fluctuation etc. Consequently, the actual

cost of building construction must be explicit and may not be finally established until after the successful completion of the construction work. This also applies to scenarios where contract is considered to have fixed price (Olusegun 2010)

Cost in construction can be described as the amount disbursed to get goods or services in construction projects. Construction cost varies from stage to stage of a construction project (Nnadi 2016). Typically, building construction costs fall into five main categories which will be discussed in the next section. Table 2.1 presents the various definitions of cost from financial accounting and construction project management areas as observed in literature.

Table 2.1: Definitions of Cost in Previous Literature

Author(s)	**Cost Definition**	**Comments**
Samuel Akinyemi (2013)	Cost can be defined as a measure of sacrifice and effort needed to produce goods and services.	The Economics of Education
Chris B. Murphy (2019)	Cost is generally the expense incurred for a service rendered or product being sold by an organisation.	Corporate Finance & Accounting
Rosemary Peavler (2018)	Cost is the amount it takes for a company or an organisation to produce the product or service it sells or provides.	Business Finance
Business Dictionary (2019)	Cost in construction is the expense incurred for materials, labor equipment, services, overhead etc.	Construction Business Dictionary
Allan Ashworth and Srinath Perera (2015)	Cost represents the amount it costs to produce or manufacture an item or provide a service.	Cost Studies of Buildings

Chitkara (2011)	Cost in construction is defined as an expenditure budgeted to acquire or create desire construction facility as agreed by the client.	Causes of Cost Overrun in Construction

2.3 Cost Theory and Building Construction Economics

Cost theories are commonly used to analyze the performance of cost curves with respect to several criteria such as long-run and short-run scale to draw conclusions on them (Nwokoye and Ilechuckwu 2018). Cost theories investigate the concepts of cost in the long and short run scale. Several organisations utilize cost theory to provide an outline for understanding how resources are allocated for production to enhance profitability (Hall 2019). Cost theory is an area that could be significant in construction cost management because delivering building construction is clearly about producing something (Valence 2010). In building construction, cost theory offers an approach to understand how project costs are monitored and controlled. Cost theory includes the traditional cost theory and the modern cost theory.

2.3.1 Traditional cost theory

The traditional cost theory analyses the nature of costs curve in both long and short run scales and concludes that both long and short run curves are U-shaped with the long-run curves having a flatter curve than the short-run cost curves (Myers 2008). The traditional cost theory evaluates costs in two parts based on time-period which include (i) costs in short run and (ii) costs in long run. Under the traditional cost theory, costs are classified into three which are total costs, average costs, and marginal costs.

2.3.1.1 Short run costs

The short-run costs in traditional theory include fixed input and variable inputs. Short run-in construction is the stage where at least one input is fixed and while some other inputs are variable (Valence 2010). Hence, short-run costs are split into fixed costs and variable costs. The short-run consist of three main cost concepts which are total costs (TC), total fixed costs (TFC), total variable cost (TVC).

a) Total cost

Total costs comprise of both total fixed costs and total variable costs. In construction, total costs are the sum of all consistent expense in to be incurred in the execution of a projects (Myers 2008). It is the sum of total variable cost (TVC) and the total fixed cost (TFC) at a specified level of productivity. Total cost also varies across different stages of construction given the series of activities involved in construction projects. The equation of total cost is illustrated below:

TC = TVC + TFC ---------- *equation 2*

TC = f(Q) ---------- *equation 3*

From equation 2, it follows that.

TFC = TC – TVC ---------- *equation 4* TVC

= TC – TFC ---------- *equation 5*

Hence, total costs in construction represent the amount of money incurred at different stages of project execution (Myers 2008). The graph in figure 2.1 below represents total cost of the traditional cost theory.

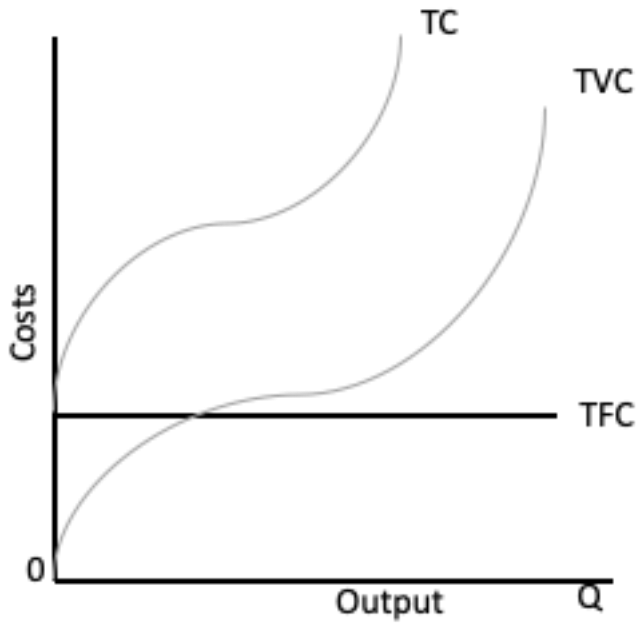

Figure 2.1: Total Costs

b) Total fixed costs

These are production costs that require no change with the level of output and these costs are incurred regardless of the level of productivity of the firm (Jackson *et al.* 2007). In other words, they are the total sum of all costs expended by the firm for fixed inputs and are independent of the output level. Examples of total fixed cost are wages for administrative staff, expenses for building wear and tear etc.
Total fixed cost is graphically represented by a straight line which is parallel to the output axis as illustrated in figure 2.2

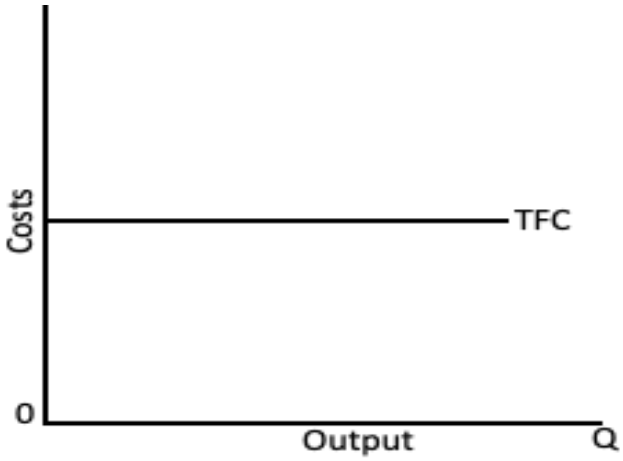

Figure 2.2: Total Fixed Cost c)

Total variable costs

These are production costs that change directly with output. These costs rise when there is an increase in output and vice versa. They include direct labor costs, cost of raw materials etc. Hence, total variable costs are those incurred by the firm for variable inputs and these costs will vary with the amount of construction activities undertaken by the organisation (Sloman and Norris 2008).

TVC = f(Q) ---------- *equation 1*

The total variable cost in traditional cost theory is presented graphically with an inverse-S-shape as illustrated in fig 2.3.

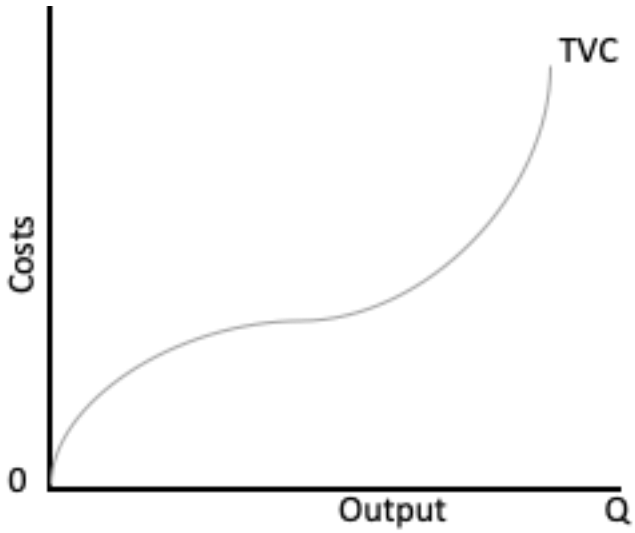

Figure 2.3: Total Variable Cost

Other concepts of costs

Other concepts of cost are derived from the existing cost concepts. For instance, the average-cost curve is derived from the total-cost curves.

a) Average fixed cost

The average fixed cost is the fixed cost divided by output at any given stage of production (Agawala 2008). The formula is given as.

$$AFC = \frac{TFC}{Q} \quad \square \ 0 \qquad \textit{equation 6}$$

AFC is graphically represented with a hyperbola, which indicates the same magnitude at all its points (i.e., the level of TFC).

From fig 2.4 AFC decreases as output increases.

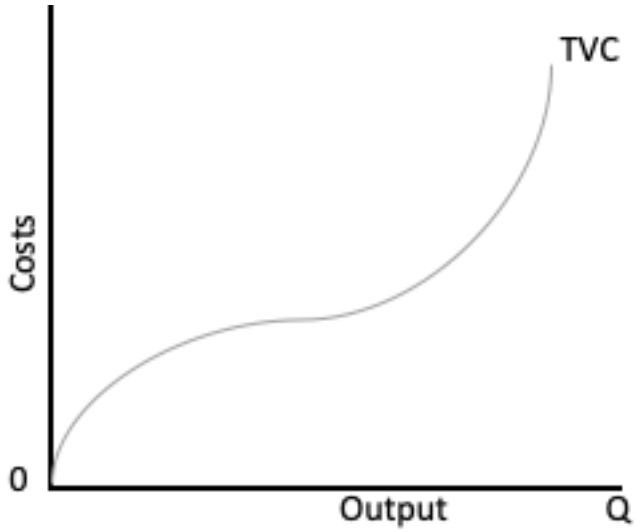

Figure 2.4: Average Fixed Costs

b) Average variable cost

Average variable cost (AVC) is the total cost per unit productivity or output. AVC is derived by dividing the total variable cost by output. AVC is used by profit maximizing firms to determine the point to shut down production in the short run. The simplest way to determine whether a cost is variable is to monitor the output, if the output changes, the cost will also change (Jackson *et al.* 2007).

The average variable can be derived with the equation below.

$$AVC = \frac{TVC}{Q} \quad \text{---------- equation 7}$$

The graph in fig 2.5 illustrates the average variable cost function in short run of the traditional cost theory.

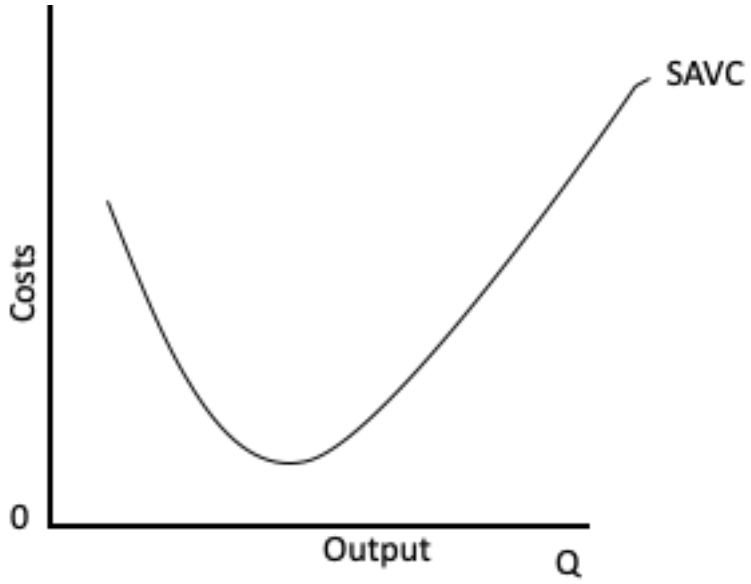

Figure 2.5: Average Variable Costs

c) Average total costs

The average total cost is described as the total cost of production divided by the measure of production. The average cost of the short-run analysis is more important than the total cost. it varies but must be sold at the same price (Nwokoye and Ilechuckwu 2018).

Average total cost in the short-run analysis is obtained by dividing total cost by the output level i.e.

$$SAC = \frac{STC}{Q} \quad \text{---------- } \textit{equation 8}$$

Given STC = TFC + TVC

$$\text{Then, } SAC = \frac{TFC + TVC}{Q}$$

$$SAC = \frac{TFC}{Q} + \frac{TVC}{Q}$$

$$SAC = AFC + AVC \quad \text{---------- } \textit{equation 9}$$

The average total costs (ATC) is derived in similar pattern as the SAVC. Hence, they both have the same U-shaped curve as illustrated in figure 2.6.

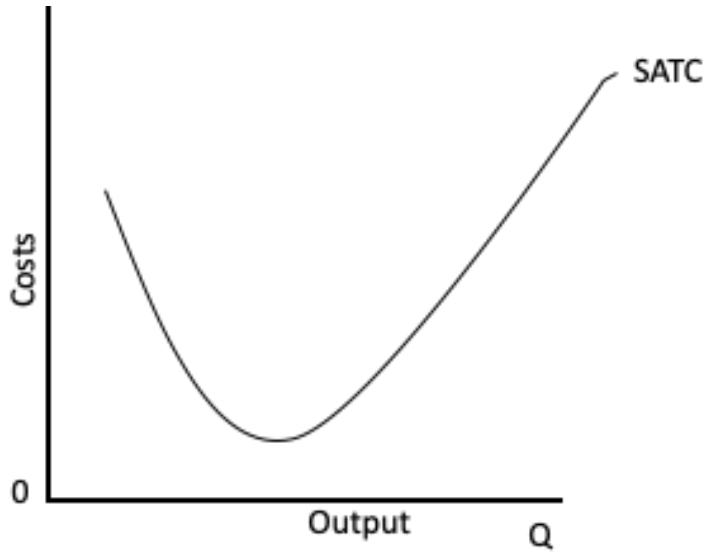

Figure 2.6: Average Total Costs

Deducing from equation 9, SAC can also be defined as AFC + AVC. Hence,

AFC = SAC – AVC ---------- *equation 10*

and

AVC = SAC – AFC ---------- *equation 11*

d) Marginal cost

According to Turvey (2000), marginal costs are estimates of costs that will be incurred due to substantial change in future output**.** It is the additional cost made to total cost because of an increase in one or more elements of a product. In other words, any additional cost incurred when there is an increase in production by one or more units of goods or services. It is also known as incremental cost. Arithmetically, the short-run marginal cost (SMC) is the derivative of the total cost (TC) function.

Hence, if

MC = SMC = $\frac{\Delta TC}{\Delta Q}$ or $\frac{\Delta}{\Delta Q}$ ---------- *equation 12*

Or SMC = $\frac{TC + \Delta}{Q}$

At fixed cost (which is zero)

SMC = $\frac{\Delta TVC}{\Delta Q}$ ---------- *equation 13*

However, deriving the marginal cost from a function of total cost, the derivation is found to be in relation to output (Q).

Therefore, SMC = $\frac{dTC}{dQ} > 0$ ---------- *equation 14*

Marginal cost in short run is graphically represented with a slope curve as illustrated in figure 2.7.

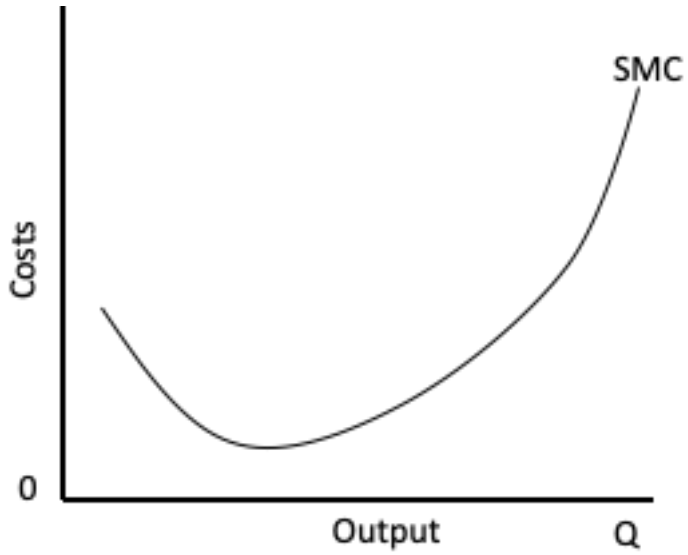

Figure 2.7: Marginal Costs

2.3.1.2 Long-run costs

In building construction, all costs under long-run conditions are usually not fixed and include costs incurred at the planning stage of projects (Agawala 2000). Like the short-run, long-run costs have three cost concepts namely, Long-run total cost (LTC), long-run average costs (LAC) and long-run marginal costs (LMC)

a) Long-run total costs

The long-run total cost curve reflects the relationship between a firm's level of output and the total cost when all inputs are variable. Consequently, the firm could possibly produce each level of output with the optimum blend of inputs.
The graphical demonstration of the long run total cost is illustrated in figure 2.8.

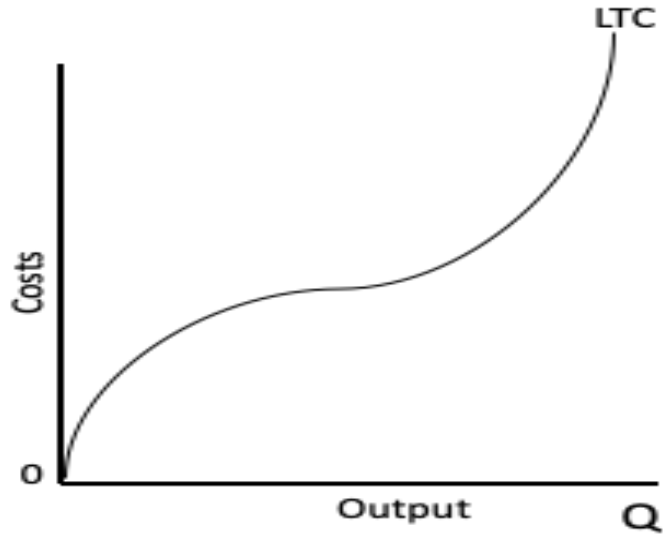

Figure 2.8: Long-run Total Cost

It is important to note that the total curve always remains 0 (i.e. Q =0) because all inputs in the long-run firm vary.

b) Long-run average cost (LAC)

The long-run average cost (LAC) curve shows the lowest average total cost of production at any given level of output with variable inputs. Long-run average cost analysis in construction is sometimes referred to as planning curve, a firm could technically build its input size to its desire since all factors of production are variable (Case and Faire 2007). The LAC is however derived from the short-run cost curves as illustrated in figure 2.9.

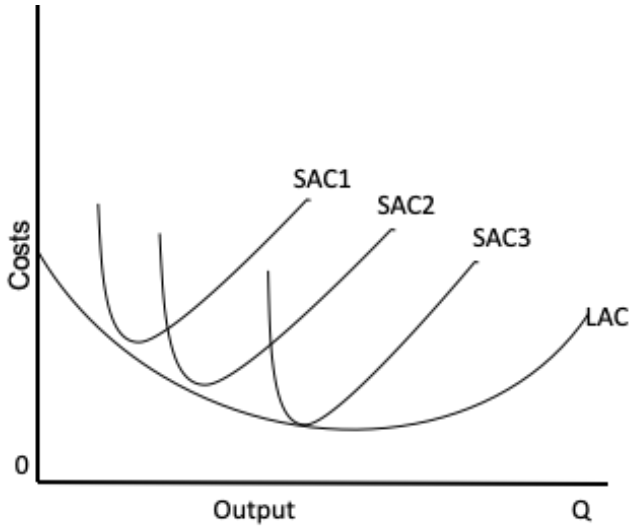

Figure 2.9: Long-run Average Cost

c) Long-run marginal cost (LMC)

The long-run marginal cost is the minimum increase in the total cost of producing a unit at variable inputs. Long-run marginal cost in construction is the expected additional cost of building, maintaining, and selling and additional unit (Froeb and McCann 2008). The long-run marginal cost curve is formed by the return to scale long-run concept as opposed to the law of diminishing marginal returns which is usually a short -run model. Figure 2.10 below illustrates the LMC curve.

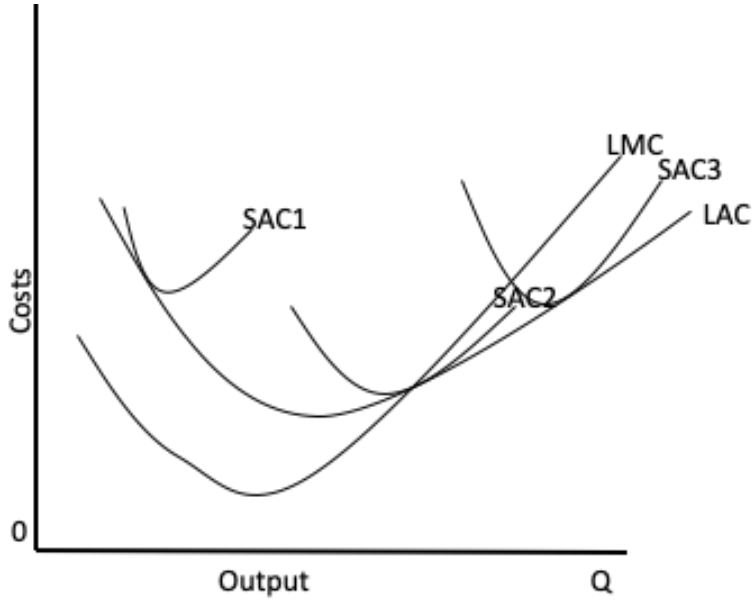

Figure 2.10: Long-run Marginal Cost

2.3.2 Modern cost theory

The modern theory challenges that the long run average costs fundamentally included production and managerial costs of which there is a constant fall in average production costs even at large scales whereas the managerial costs per unit of production may rise only gradually and at large scales of productivity. The modern cost theory has been advanced by economics like Andrews, Stigler etc. Cost curves according to the traditional cost theory are U-shaped. However, the modern cost theory in an ideal situation cost curves are L-shaped (Gupta 2018). Just like the traditional cost theory, there are two main cost analysis (short-run and long-run cost) in the modern cost theory.

2.3.2.1 The short-run cost curves

Like the traditional short-run cost analysis, the modern theory short-run costs are categorized into average fixed cost (AFC), average variable cost (AVC), and average total cost (ATC) and short-run marginal cost (SMC). According to Case and Faire (2007), modern short-run curves are typically developed from total cost which is subdivided into fixed cost and total variable cost. However, in the modern cost theory, the average variable cost and the marginal cost of the short-run analysis are bowl-shaped as opposed to U-shape in the short-run analysis of traditional cost theory.

average fixed cost,

a) Average fixed cost (AFC)

This is the indirect cost of both physical and personal organisations of a firm. This include cost of wages and administrative staff expenses, land and building maintenance expenses etc. direct factors like material and labor are perceived not be set limit on size the size of fixed factors which ultimately determine the size of equipment (Sloman and Norris 2008). The average fixed cost curve is illustrated in figure 2.11.

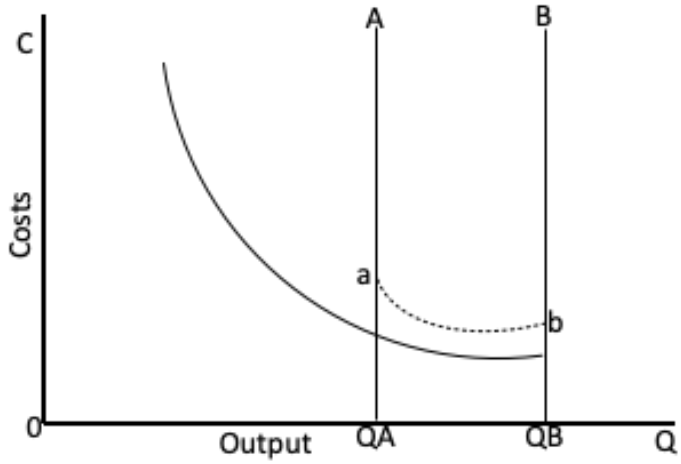

Figure 2.11: Average Fixed Cost Curve

b) Average variable cost (AVC)

As with the traditional theory, the average variable cost (SAVC) of the modern cost theory includes (i) running cost (ii) cost of raw materials and (iii) direct labor cost which varies with output.

The short-run average cost variable cost of the modern cost theory has a broadly U-shaped that has flat stretch spanning through a range of output, that is a saucer-type shape. The shape of the curve indicates it initially cost less to build or produce successive units, but eventually cost more and more to build successive units as law of diminishing returns sets in (Myers 2004). Figure 2.12 below illustrates the short-run average variable cost curve.

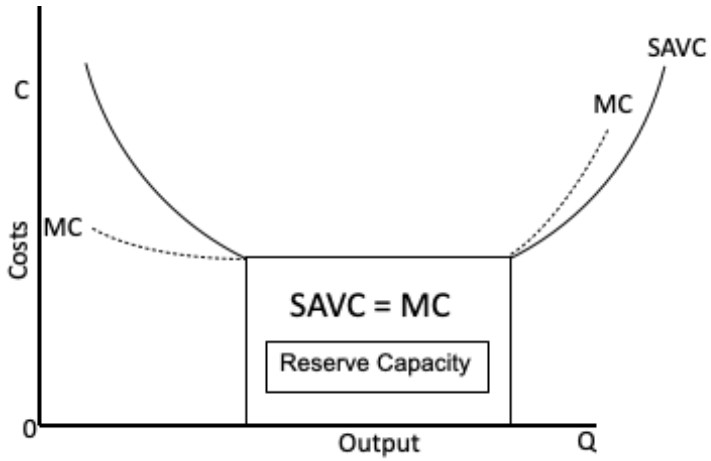

Figure 2.12: Average Variable Cost Curve

c) Average total cost (ATC)

The average total cost (ATC) is established by fixed (normal profit inclusive) and the average variable cost at every level of production. The ATC curve has a similar shape the AVC curve. The curve drops constantly up to certain level of output where the capacity of reserve is exhausted. The curve drops and rises in this pattern because ATC is the summation of the AFC curve and the AVC curve (i.e., ATC = AFC + AVC). An efficient organisation will target to achieve its output at the point where the unit of production is associated with the lowest cost possible- that is the lowest point on the average cost curve (Whitehead 2010).

2.3.2.2 The long-run cost curves

According to Valence (2010), experimental verification about the long-run average shows that the long-run actual cost (LAC) curve is L-shaped as opposed to U-shape in the traditional cost theory. The LAC curve initially drops rapidly but the curve flattens out after a point or may slope downwards towards the right-hand end. The following have been assigned by economists on reasons for the L-shape of the LAC curve.

a) Production and Managerial Costs

All costs in the long-run being variable, managerial production and production cost of a firm are being considered when evaluating the effect of output expansion on average cost. Hence, production cost drops constantly while managerial cost may increase at very large scale of output as it increases. Production cost in construction materials and labor (Shephard 2016). The behaviour of managerial and production costs is illustrated in fig 2.13 describing the L-shaped of the LAC curve.

b) Production cost

It is often a general practice for many firms to increase their scale of production, due to the practical economics of large-scale production that these firms enjoy. These firms enjoy the substantial economies, but after a certain point of output

when most of the economies have been realized, the firms get to the minimum optimum scale.

c) Managerial costs

According to Wilkinsion (2005) modern firms or organisations, there is usually a managerial set up for the smooth running of every plant or equipment. There are different management levels, each having its independent management technique which can be applied to a certain variety of output. Hence, the nature of a managerial set up will determine the cost. The managerial cost initially drops with an increment in output and will rise slowly only at a significantly large scale.

In conclusion, managerial costs may rise slowly at a large scale of output while production cost drops easily at a very large scale.

The figures (2.13 and 2.14) illustrate the long-run actual cost curves in relation to production and managerial costs.

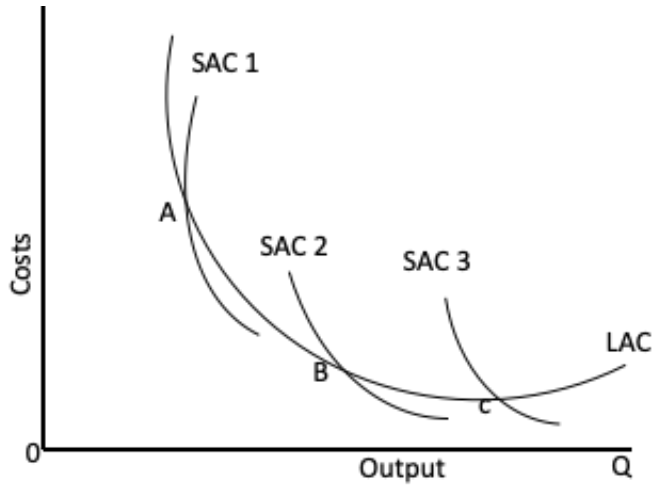

Figure 2.13: LAC Curve

From figure 2.13, every SAC curve contains Managerial costs, production costs, other fixed costs, and an amount for actual profits. Pints A, B, and C denotes the minimum optimal scale of output of each plant. By combining points A, B,

and C of a large scale, a continuous smooth curve is traced out to determine LAC curve as illustrated in figure 2.13.

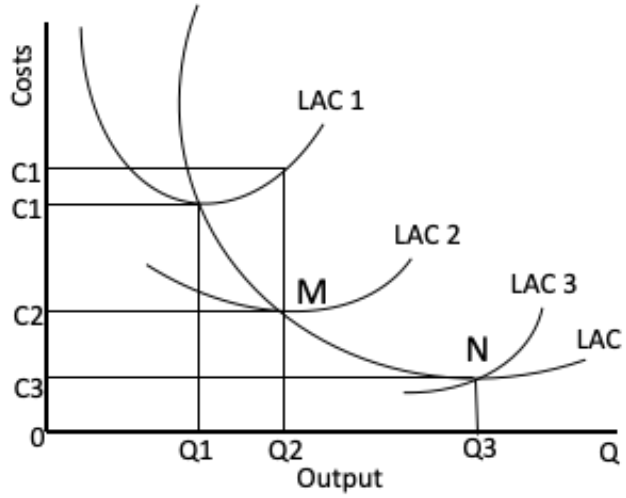

Figure 2.14: LAC Curve

The curve in figure 2.14 does not necessarily reflect a significant level of output. It also does not encompass SAC curves but intersects them at the optimum level of production of each plant.

d) Technical progress

The technical progress is another reason postulated by economists as evidence of the L-shaped LAC curve in the modern cost theory. However, the traditional cost theory accepts the non-existence of technical progress while describing the U-shaped LAC curve. The empirical findings on long-run cost proves the prevalent existence of technical progress in firms or organisations (Nardidni 2012). The long-run average costs reveal a dropping trend at a phase between which the technical progress has occurred. The L-shape LAC curve resulting from technical progress is illustrated in figure 2.14 above.

e) Learning

Learning process is also one of the reasons for L-shaped LAC curve in the modern cost theory. Learning can be described as the result of experience

(Nwokoye and Ilechuckwu 2018). Assuming experience in this instance can be measured by the volume of commodity produced, then an increase in production will bring about lower unit cost. Hence, learning consequence in this case is comparable to increasing returns. First, the knowledge obtained from working on a large scale cannot be forgotten. Second experience is measured by the combined output produced since the inception of production of such output. Lastly, productivity rate is increased through learning.

Figure 2.15 illustrates a learning curve (LAC) which associates productivity cost of a given output to the total output over the complete time period.

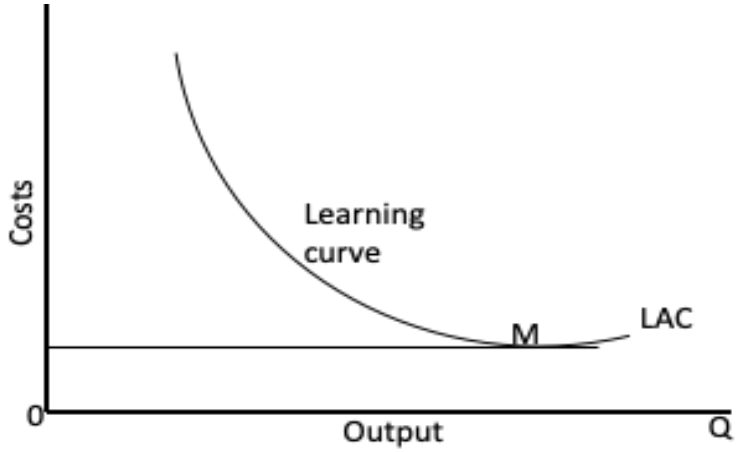

Figure 2.15: Learning Curve

In conclusion, the construction industry is part of the economy which is different in several ways compared to all other areas of economic endeavor venture (Ofori 2016). This could be due to the fragmented nature of the construction industry which sometimes warrants its own specialized economy. Construction economics involves the application of techniques and economic expertise to construction projects. It is therefore associated with the study of man's needs in relation to shelter and the appropriate and suitable condition in which to live (Ashworth and Perera 2015).

2.4 Building Costs

The business dictionary simply defines cost as an amount that should be paid or given up getting something (Business Dictionary 2019).
However, with establishment of several financial accounting societies and increasing academic research in construction project management, the term cost has been described differently. Cost in construction can be described as the amount disbursed to get goods or services in construction projects. Construction costs vary from stage to stage of a construction project.

Taylor (2007) also defines building cost as the money, labor, equipment, and other resources needed to complete a project. In other words, cost plays a significant role in the general success of any project. The effect of cost can be recognized in every element of the project. Hence, a well-planned cost system goes a long way in the successful delivery of a project.
A typical project constitutes triple constraint one of which is 'Cost'. These project constraints if put together as specified will drive the project towards achieving its aim and objectives and essentially satisfying client's needs. Building construction costs constitute part of the general costs expended during a building execution stage. These costs will involve the actual costs of construction works. The construction may also include all hard and soft costs associated with the site acquisition, construction and improvements related proposed building projects.

2.4.1 Types of building costs

Some specific types of costs included in building construction projects are **fixed costs** (one-off costs incurred at a particular of a building project e.g., cost of equipment), **time-related costs** (costs expended on a particular project activity for specific period of time e.g., wages, equipment and building rentals fees etc), **quantity-proportional costs** (these are relative costs, and they vary based on quantities e.g. cost of material). However, building construction costs are mainly classified into, direct and indirect costs.

2.4.1.1 Indirect costs

These are costs incurred in funding of project works which are related to any physical portion of the project (Sears, Sears, and Clough 2008). Project overhead costs are considered indirect cost. Some variable costs are also considered as indirect cost running cost of a telephone line used on a project site is considered indirect. This is because cost of running the telephone line varies directly with the usage. Direct costs are not directly accountable for specific facility or products in a project e.g., administrative cost etc.

Typically, overall project cost is the total sum of direct and indirect costs:

Overall Project Cost = Direct Project Costs + Indirect Project Costs

- **Overhead costs**

  For any construction project, it is crucial for contractors to ensure successful completion of projects to client's satisfaction, and at the same time make a reasonable profit on the project especially in today's highly competitive construction market. Therefore, the decision is not only delivering the project within budget, time and quality but also considering the latter part of the project, which is delivering the project as planned with the expected profit (Egemen and Mohamed 2007).

  While cost of overhead is very important in construction cost estimation, it can easily be ignored. Ignoring overhead cost has pushed so many contractors out of business; hence, overhead cost constitutes a substantial percentage of the total construction cost. Project overheads include all costs incurred by the construction firm in maintaining the firm in business and supporting the production process but are not directly related to a specific project (Assaf *et al.* 2001).

  One the major problems encountered in current practice of estimating project overhead is the inability of the construction companies to understand the real costs for each work elements and those for each participant such as

subcontractors This either compel cost estimators not to assign overhead or use uniform cost elements (i.e., Direct labor costs) to estimate overhead costs (Kim and Ballard 2002).

In many cases in the Nigerian construction industry, contractors do not assign overhead costs separately and as such do not assign overhead costs to participants like subcontractors and work elements such as earthwork etc. Instead, they either assign overhead costs to work divisions in proportion to direct labor hours/direct labor or a mark-up of 20% for profit and overhead which is referred to as volume-based allocations (Omotayo and Kulatunga 2017).

These therefore make it difficult to discover what part of the project money is being made or lost because progress payments for each item of work usually contain overhead costs and eventually results in cost distortion (Sommer, 2001). It is therefore important for construction industries to estimate the overhead for the various tasks for each individual project executed rather than flat percentage rate for overhead as practiced by many contractors especially in Nigeria. This will go a long way in addressing some of the issues of cost uncertainties associated with different projects as every project is unique and characterized by its own uncertainties.

2.4.1.2 Direct costs

These are costs incurred directly on project facilities, functions, or products e.g., cost of labor, material, and equipment. These costs are comprised of cost components that can be identified by implementing a section of construction activity (Chitkara1998; Harris *et al.* 2013; Greenhalgh 2013). Besides labor, material and equipment, direct costs in construction contracts can also be attributed to plausible subcontractors works. Direct costs in construction can therefore be categorized into:

- **Material costs**

These are costs of materials used in the manufacturing a product or for providing service. Material in construction industry refers to the cost of various articulated

components delivered to building construction site which results to a functional element of the building project when appropriately combined. Establishing material costs for a project is straightforward as opposed to other parts of a project that require cost estimation. Often, the most reliable sources for material costs are suppliers. However, the estimator must always ensure that all specification requirements are covered in the quoted prices (Harris *et al.* 2013).

Material costs can affect project estimate greatly and this largely depends on the supply source and viability of the quotations received by the estimators (Onwusonye 2006). Thus, managing and controlling cost-related to material offers project opportunities for cost management.

Ensuring a timely flow of materials is very essential for the success of any construction project. Materials must be purchased at the appropriate time as the early purchase of some materials may result to tying down of capitals and incurring interest charges on the surplus inventory of materials.

• **Labour costs**

Labor costs are costs associated with the direct sum of all salaries and wages (including arrears and bonuses) paid to employees by the employer. Labor costs are classified into fixed costs or variable costs. Fixed labor costs are sets of fixed fees for services on a long-term contract (Chappelow 2019). An example of fixed labor costs is the amount it costs an organisation to contract an external vendor to do a repair maintenance. On the other hand, variable labor costs are wide-ranging costs incurred at different level of production or services by an organisation. For instance, the labor costs required to run an equipment is a variable cost which varies with the level of production of an organisation.

To determine the labor costs of a project, it is essential for the estimator to know the following: the specific condition of proposed work, expected weather condition, duration, and frequency of overtime etc.

In building construction, labor hours can be established by analyzing a unit man hour per item of work basis. The use of labor per unit of work can effectively be applied in project cost management when the cost history supports the data to be used in project cost estimate.

It is important that the consultant preparing project cost estimate to give allowance for variation in production capability that may occur due to project size, complexity, and location. Thus, consultants must determine the best way to account for labor by using a percentage of total labor cost which can be dependent on the wage level rate of the geographical region the project is to be executed.

• **Equipment costs**

These are costs incurred in the acquisition of the equipment to be used by an organisation. Furthermore, equipment cost does not include the purchase price alone, but all costs required to get the equipment installed and ready for use. Typically, cost of equipment can include items such as freight and handling charges, cost of site preparation to receive the equipment, assembly, and installation, testing etc. (Sears, Sears, and Clough 2008).

Plants used in building construction can either be owned by the contractor of the project or hired from a plant hiring company. Therefore, the cost may be covered by certain percentage of the entire project cost.

The careful selection and operation of plants and equipment in a project must constitute an integral part of the entire plan of a project. The complexity and size of a project also determines the type and number of plants and the equipment required, and this is highly significant to the cost of project.

The cost information for plant and equipment can be priced in the bill of quantities either by including the hire charges quoted by the plant company or by including the rate which has already been calculated for the company owned plant.

Other types of building costs

Other types of building cost include.

- ***Whole-life Costs***

Whole-life costs include the initial and subsequent running costs and remaining costs of building or an asset throughout the life of a project. The concept of whole-life cost is also referred to life-cycle cost (LCC). Determining whole-life costs involves analysing the overall cost of an asset including the subsequent operational, maintenance and disposal costs (Al Hajj 1999). Costs considered in determining whole-life cycle usually include the financial costs of assets and the social and environmental costs which are sometimes difficult to ascribe numerical values.

Whole-life cost analysis is commonly used to evaluate options when acquiring new assets and for decision-making. It is also functional in comparing actual costs for similar types of assets (Norris 2001).

- ***Social Costs***

Social costs are costs by firms or organisations involved in producing commodity or services. These costs include both explicit and implicit costs. However, the production activities of an organisation may result in economic harm or benefits. For example, production of materials like plastic or steel and chemical may pollute the environment resulting to social costs. This may also result in the society suffering some inconveniences as due to the production activities of the organisation.

- ***Environmental Costs***

Environmental costs are costs associated with the potential or actual depreciation of natural assts because of economic activities (Environmental Statistics 2001). Environmental costs can be observed from two different standpoints, namely as (a) costs related to economic units potentially or causing environmental deterioration due to their own activities or as (b) costs expended by economic units impartially of whether they have really impacted the environment.

2.5 Building Cost Information

According to Krishnan and Warfield (2006), a slight fluctuation in price can result to significant changes in profitability. An important goal of managerial costing is to provide product cost information that will assist cost managers in making pricing decisions. Many cost information literatures have analysed the proper treatment of costs associated with projects committed to support project activities to design product-cost systems, and hence improve organisations pricing decisions. However, economic theory suggests that in today's competitive market, information management has become a “prerequisite” for project management for profit-maximizing firms. The role of cost information in supporting processes in firms' operations has become increasingly important (Prajogo *et al.* 2018).

Information is the bedrock of all business decisions. It is pivotal to making accurate decisions. Construction also plays an important role in construction from the early stage of design through execution to completion of projects. Information in building construction can be pivotal in various aspects of project process, ranging from project design, health, and safety to quality assurance, etc.

Construction management involves a good deal of information and requires an effective database that can be used in storing historical building information as well as storing information generated during the building construction process (Park and Song 2017; Perera and Imriyas 2010). They argue that information management in building construction is a key success factor in improving project cost performance and cost effectiveness.

Past research proposes the usefulness of information in the construction industry to successfully handle different construction projects information requirements. According to Ismail (2009) the success of the construction industry is increasingly predicted on investments driven by information technology. Also, Akintoye *et al.* (2001) opine that cost information in project execution helps monitoring and ensuring projects meet set targets. Acquiring the right information in building construction can be quite challenging and if not done properly can affect the successful delivery of building projects. This is because one of the prerequisites for successful building cost

estimation involves acquiring the right information and ensuring the validity and reliability of such information (Sabol 2008). Cost information is an integral part of several construction activities such as cost control, forecasting, budgeting, estimating, project risk analysis and investment appraisal. It is also used in measuring profit margins, decision making value assets etc. The type of cost information to be explored depends largely on the type of cost under consideration.

A fundamental of part of quantity surveying profession is to effectively communicate accurate cost information to the client to ensure proficient design, realistic pricing and building production (Akintoye *et al.* 2001). Integrating cost and time management in building projects has been established as the most efficient way for managing projects (Sunil *et al.* 2015). Construction related costs information are used to set construction prices and usually the actual cost of construction plus the percentage allowed for profit. However, the practices of using building cost information differs around world (Best and Mecikle, 2015). This quantity surveyors can readily develop cost estimates factoring various cost indices within their home due to their familiarity with the major sources of cost information within their own countries, they are often aware of useful sources of cost data and related cost information in other countries. This problem is often exacerbated by the lack of information about key factors that can influence the estimate for specific geographical location (Humpreys, 1997). In other word there is considerable variation between countries in in the estimation of building costs.
At present, there is very little multi-country documentation available on building cost data (Kincannon and Franchet ,1998)

2.5.1 Sources of Building Cost Information

According to Akintoye *et al.* (2001), cost information for building construction projects may be obtained from a variety of sources depending on the factors influencing the specific mode of collection. He argued that these factors may include:

- Reliability and accuracy of the expected building cost
- Availability of relevant cost information
- Availability of time for cost information collection
- Nature of project for which information is required

- Ease of use
- Availability of sufficient design information
- Expected frequency of the use of the specific cost information

Furthermore, building cost information is accessible from various sources which include published data, suppliers and contractor's quotations, free online access data, contract cost from previous projects, Gazettes, Bill of Quantities, Cost books, cost information from personal projects etc.

This information when obtained can be used to prepare a wide range of items including cost estimate, adjustment of estimates, preparation of bill of quantities, and to establish geographic economic trends of building projects among others (Dell'Isola 2002). It is very essential to have an in-depth understanding of the various sources of information to be able to evaluate their relevance and dependability in preparing cost estimates and the management of cost information. This information also must be carefully and well interpreted (Ricart-Costa, Subirana and Valor- Sabatier 2004). Furthermore, it is important to carefully consider the condition that informed the choice of procurement strategy bearing in mind the changes in market conditions which implies that cost information must be reviewed from time to time (Malhotra 2005). Most of these issues demand great skill and expert judgement as well as identifying the various cost indexes and market conditions in different locations.

2.5.2 Uses of Building Cost Information

Cost information is an essential element across several activities involved in building construction projects (Lepădatu, 2011).

The type of cost information will depend on the stage of project and the type of cost to be managed. In relation to building construction, cost in formation can be used to estimate building costs and aligned with project budgets and set out in cost plans. Hence cost information evolve is utilized the life of the project.

Table 2.2: summary of literatures on uses of building cost information

Item No	Description	Source/References
Budgeting	Cost information plays an important role in cost budgeting. It serves as a financial tool that professionals can use for cost planning and estimation	Li, Y., Liu, H., and Song, X., (2018)
Feasibility Study	Cost information is key element in feasibility study to ascertain the viability of the project. It also assists in the development of other project documents such as project execution plan, business case etc.	Mohammed, S. R., Najj, H. I., and Ali, R. H.
Cost Planning	Cost planning arose from the need to effectively plan and control cost of construction projects from inception through design to construction phase	Corbett, P. and Rowley, P (1999)
Cost Control	Cost information enhances project cost control in evaluation and selection of cost technique for measuring cost potential and performance of project	Ancic, D. and Ancic, J.
Risk analysis	Cost information is very essential in risk analysis. Cost information gathered can be used in risk evaluation of building projects.	Aven, T. (2015)

2.6 Building Cost Information Management Practice

According to Horngren *et al.* (1990), building cost information management is the process of planning, coordinating, controlling and retrieval of all cost cost-related information of building projects from inception to the completion of the project. Also, Luu *et al.* (2007), defines building cost information management as the as a set of

principles or methods for costing and generating information to support different cost-related managerial decisions of a projects**.**

According to PMI (2008), the management of building cost information involves several stages which include: cost estimating, cost budgeting and cost control. These processes are performed at different stages throughout a project and information gathered from these stages are constantly updated, managed, and stored as reference future projects.

The concept of cost information management as in public procurement is anchored on need to control project cost. Ashworth and Hogg (2007), explain that project cost control requires the adequate control of costs arising through the entire design and construction process of the project, focusing on the balance between the actual cost being spent and the actual value of works carried out or items provided. This is usually measured in an arithmetic form in project management using Earned Value Analysis.

Construction projects processes can be a lengthy one depending on the size and nature of the project. The procedures may involve many expertise and companies with quite often constant activities and piles of paper works on project information. As such, information management is very essential for information flow and to improve quality and speed of workflow in projects from commencement to commissioning. Mohammed and Stewart (2003) argue that one of the key drivers of effective cost management in project is the having reliable information system, both in the form of accumulated information, coded and stored in the firm database structures and in the form of information flows that permit rapid inter-organisational transactions between project participants.

However, progressive academic research in this area by Oladapo (2006) has also identified that Cost information management has played key role in monitoring and controlling project activities as well as specification of construction activities. As competition for international best practice in public procurement continues to rise, many countries and organisations are investing huge number of resources into

information and communication management as they seek to gain competitive advantage as well as to improve the productivity and control of internal procurement processes (Stewart, 2008).

According to Franks (2013) information management could be traced back to the days of the cave dwellers where human being was constantly compelled to record their experiences using tools available by painting symbols on walls etc. Several academic studies have been conducted on implementation of information technology in the Nigerian construction industry. However, no prior research has been done on the usage level and impact of cost information management of building projects in Nigeria. Nigeria is a fast-developing economy in Africa and the discrepancies in acquiring cost information especially in the construction sector and the effect of the economic, cultural, and socio-political issues on construction projects among other issues contributes to the high rate of variations in project cost and poor project delivery.

There is therefore a need for the adoption of a reliable building cost information model for quality management and proper monitoring of project performance and determination of quality costs. This will help in determining potential cost of possible failure in projects through the implementation of prevention strategies and ultimately, client satisfaction can be achieved.

Include a paragraph or two from information management (underpinning theories)
What are the key or main antecedents in information management e.g

- Capturing relevant information at the right time
- Capturing the quality of information

2.6.1 Current practice of building cost information management

According to the Project Management Body of Knowledge (PMBoK) (Project Management Institute [PMI], 2013) project cost management involves the planning, estimation, budgeting, funding, financing, managing, and controlling cost to ensure that projects are completed withing budget. Hence, cost information in the construction

industry includes all cost related information of project activities form initiation through to the occupation and use of the building (Ashworth, 2010).

Cost information management is a primary practice in construction project management. The key essence is to ensure that budgets allocated to key elements of construction projects form the basis for cost control. Cost information should therefore include the best possible estimates of cost for the project and should also form the basis form basis for forecasting future project costs.

Flyvbjerg (2007) defines cost management as targeted and methodical control of costs involved in a project. The aim is to monitor the project, processes and resources using concrete measures, ensuring that costs are efficiently managed.

Before commencing construction (i.e., at pre-tender stage), cost information management is centered on cost planning and estimation. The objective of cost information management is to ascertain a realistic budget for the proposed development whilst enhancing value for money (VFM) for the client.

Building cost information management spans through all phases of building construction projects whilst its activities can vary widely.

According to Keshta (2019), Managing cost information is one of the significant aspects of management in each of the construction project phases which defines the project life cycle). The primary step towards a robust cost information management in a construction project is having a clear idea of the likely cost of the project. The aim is to establish that cost performance at every phase of a project and ensuring that it meets project cost baselines. Deducing from the pertinent description of RICS, the cost management life cycle begins as early as cost estimation in the preparatory phase, cost planning at the design phase, cost budgeting and preparation of tender documents, cost control throughout the construction phase, and post-tender estimate until the conclusion of the construction. Cost planning in cost information management is done mainly to develop a pre-agreed cost framework in the most cost-effective manner while cohering with all the project requirements and baselines.

2.7 Cost Information Management in Key Phases of Construction

According to The Project Management Body of Knowledge (PMBOK, 2013), cost management is made up of four stages which generally follow to the project management progression as it goes from planning to construction and usage. Similarly, building cost information management takes place in the 4 key phases of construction which include design phase, post-tender phase, construction phase, and use. It is important to note that after the use phase there is also the demolition phase which involves cost information management, however for reason of simplicity and research scope the research will stick with the 4 key phases earlier stated. Hence building cost information management is conducted through all the phases of a project as summarized in Table 2.2 illustrating the flow of building cost information management activities through the key phases of constriction project. Figure 2.6 below illustrate the flow of building cost information management activities associated with the key phases in building construction.

Fig 2.2: cost management at key stages of construction

Source: Smartsheet, (2017)

Cost management cover a full life cycle of a building from initial planning phase through measuring the actual cost performance and completion phase. The cost management process can be categorised into four phases of construction: Resource planning, cost estimation, cost budgeting, cost control. The initial phase of resource planning which involves ascertaining future resource requirement for project scope of work. According to Ameh and Daniel (2017), resource planning begins at the scope and execution plan development process of a project.

Akanbi *et al*., posited that cost estimating process is generally applied during each phase of project. Typically, the method of estimation becomes more definite as the level of scope of work becomes more certain this is then followed by cost budgeting. Cost budgeting is a cost estimation process involving the allocation of estimated cost of resources against which cost performance will be measure. In other words, it forms a baseline for cost control. They are often time-phased to address cost budget and cashflow in projects.

The fourth phase of cost management is cost control which involves the measuring cost variance and taking effective corrective measure to achieve minimum cost.

2.7.1 Overview of cost management during the key phases of construction

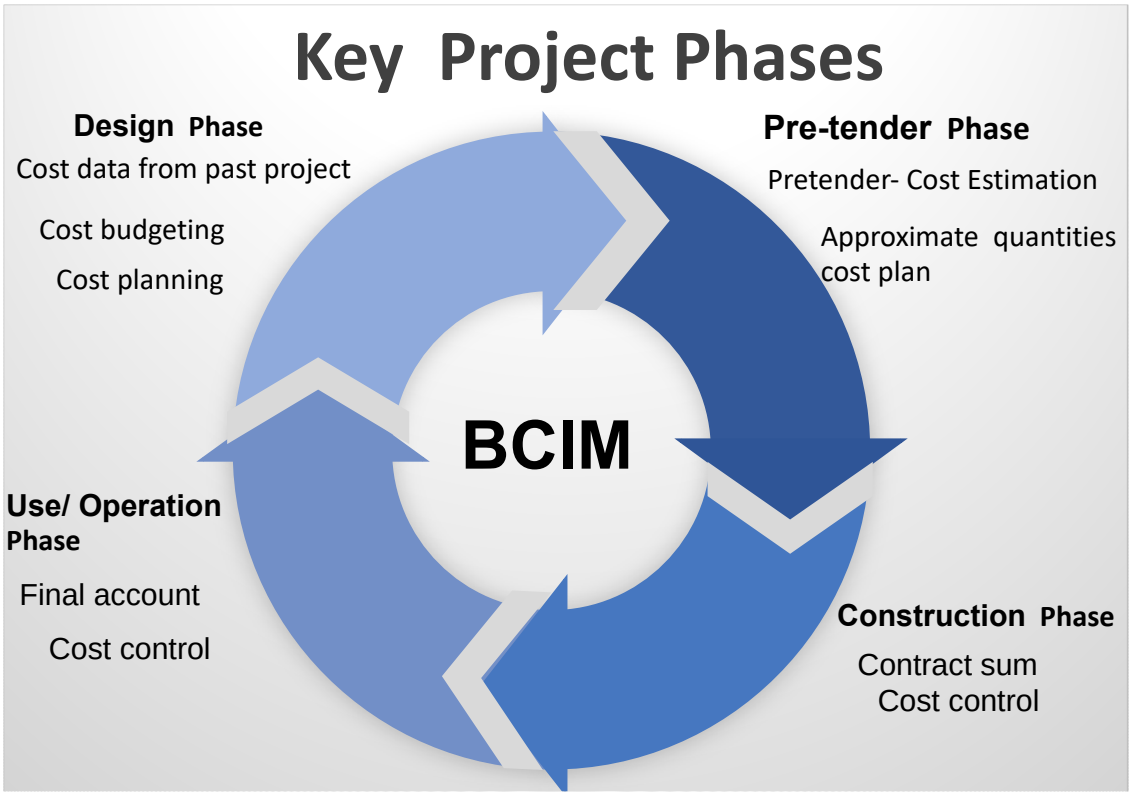

Fig 2.3: Cost information management at key construction phases

2.7.2 Design phase

The design phase essentially forms part of the initiation stage of a project. According to Cunningham (2015), the process at this stage often develops over a period of (many) months depending on the size and complexity of the project, through several stages which the client requirements are established and developed. The process begins with the development of budget through order of cost estimate and controlled through cost plans (RICS 2016). This is achieved by defining resource planning using a work breakdown structure (WBS) which involves a detailed hierarchical representation of all project deliverables and work required to complete them to calculate the total cost of resources required to successfully complete the project

At this stage, the project manager ensures that cost data from past project are available (flyvbjerg 2012). This will help determine the required resources for each component of the work breakdown structure cost baselines and the cost requirement of the project deliverables. Hence, having a reliable cost information management database will help make key decisions with regards to project costs allocation constraints.

This stage also involves general project cost planning often prepared by cost consultant (quantity surveyor). This cost plan evolves through the project life, developing in details and accuracy as more cost information becomes available.

2.7.3 The Pre-tender phase

This phase involves identification of project needs, planning and budgeting as well as definition of requirement. The pre-tender phase is often considered to be crucial for the successful management of contract. The pretender phase involves preparation of pretender estimates which sits somewhere between cost planning and post contract cost control (RICS 2019). In other words, the quantity surveyor prepares the final costing of the works before tenders are established. The pretender estimate also provides a basis for benchmarking tenders when they are returned. According to Garimella (2018), one of the key objectives of cost planning and cost control at pre-tender stage of construction is to ensure that the successful contractor's tender does not exceed the budgeted cost.

Hence it is essential to obtain an accurate cost information for estimation. Odunsami and Onukwube (2008) identified the poor quality of cost information as one of the factors that influences the accuracy of pre-tender cost estimation. Akintoye (2000) similarly explained that the sources of cost information, is a key determining factor in the accuracy of cost estimation in construction. As such the accuracy of pre-tender cost estimate is essential in determining the success or failure of a construction project.

Consequently, a reliable cost information at the pretender phase can prevent cost distortion and inaccuracies (OLAF 2016). This becomes imperative in determining the cost feasibility of a project and ensuring that works can be benchmarked against available cost data (Omran and Hooi, 2018). Owing to this, cost information at the pre-tender stage becomes increasingly important as a key starting point for accurate pre-tender cost estimation.

Pre-tender document should be broken down into different packages, this will ensure that tenders are easily compared to one another and pre-tender estimate. Also, it allows for identification of any anomalies or potential savings.

2.7.4 The Post-tender phase

This phase involves the preparation of post-tender cost estimate. It is prepared following the receipt of construction tenders and becomes the first cost report.

According to Akinkoye and Olasanmi (2018), various studies have been conducted post tender cost estimation and financial performance of construction project. Hence it is argued that obtaining a reliable cost information should be critical at the post-tender phase of construction project to ensure cost management and financial profitability of the project (Mwangi *et al*., 2018). Similarly, a report by (MacMillan , 2016) on the effectiveness cost information as a key performance indicator on post-tender contract negotiation in construction performance in the UK revealed that it improves construction cost performance and procurement performance by 72% whereas in Nigeria, it was noted from previous research that due to the numerous factors such as inadequate design information and the lack of experience and

expertise, it is extremely difficult for quantity surveyors to arrive at accurate cost estimation which in turn affect post tender negotiations (Oladinrin, Olatunji and Hamza, 2013). Nonetheless, the overall of post-tender cost estimation and negotiation on construction cost performance remain
n unclear especially in an emerging economy like Nigeria (Ngwenze and Ismail, 2021). However, it is imperative to consider the form of contract to be reflected in the tender document when undertaking a post-tender cost estimate.

2.7.5 Construction phase

This goal at this point is to have every work package planned to begin the actual construction execution. Cost management is therefore considered to highly critical at this stage (Koutsogiannis, 2020).
However, cost control during the construction phase has been a major concern as every client demand value for money on construction differs (Igwe *et al*., 2020). Also, the construction stakeholders are faced with cost control challenges posed by ever-increasing construction facilities and unreliable and outdated sources cost information. Hence the trend of information technology in construction cost estimation and control requests that construction cost optimization be digitalized and automated for better competence of construction professionals and effectiveness of project delivery.

In addition, the introduction of Building Information Modelling (BIM) technology in construction has played a huge role in improving construction project in relation to quality and time. Initial experiences of the use of BIM indicates that it significantly reduces construction time (Eastman et al. 2009). These initial findings of BIM has since increased the popularity of BIM usage in construction.

Although the benefits of BIM in construction are widely acknowledge and the technology to adopt BIM is improving rapidly, there are still some challenges that needs to be overcome for BIM to be used f-or some aspect of construction like cost control (Fischer and Kunz, 2004). This further indicates that, no perfect Building Information Management system exists. Similarly, as good as Building Cost Information Services (BCIS) is the estimation of building construction projects, it is not void of limitations.

Owing to the limitations of the use of some technologies or database in construction cost control and management the study a proposed building cost information management framework will provide a common database platform to mitigate some of these cost management limitations and will enhance building construction cost estimation.

2.7.6 Usage Phase

Cost management is one of the most important aspect of a project that affects every phase of the project. The cost management functions importance cuts across all phases of a project life cycle. However, the construction industry has experienced difficulties in cost management due to discrepancies in information connectivity across the various phases of construction projects, which (Dib 2007) has described as the “island of information syndrome”. For instance, at usage phase, a project is deemed to be completed and ready for the client’s operation and utilization (Dib, Adamo-Villani and Issa, 2013). However, in other to ensure clients full satisfaction, it is important to ensure that they provided with all necessary cost information on the usage and the utilization of the final product. This, to some extent will improve serve rendered to client.

Hence, cost information management is believed to be effective in reducing project life cycle cost and improve services to clients. (Guo, Heng and Martins 2020). Given that construction projects are traditionally fragmented into different phases with each of the phases requiring cost information per time which It becomes highly imperative to introduce a cost information.

The proposed BCIM framework will also offer cost information that may be useful for building management.

2.8 Review of existing cost management frameworks for building project delivery

According to Liu & Zhu (2007), a framework embodies the reality of an actual process or system. The purpose of this narrative is to establish whether efforts have been made to identify relevant parameters to prioritise building cost information management from a list of building cost management literature. Apparently, several studies have developed various frameworks advancing towards assisting decision makers in evaluating the complexities around project cost management and ensuring an effective project cost management. However, many of these frameworks were not specifically addressing cost information rather they address the management of cost itself. In other words, extant literature has not explicitly identified cost information as a driver or contextual force that govern effective project cost management. For instance, Oladapo (2001) developed a project cost management framework. This framework established the need to integrate the life cycle costing methods into the design of cost structure for a project management. However, this did not show a clear link between cost information of estimating the right cost of a project. In addition, Obi *et al.* (2017) developed a successful factor framework for effective cost management however, this was claimed to only be applicable during the cost control phase of a project and not necessarily addressing wholistic cost management of projects from start to finish

Similarly, Omotayo and kaltungo (2017) also developed a cost management framework for low-cost housing. While this framework identifies the importance of source of cost data at the early stage of a project it does not address the various cost indices used for cost information updates. While some of these frameworks continues to pave way for additional research, the key challenges appear to rest with the theory underpinning them as well as the evidential chain requirement for project cost performance. For example, some of the process-based frameworks are too broad for implementation, as key success factors (to support validation and implementation) and well specific drivers are required. It is therefore important to acknowledge the need to improve the value of cost management frameworks, including the existing contextual interrelationships. These are important drivers' important drivers of cost information management process. Moreover, Ahadzie & Amao-Mensa (2010) suggests the need to appreciate all driving forces for cost management to support successful delivery.

A holistic framework therefore requires relationships, especially how these relationships and delivery output can be utilised in practice. This principle therefore underpins the core rationale of this study and the output.

2.8.1 Challenges of selected cost management framework

A review of three selected framework shows some areas of weaknesses. These frameworks succeeded in providing details of technique process and key success in cost management reflecting the stages in construction projects. However, they failed to distinguish the input process (cost information sources) or highlight their relationship as well as the success factors to aid effective implementation of these frameworks. Furthermore, these studies were conducted over a decade ago which suggests the need for a more recent study to reveal current cost information management strategies and approaches employed in Nigeria.

2.8.2 Summary of findings

The frameworks were quite remarkable, as they cover project cost management at different stages of construction. They highlighted the processes and method; however, they lack the representation of information management success factors. As such, it presumes that the users may not be certain of the factors required to be put in place to effectively implement the techniques within process.

The foregoing review suggests that frameworks are developed based on the identification of contextual problems the researcher sought to address. As suggested by Charoenngam and Sriprasert (2001), an effective cost management framework should specify updated information about various aspect of project cost performance to enhance decision support for all stages of management during construction.

2.9 BCIM Practices in Nigeria

The Nigerian construction industry is characterized by several economic uncertainties with the existence of numerous corrupt practices and professional misconducts in both public and private construction projects (Sanusi 2010). He maintained that most contractors hike tender price for selfish reasons and to cover for any loss that may occur due to change of government and government policies. This practice thrives because there has been no standardized building cost information structure to check the transparency of contractors' tender price (Akintoye 1991). This also leads to cost overrun and delays which have been identified by many studies in this area as principal factors responsible for building cost variances. Akintoye and Fitzgerald (2000) identified inability to respond to the variations, lack of cost data review and use of basic isolated systems as some of the major reasons for inaccuracies and unreliable cost estimates. Arguably, the importance of cost information in the Nigerian construction industry cannot be overemphasized given the construction industry serves a major network through which huge funds are diffused into the Nigerian economy (Amusan *et al.* 2017). Also, Elinwa and Buba (1993) emphasized the need for a construction cost database as a tool to enhance cost performance of building projects in Nigeria. This will also enhance cost transparency in contract execution in Nigeria and provide an effective means for cost control at the execution stage of building projects.

According to Sanusi (2008), over the years, the Nigeria construction is envisioned to be one of the major drivers of the Nigerian economy. It has been responsible for the provision of building structures and infrastructure projects. Earlier on, Akintoye *et al*. (1992) Earlier on, Akintoye *et al*. (1992) proposed a need for enhancement in the quality of cost information and cost databases in Nigeria. According to Azhar (2011), such enhancement is characterized by the introduction of a reliable building cost information database. However, the general context and expert opinion suggested that the implementation of a national building cost database may largely depend on the choices and capabilities of practitioners, as various organisations tend to implement their in-house organisation cost information software for building projects (Jrade and Lessard, 2015: Lan, 2014; Olatunji and Sher, 2014).aAccording to the Nigerian National Bureau for statistics (NBS), the building and construction has contributed an

average of 1.44% to the overall GDP between the year 2001 and 2005 GDP (NBS 2006). Also, El-Ruffai (2011), reported that the construction accounted for about 12.09% in 2010, as opposed to 11.97% in 2009, and has demonstrating a more significant investment in building construction activities. This figure was projected to rise steadily to about 2.13% annually (BMI 2007). Given these the significant contribution of the building and construction industry to the Nigerian economy, there is therefore need for a reliable cost information to aid accurate building cost appraisal and for better cost performance of building projects in Nigeria.

However, the Nigerian construction industry have been faced with issues of building cost variances and high cost of building projects. The impact of inaccurate cost estimation on building projects in Nigeria is significant (Akintoye, 1998). Overestimated building costs results in high tender price unaccepted by clients. While underestimation on the other hand could result in contractors incurring losses on contract if awarded (Akintoye and Skitmoore, 1991). However, the preparation and accuracy of any type of cost estimate will depend greatly on the amount of information available and tools used during different project phases (Abdoul, Lewis and Alzarooni, 2004).

In the Nigerian construction industry, the quantity surveyor is prime cost economist; hence, the focus on quantity surveyors as the hub of building cost estimation and management in Nigeria. Practitioners and researchers have identified the uncertainty of construction cost estimates in Nigeria and the need for a reliable cost prediction system. Building projects in Nigeria are known to overshoot their budgeted cost owing to the various financial issues and technical pressures of cost limits, value optimization and quality (Oyebode, 2019).

According to Jagboro and Bolanle, (2005), a staggering amount of over 450 billion naira has been recorded for projects considered as failed contracts spanning from year 1979 to 1998. The main reason for this can be linked to the lack of adequate cost management and unavailability of cost database to check cost transparency; hence professionals involved had little or no cost management inputs in both

qualitative and quantitative terms. Another major reason for poor building cost information management practice and high rate of building project abandonment in Nigeria especially in government projects is that mobilization fee for most government projects given to contractors is further reimbursed to the awarders of the contract in the form of bribe (Oyebode, 2019). This usually involves huge sum of money thereby increasing the overall cost of projects which in some cases eventually lead to project abandonment. This has resulted to public expressing serious concerns over the large number of abandoned public projects in various parts of the country.

Given therefore, the high cost for construction resources and high interest in this dwindling, deregulated and depressed economy, it is important that efficient costing should be a very strong element in project design and implementation. The need to have cost data available from the earliest stages of the design is crucial for effective planning, appraisal, accurate cost estimation and effective cost management of building construction works in Nigeria (Umezinwa, 2017).

2.9.1 Barriers and challenges to building cost information management in Nigeria

Poor performance of construction remains in both developed and developing countries (Flyvbjerg *et al.,* 2003). Various publications in construction management emphasizes this concern. Although Toor and Ogulana (2010) have proposed the need to use other performance evaluation metrics (such as Stakeholder's satisfaction, safety, etc.); cost time and quality remains the most popular performance indicators. Despite the existence of various studies addressing poor cost performance of building construction projects, (Ramanathan et al., 2012; Alsehaimi et al., 2013), it is apparent that this remains a re-occurring issue. Practical indication from previous study suggests that unreliability of cost information is one of the significant factors responsible for poor performance of building construction projects (Ng et al., 2004; Atkinson, 2002). In a similar vein Meng (2012), revealed that effective cost management practice within the construction industry is an important component in the process of improving performance of building construction projects. Hence an understanding of cost information management practice is vital to meeting project performance objectives.

In recent times, researchers in the field of construction have shown an increased interest in construction cost management related studies. This is due to the need to meet advance global cost information management practice. Similarly other studies have investigated the use of information and communication technology (ICT) in building construction (Peansupap and Walker, 2005; Ng *et al*., 2001; Duyshart *et al*., 2003). However, there is limited evidence of studies particularly addressing building cost information management especially in the Nigerian construction industry. Except for Akintoye *et al*. (1992) and Elinwa and Buba (1998) which addresses construction cost information management in Nigeria with their focus on quantity surveying practices. They revealed that lack of reliable cost database, timing of information and cultural/organisational barriers were contributing factors to poor project performance among other factors.

2.9.2 Factors affecting Building Cost Information Management in Nigeria

There are several factors that affect construction project cost some of which are factors that are specific to projects and those that reflect the characteristics of the project team. Various analyses from past studies have shown that regressions are mainly used in estimating project cost.

However, many consultants often include a few numbers of factors when preparing project cost estimate and projections from such estimates most times turn out not be accurate (Chan and Park, 2005). Thus, to overcome this technical inefficiency, consultants and building cost analysts must identify all contributing factors that influence the estimation and final preparation of project cost, to construct effective and predictive project cost management system and assess the relative importance of determining factors to deliver project within the budgeted cost.

A construction project can be characterized by many variables and requirements, some of which can be related to the project characteristics, client, and contractors/consultants. These requirements may include high level technological level, contractor's specialised skills of contractors, procurement type and public contract. All these have significant effects on project cost.

Other factors affecting construction cost components include contractor's technical expertise; level of client's construction knowledge and sophistication, contractor's ability to manage finance etc. The assessment of the impact of each of these factors on project cost can go a long way in proving a decision support system for consultant to estimate project cost accurately. The Nigerian construction industry is characterized by a wide range of problems some of which include time and cost overrun, delay, abandonment, fluctuation in price of materials, fragmentation, etc. (Oyedele and Tham, 2008). The success of a project is dependent on, the performance of the project key players among other factors. The consultant falls in the category of the project key players in the construction industry whose duties are to carry out project cost estimate as well as, project cost analysis throughout the project stages.

Also, the Nigeria construction industry is accustomed to heavy reliance on paperbased cost information system. Project cost performance of has suffered many setbacks as a result, therefore the cost information management system plays a significant role on the success project cost management and delivery in Nigeria. Furthermore, failures on the part of consultant in estimating project cost properly during the planning and design stage might lead to several factors causing significant problems in successive stages of the project. This eventually leads to a poor project management with less chances of success in terms of the project objectives. Many literatures in construction practice have examined the impacts of inefficient cost information management system, which can be linked to non-availability of comprehensive cost management system and a host of other factors. (Oyedele and Tham, 2008).

Nigeria being a developing country with an emerging construction industry has been faced with many factors that affect the components of cost information including:

- Corruption
- Material factors
- Labor factors
- Plants and Equipment
- Proximity to site

- Location
- Project size
- Complexity
- Environmental factors

Corruption

According to Adeyemo and Amade (2016) corruption erodes quality, dents social and economic development. Okafor (2013) define as any behaviour or act that infringes societal approved standard. Similarly, Oladele (2013) argued that the definition of corruption becomes more complex when viewed in terms of classifications such as; transactional corruption, supportive corruption, personal and institutional corruption etc. From the foregoing, it can be inferred that there is no unanimity on the definition of corruption, but there are behaviours or actions that could be ruled as corrupt.

Corruption is the single biggest contributor to the high cost of government building projects. Inuwa *et al.* (2015), argued that most projects in the Nigerian construction industry fail because of the corrupt related activities by professionals on whom the responsibility and management of projects lies. For instance, contractors build-in huge margins called “PR or Public Relations” into contract sums because they are ‘expected’ to kick-back those who influence the award in their favor. They also build additional margins for delays and variations. Also, undeserving contractors build in the huge amounts in project cost estimate to secure contracts unfairly, and then build additional amounts to secure services of professionals who would otherwise do the job better, at lower costs.

Similarly, Hakeem Baba-Ahmed (2011) observed that the contractors build in additional costs to get supervising consultants and civil servants to overlook shoddy work, causing deliberate delays and questionable reviews and claims. They build in margins to cover costs of importing materials, much of which is illegal; to settle fraudulent taxation or evade genuine taxes; to cover costs for securing power, water and even access to communities at costs which are far above what they should pay. Some of these additional costs are also used by contractors to pay new political

leaders, in the events that there is change in government or management during the lifetime of the contract.

Corruption has eaten deep and caused significant harm to every facet of Nigeria, however the construction is the worst-hit by corruption (Ebekozien, Chukwudi, and Uchenna 2015). The outcome of corrupt practices in the Nigerian construction industry has led to large number of abandoned projects across the country and depriving millions of Nigerians access to good housing and other infrastructural amenities. However, the fight against construction-related corruption in Nigeria by the present government is perceived by many as sheer speech-making (Sotubo 2016). This is because there have been alleged cases of construction-related corrupt activities against some government officials. For instance, Umoru (2017) reported that the vice president's gatehouse of three-bedroom apartment construction was awarded for N 250million naira (£100,500), and a prayer mosque of about 100 square meters in size for the Senate President and the Deputy Senate President's residence was awarded for over N 200million naira (£80,400) as alleged by senator Dino Melaye. But these allegations were countered by the office of the Vice President office claiming that the gatehouse and other projects were awarded and completed during their predecessor's administration (Nwabughiogu 2017). The foregoing reflects the level of corruption in the Nigerian construction, hence, the need for construction professionals and the Nigerian policy makers to intensify efforts to mitigate corrupt practice and promote transparency in contract award procedures.

Unavailability of Building Materials

Building materials ranges from simple ones like tiles, bricks, cement, sand, timber, and aggregates to more intricate ones like reinforce steel, machineries, and safety equipment etc. Therefore, the demand and supply of building materials or the lack of it can affect building costs (Windapo and Cattell 2012).

The use of substance materials also affects the costs and quality of building projects in Nigeria; with many locally produced materials not meeting the quality standard of building materials. Oke and Abiola-Falemu (2009), reported that the quality of

materials used in building projects in Nigeria is not satisfactory and the problem lies in the use of inappropriate material for building projects.

Also, the market conditions contribute to the demand and supply of building, this is because the increase in the price of building materials is dependent on the market conditions under which such materials were produced. For instance, materials produced by only one or fewer firms will tend to have rapid increase in price compared to materials for which many manufacturers compete for the same market. A typical example of this is the Dangote cement which was reported to be priced at $9.57 per 50kg bag compared with $3.25 globally for the same quantity (World Bank 2016). The high cost of Dangote cement reflects lack of competition in cement production in Nigeria.

Furthermore, high importation of building materials has also contributed majorly to the increase in cost of building leading to a drop in the quality of the home-produced building materials. According to Atologe (2009), the need to achieve quality projects, quality growth and the lack of production infrastructures have all resulted in the high dependence of Nigerian construction industry on importation of building materials. Likewise, Owoye (2003), noted that the Nigerian construction industry imports nearly 60% of its raw materials while Qalitheia (2010) rates it at over 70%.

There is no doubt that importation promotes international trade and globalisation, and which accelerates economic development and make room for variety of building materials (Mbamali and Okotie 2012). However, the unbridled taste for foreign building material has left the Nigerian construction industry still dealing with a lot of fundamental challenges ranging from inadequate technical and managerial know-how, high cost of building/construction costs, lack reliable cost database and poor building cost information management. Also, this can result in steady decline of locally produced building materials and overreliance on importation which broadens the gap between import and export creating an unhealthy economic environment.

High Cost of Labour

Labor force in building/ construction is an important aspect in the successful delivery of projects. Labor is considered as one of the key factors affecting the success and overall performance in any organisation. Many researchers have reported a decline in construction productivity resulting from insufficient labor force. For instance, Lawal (2009), rated the productivity of construction workers in the Nigerian public service to almost zero.

According to Hansson (2007), another problem associated with labor in the Nigerian construction industry is the possibility of its variation across geographical location. For example, the South-south of Nigeria (i.e., Porth Harcourt, Akwa Ibom, Cross River etc) have a higher volume of construction activities than the Northern region of Nigeria (i.e., Kano, Jigawa, Borno etc) where construction activity is low. Consequently, labor productivity in the South-south region is higher compared to the Northern region with low productivity of construction with its attendant problem of cost overrun, time overrun, variations etc (Odesola and Idoro 2014).

Also, the cost of labor is likely to be more expensive in North-central and Southwestern regions such as Abuja and Lagos due to higher number of construction skilled-labor force. Compared to the Northern-region with fewer skilled-labor force where quality and productivity could be affected (Oladopo and Aibinu 2008).

Other factors affecting building affecting building cost information management include:

- Plants and Equipment factor
- Proximity
- Location/Topography of Project Site
- Project Size and Complexity
- Environmental Factor

2.9.3 Qualities of Cost Information

Cost information in construction projects is very important especial at the initial stage of cost estimation. However not all cost information may be good enough for project cost estimation. Any information obtained for the purpose of costing construction work must be as reliable as possible to ensure an effective cost estimating process.
Some the qualities of good cost information include:

Validity

Good cost information is expected to be relevant for strategic project cost decision. It is also expected to be substantial enough for effective cost management

Current

Cost management decisions are often based on cost information; therefore, it is important to ensure that cost information used are up to date and as current as possible.

Consistency

Cost information should also be consistent and concise to avoid tendencies of errors when such information is used for project cost estimation.

Reliability

Cost information is also expected to be reliable and dependable for project cost estimation.

Generalization

This has to do with cost information being applicable as much as possible for project cost management.

Chapter Three
Building Cost Planning and Estimation Practices

3.0 Building cost planning and estimation in Nigeria

Building cost planning and estimating are procedural practices of predicting cost of building projects (Akintoye and Fitzgerald,2000). Usually, construction contractors are known to tailor cost estimation and planning to the pricing of bills of quantities in line with the standard method of measurement. However, Law (1994) recons that many contractors in practice adopt their own methods of estimating and planning building cost and bidding.

Fagbenle (2011) have identified that the interrelationship between construction and the economy further reinforces the need to ensure that building/construction project planning and management are cost-effective.

Generally, it has been recognized that, actual cost of building projects in Nigeria most often differs from the estimated cost (Oberlender and Trost,2001). This issue has been argued to be due to such factors as bidding procedures, bureaucratic bottle necks, estimating processes and the use of outdated sources of building cost information (Adamu, Bioku and Kolawole 2011). For instance, Ibrahim and Kano (2004), affirmed that cost of building projects in Nigeria overrun their original estimated cost by an average value of 88.74% and Elinwa and Buba (1993) asserted that actual cost of building projects in Nigeria exceeds initial estimated cost by a value of 8-133%.

(Adamu, Bioku and Kolawole 2011). Despite the complexity in the Nigerian construction industry, it continues to be a major contributor to the Nigerian economic development and growth. Its contribution ranges from procurement of goods and services to the delivery buildings and other infrastructures thereby providing employment opportunities to its labor force. According to Fagbenle (2011), the interrelationship between construction and the economy further reinforces the need to ensure that building/construction project planning and management are cost-effective.

The core objectives of the construction industry to deliver good quality project within estimated cost and time underlined the need for an effective cost management system in Nigerian (Ayodele and Olumuyiwa 2014). However, attaining an acceptable level of quality, cost and time has been a challenge in the Nigerian construction industry (Ibironke 2012). Also, Olusola Ayangade and (2002) opined that building/construction in Nigeria is characterized by defects, incessant collapse and failures. They further emphasized that projects are completed at exorbitant rates and takes longer time to complete.

Additionally, many on-going and completed projects in Nigeria are in deficient in performance objectives due insufficient funds, low quality and soddy output arising from inaccurate estimation of building costs and variation in contract sum (Ubani *et al.* 2010). The building construction industry is considered to play a major role in the economics undertakings of the country (Olukayode, Mathew and Taiwo 2015).
Cost performance in building construction can be described as meeting the cost baselines of the original cost estimate. According to Oke *et al.* (2016), one of the key success factors in a building/construction project is the cost performance. This is because cost is a key consideration from project inception through to the management of the project life cycle. Also, Gido and Clement (2003) describe cost performance as an effective project management technique. However, it is very rarely in the building/construction industry that building projects are completed within the estimated budget due to various unforeseen factors.

3.1 Building Cost Budgeting

Building cost budgeting involves aggregating the cost of individual activities to generate a time-phased performance of a building cost estimate. A time-phased presentation of building project displays the total cost at each phase during building project execution (Abdomerovic, 2006). The Association for Project Management (2012) described budgeting a process estimating cost for a proposed project and setting an agreed target. To establish an effective building cost budgeting plan each aspect of the project must be analysed and allocated a specific cost estimate. The process of cost budgeting in building construction is simple yet very necessary in

ensuring successful project cost planning. Construction cost overrun has been established to be a prevalent problem in the Nigerian construction due to various factors one of which is building cost budgeting.

3.2 Building Cost Estimation

The accurate estimation of building is imperative as cost estimation form a basis for financial decision making and cost control in building construction. Cost estimation is crucial in project planning. According to Ubani, Amaje and Okebugwu (2015), the success of a building project management depends largely on the accurate estimation of the building costs. They posited that cost that inaccurate cost estimation is one of the problems faced by the Nigerian construction industry. Also, Aibinu *et al.* (2011) affirms that cost estimation of building projects in Nigeria are often susceptible to inaccuracies due to limited time for estimation, biases, and lack of information. Similarly, Mohammed (2008) reported the level of inaccuracies of between building cost estimation in Nigeria to be between 10% and 15%.

The rate of inaccuracies in building cost estimation in Nigeria is perceived to be significantly high (Kadiri 2014). Arguable this explains the high incidence of project cost overrun and project abandonment experienced in the Nigerian construction industry. The implication of this could be attributed to the fact that quantity surveyors in the Nigerian construction industry may not have enough cost information at the time of estimation due to the lack of building cost database.

3.3 Building Cost Control

There is a strong relationship between project cost control and cost performance. Cost control in building construction is considered one of the key factors for building cost performance. Thomas *et al.* (2002) posits that controlling and document performance data in building construction could be useful for future project cost appraisal and reference. Also, George *et al.* (2012) suggested that one of the primary function cost controls is to execute a project within the project cost baselines. However, many contractors in the Nigerian construction industry have found project cost control challenging due to several factors affecting the project delivery in Nigeria.

The typical cost control for items of work in any building project are categorized into two costs: Budgeted cost and actual cost. Having these cost categories give room for comparison between planned and actual cost to monitor cost performance. To understand the dynamics and differences between budgeted cost and actual cost of a building project, it is important to examine the variance indicators using earned value analysis.

Earned value analysis in building cost control involves the monitoring project plan, actual work performed and the value of completed to ensure project is meeting its baselines. It is a systematic project management approach used to check for variances in projects based on completed work and planned work.

3.3.1 Budgeted Cost

Budgeted cost in building construction simply refers to the amount set by a client or owner to spend over a period on a particular building project. The budgeted cost of a project is derived from the detailed cost estimate prepared at initial stage of the project

3.3.2 Actual Cost

Actual cost of building is the exact cost expended on a building project. This include cost of labor; materials etc. actual cost can be derived by adding all costs involved (direct and indirect costs) in the project

3.4 Building Cost Variances

Cost variance is phrase used to describe a cost shift from the budgeted of building construction. It is the difference between budgeted or planned costs and the actual costs. Most times cost variances in building projects often leads to increase in building costs where the actual cost is higher than the budgeted cost. Thus, **t**he building construction industry has a formal procedure to ascertain the initial building costs before a contract is awarded. This is done to determine the client's financial level

whether it is worth embarking on the project. Hence, if resources are not harnessed adequately in building projects, it results in project cost overrun. According to Ogunsemi and Jagboro (2006), one of the most serious challenge the Nigerian construction industry is faced with is the issue of building cost variances, where building projects are often completed at sums higher than the initial sum. This issues according to (Olatunji 2006) can be linked to the poor construction techniques, poor management and limitation of funds and time.

According to (1999), Cost is a key measure of building project success. This is true, especially in developing countries like Nigeria where public constructions are executed with scarce financial resources (Daniel and Andrew 2003).
Furthermore, extensive studies of cost overrun in the Nigerian construction industry over the years have revealed that some of the main causes of building cost variances include high cost of labor, plants and material, inadequate pre-planning, construction delays, poor contract management, corrupt practices, and the lack of cost information among others (Okpala and Aniekwu 1988; Dlakwa and Culpin 1990; Buba and Elinwa 1994; Mansfield *et al.* 1994).

The problem of building cost variance in Nigeria is phenomenal and will require effective measure in place to minimize the high level of project cost overrun in Nigeria. Cost variance can however be caused by many factors some of which will be discussed in the next section.

3.4.1 Factors Influencing Building Cost Variance in Nigeria

In building construction, there are significant factors that influences the project cost performance. The occurrences of building cost variances however are due to some of these influences of project factors. Several literatures have reviewed factors responsible for construction cost variance in Nigeria and the list of the reviewed factors are illustrated in table 3.1

Table 3.1: Factors Influencing Building Cost Variance Extracted from Previous Studies

S/N	Author	Year	Top Rated Factors
1	Okpala and Aniekwu	1998	Method of financing and payment for completed work, price fluctuation, poor contract management, shortage of material
2	Nwosu	2003	Weather conditions, insufficient and incomplete drawings, inaccurate estimates, unrealistic and inaccurate establishment of units, knowledge and competence of clients, variations.
3	Kasimu M.A.	2012	Material price fluctuation, insufficient time, lack of historical cost data, lack of experience, variation, incomplete drawings, inadequate specifications, incomplete drawings, lack of labor productivity, site topography, level of competition
4	Ameh et al.	2010	Cost of material, economic instability, frequent design changes, lack of contractors' experience, mode of financing, high interest rates, incorrect planning, fraudulent practices and kickbacks, poor financial control on site, poor contract management, additional works, high cost of plants and machineries.
5	Eshofonie	2008	Wrong method of estimation, cost of material, incorrect planning, high cost of transportation, additional costs, poor financial control on site, incorrect method of estimation, material price fluctuation, previous experience of contractor, contract management, lack of construction cost data.
6	Omoregie and Radford	2006	Financing and payment for completed work, change in site condition, poor contract management, price fluctuation, delays, additional works and design, shortage of materials, importation of plant items and materials, inaccurate estimation
7	Otunola	2008	Delays in sub-contractor's works, inflation, poor estimation, fluctuation of labor and material costs, government policies, variation/additional work, delay in approving claims, underpricing of tenders, poor project planning, poor financial control

It was observed from the studies reviewed that identified factors were repetitive among authors. This also an indication of the severity of these factors in the Nigerian construction industry. However, this study reviews some of the factors not highlighted in previous studies along with the some of the top-rated factors identified in previous studies.

This study therefore aims to investigate factors influencing building cost variances in the Nigerian construction industry with a view to establish the impact of the influencing factor on building cost information management in Nigeria. These factors include.

- Corrupt practices and kickbacks
- Lack of building cost database
- Inaccurate building cost estimation
- Systematic misrepresentation
- Additional works
- Fluctuations
- Variation order
- Claims
- Site location
- Transportation system
- Insecurities

3.4.1.1 Corruption and Kickbacks

Any organisation involved in corrupt practices stand a risk of huge developmental advancement. Unfortunately, the nature of the Nigerian construction industry leaves it vulnerable to corruption. The current Nigerian economic climate of inflated tender margins and reduced jobs, the risks of corrupt practices and kickbacks may be higher, as many contractors may indulge in practices against their professional ethics in a bit to get jobs or survive.

The bureaucracy and bottlenecks involved in the Nigerian construction contract processes especially in public projects does not give room for transparency in project cost management.

According to Olufemi and Omolayo (2013), the Nigeria construction industry has been highlighted for such corrupt practices as bribery, tender sum inflation, employment of illegal worker at low costs, disposing of information to preferential bidder etc. Also, Oyewobi *et al.* (2011), suggested that practically all aspect of construction processes in Nigeria are characterized by corrupt practices, right from pre-design stage through to post construction stage of projects. A report by Kwadwo (2013) stated that Nigeria construction industry is growing tremendously and fast becoming a hotspot for innovative construction. However, to sustain this growth; corruption factors and their cause must be thoroughly evaluated with the aim of drastically minimizing them or eradicate them completely.

3.4.1.2 Lack of Building Cost Database

The lack of national construction cost database in Nigeria has led to a lot of unwholesome practices in the construction cost management in Nigeria. A report by the Quantity Surveyors Registration Board of Nigeria (QSRBN) at the at the Nation Project Cost Reduction Summit in Abuja Nigeria in 2017 proposes for the establishment of a national construction cost database to check project cost variances induced by inflated project costs and fraudulent practices.

However, this proposition is yet to be established as the problem of high building cost is still on the increase in the Nigerian construction industry. According to Ojo and Odediran (2015) one of the factors affecting the accuracy of building cost estimation is the lack of historical data for similar projects. They further emphasized that the accuracy of any type of building cost will depend greatly on the availability of the building cost information required.

3.4.1.3 Inaccurate Building Cost Estimation

Estimation in building construction is one of the crucial tasks in budget development stage in the life cycle of a project. Ojo and Odediran (2015) opine that estimation is often carried out under uncertain conditions. However, Mukhtar and Zubairu (2009) argued that accurate building cost estimation is highly important for both contractor and clients. it provides a basis for contract submission in a tender and allow parties involved building construction to understand their respective commitment at the early stage of a project. Ensuring an accurate building cost estimation becomes a key success factor for project cost performance in the Nigerian construction industry.
Therefore, estimators are required to gather great deal of cost information prior to estimation to ensure accurate pricing of items of work.

3.4.1.4 Fluctuation

Fluctuation refers to any approved decrease or increase prices of materials and/or wages after tender date. According to Ibrahim and Kano (2004), fluctuation in building construction can be referred any approved changes (increase or decrease) in labor wages and material before the date of a tender is accepted. The impact of fluctuation on building contracts is largely dependent on its magnitude. A high level of fluctuation may cause significant difference between final cost and tender sum, whereas a low level of fluctuation may cause a little difference. Fluctuation also depends on the frequency of price changes such that frequent changes in price level results in higher level of fluctuation and vice versa. Hence the effect of labor and material price fluctuation significantly influences building cost variations in the Nigerian construction industry.

According to Udosen and Akanni (2010), the consistent increase in the cost of building material and fluctuation labor rates poses a significant threat to both aspiring homeowners in Nigeria and the Nigerian building sector as a whole. For instance, a bag of cement which was valued at N1,350 (i.e., £3.60) in 2006 goes i.e., as N1,850 to N2000 (£4.90 to £5.33) in 2009 and is currently sold between N2550 to N2800 (i.e., £6.8 to £7.5) (Haruna et al. 2018). Therefore, the effect of fluctuation on building cost information management in Nigeria cannot be over emphasized.

3.4.1.5 Variation Order

Variation plays a significant role in determining the final cost of building projects. The Nigerian construction industry particularly experiences a considerably high level of variations across both private and public building projects. According to Dosumu and Igbavboa (2017), 43.7% of building projects executed in Lagos south-western part of Nigeria have 5-10% variation due to several factors including clients lack of building knowledge, non-involvement of contractors in design process and lack of contract price fluctuation system. Similarly, Bhadmus (2015), identified five causative factors of cost variations and their impact on building projects in Abuja, north-central region of Nigeria, the factors include logistic delays and rework, quality degradation, variation decrease in contractor's profit, cash flow, lack of cost information. Hence variation orders on building projects have the potential to significantly increase building costs without necessarily adding value to the project in which case led to poor cost performance of building projects in Nigeria.

Other factors affecting building cost variance include.

- Systematic misrepresentation
- Additional works
- Claims
- Site location
- Transportation system
- Insecurities

3.5 Building Cost Planning and Estimation in the UK

The construction industry is typically known to complex, cost intensive and with huge input in various economies across the globe. According to (DBIS 2013; Smith, 2014), the UK construction industry constitute about 7% of the UK economy accounting for about £92billion gross value of the annual economy.

Delivering completed and functional building project within the budgeted cost is one of the main aims of every project (Olawale and Sun, 2015). However, achieving this has

been far from reality for most building construction project in the UK despite the many research works in construction cost control and the availability of many costs control tools and cost database (Azis *et al. l*2012). Although these cost resources have most construction firms in the UK to effectively control their cost compared to the rate of cost overrun other countries. For instance, rate of building cost control in the UK is about 10%compared to Nigeria with about 14% (Olawale and Sun 2015).

Furthermore, there have been few studies on improving the specific activities of project cost control. An example of such study is one by Mckim and Hegazy (2000) who established that project planning using a budget baseline yields better results compared to those using work packages alone. On the other hand, a study by Akintoye and Fitzgerald (2000) focused on the cost estimation of construction projects in the UK, which is a starting point of project cost planning. They opined that cost estimation within the UK is used predominantly to prepare clients tenders, audit project success as well as monitor project costs.

Chapter Four
Research Methodology

4.0 Overview

This chapter describes the methodology and adopts research methods to develop a building cost information management framework. The chapter discusses the significance of research philosophy in conducting research. It highlights how philosophical assumptions guides a researcher's worldview (Mackenzie and Knipe, 2006) and articulates the underlying philosophical assumption of this study. It also presents the research approaches and describes the adopted research methods and the justification for the adopted research methods.

The way research is conducted may be founded in relation to the subscribed research philosophy, the research strategy adopted, and the research techniques utilized (and possibly developed) in achieving the aim, objectives, and the research question(s). The research objectives and questions have been clearly outlined in chapter one of this study. This chapter however, presents:

- Description of philosophical postulations made for this research and the selected methodology to achieve the aim and objectives of the research.
- Details of how the selected methodology relates to the research, its relevance in answering the research questions and how it meets the research aim and objectives.
- Detailed explanation of the rationale for selected methodology ensuring that every objective is achieved using the appropriate approach. This study adopts a philosophical stance of pragmatism applying "concurrent triangulation" mixed method approach which include qualitative method, quantitative method and the use of documentary evidence as an eminent way of conducting mixed method research.
- the strategies adopted in investigating the research problem, research design, population sample, data collection methods, data triangulation, data analysis tools, validity, reliability and generalisability of the study. The research question of this study was established on the significance of building cost information

management in the Nigerian construction industry. This is further supported the development of the research aim which is to develop a building cost information management framework for the Nigerian construction industry. The framework serves a source of building cost information for building cost estimation and a benchmark to forecast future building project costs. To provide further clarity, the objectives of this study are reiterated below:

1. To examine the impact of types of clients on building cost information.
2. To investigate the underlying cause(s) of building cost variance around different geographical regions in Nigeria.
3. To critically examine factors that affect building cost information in the Nigerian construction industry.
4. To investigate reliability of building cost data in the Nigeria construction industry.
5. To comparatively analyze building costs in the UK and Nigerian construction industry.
6. To develop a strategic framework for building cost information management for the Nigerian construction industry.

This chapter also describes the main theory underpinning the research reasoning. Furthermore, it will discuss the two mostly widely used research methods in social science. Mixed method research strategy is also extensively discussed in this chapter.

Finally, the chapter discusses the selection of methodology adopted for this study, the data collection processes, and the form of analysis employed to meet the research objectives, to develop the BCIMF to the final stage, and to test the validity and reliability of the developed framework.

4.1 Research Philosophy

According to Ohioma (2019), a philosophy is a broad system of ideas about human nature and the nature of reality that man lives in. Research philosophy could also refer to a system of assumptions and beliefs about knowledge development (Saunders, Lewis and Thornhill, 2009). These include assumptions about the realities encountered by researchers (ontological assumptions), about human knowledge (epistemological assumptions), and ways and extent to which the researcher's values

influence the research process (axiological assumptions). These assumptions certainly shape the understanding of research. In adopting the right research methodology, a researcher must ensure that the methodology aligns with the research philosophy. Pring (2014), emphasizes the importance of understanding the philosophical issues in clarifying research design. The relationship between theory and data is an issue that has been strongly debated for many centuries by philosophers. However, understanding philosophical or paradigm issues clarifies which research design will work, which will not and will also help in identifying designs that may be part of the researcher's experience.

In addressing research philosophy, it essential to understand the sources and the nature of knowledge upon which the research assumption will be based. This is because research philosophy will reflect researcher's important assumption which forms a basis for the research strategy (Dudovskiy, 2018).

Generally, research philosophy has various branches related to a wide range of disciplines. however, within construction management which falls within both the natural and social sciences, (Knight and Ruddock 2008), there are four main research philosophies:

- Positivism
- Interpretivism
- Pragmatism
- Realism,

4.1.1 Positivism

Arguably, positivists believe that reality is consistent and can be seen and described from an objective point of view i.e., without any interference of the phenomenon under observation. They maintain that the phenomena should be independent, and observations should be recurrent. This usually involves falsification of reality with variations only in a distinctive variable to identify regularities to form relationships between some the elements that constitute the social world. Howell (2012) also explained that positivism theory provides a selection of reliable laws which allows for predictions. However, reliable laws and predictions are challenging enough, especially in social science. This is one of the major criticisms of positivism as explained by

Howell (2012) that post positivists argue that truth or reality existed, nonetheless it could only be interpreted probabilistically or imperfectly. Despite the series of debate on whether the positivism paradigm is suitable for social sciences (Cory, 2012), many others are calling for a more diverse towards information systems research methodologies. While this study will not elaborate further on these debates and arguments, it is relevant is relevant to this study since it deals with information system which is social sciences rather than physical sciences.

4.1.2 Interpretivism

The interpretivists' philosophy is one where the researcher interprets elements of the study; hence, interpretivism combines human interest into a study (Dudovskiy 2018). Consequently, interpretivists argue that access to reality be it given or socially can only be through social construction such as shared meanings, language, consciousness, and instruments. They assert that the intervention of reality can be fully implied only by interpreting it subjectively. One key element to the interpretivist philosophy is the study of phenomena alongside the understanding that scientists are directly affected by those phenomena they study. The value of interpretivist is in depicting how the experience of an individual shapes their perception of the world (Moon and Blackman 2017).

4.1.3 Pragmatism

The pragmatic paradigm as a set of principle that arose because of the debate surrounding the "paradise wars" and the emergence of mixed method approaches (Creswell 2003). The pragmatic paradigm refers to the worldview cantered on "what works" as opposed to what might be considered objectively and absolutely "real" or "true" (Frey 2018).

According to Tashakkori, Teddlie and Teddlie (1998), pragmatism has been observed to be appropriate paradigm for justifying the use of mixed method studies in social science and behavioral studies. It is also perceived to help researcher address questions that do not lie comfortably within wholly qualitative or quantitative approach to methodology and design (Creswell 2003). Hence pragmatism research philosophy recognizes that there are various ways of interpreting the world and conducting

research, that no single point of view can clearly give the entire picture and that there may be multiple realities (Collis and Hussey, 2014).

4.1.4 Realism

According to Sobh and Perry (2005), realism is often viewed as entities that exist independent or perceived theory. Realism has arguably been an important form of research philosophy which depends on the knowledge of objectivity of reality from the human mind. In other words, the realism philosophy is built on the postulation of scientific method to knowledge development. Hence, direct realism presents the world through individual human senses.

Realism can be divided into two categories: direct and critical realism (Saunders, Lewis, and Thornhill, 2012).

- **Direct realism**, also referred to as naïve realism, depicts the world through personal human senses. Direct realism accepts the world as relatively unchanging
- **Critical realism** on the other hand, posits that humans do experience the sensations and images of the real world. According to this category of realism, images and sensation of the real world can be misleading and often do not portray the real world.

Table 4.1: Research philosophies and data collection methods adapted from Saunders, Lewis, and Thornhill (2012)

	Pragmatism	Positivism	Realism	Interpretivism
Data collection method	Mixed or multiple method designs, quantitative and qualitative	Highly structured, large samples, measurement, quantitative, but can use qualitative	Methods chosen must fit the subject matter, quantitative or qualitative	Small samples, in-depth investigations, qualitative

4.2 Underlying research philosophy of the study

Research philosophy reflects the researcher's key assumptions which acts as the foundation for the research strategy. Successful research must pass through series of phases during the formulation of a research methodology. Saunders, Lewis, and Thornhill (2009) explain the different stages of a research when designing a research methodology using a research onion illustration in Figure 4.1. The research onion is very essential in understanding the different techniques for data collection and analysis procedures. The layers (not the shape) in Figure 4.1similar to the onion strata illustrates the identification of philosophical assumptions in research. The outer layer reflects philosophical assumption such as' positivism, realism, interpretivism and pragmatism, indicating their importance as some of the first areas to be considered in a research methodology.

The research topic, aim, objectives and questions of this study are centered around building cost information management. Essentially, the research methodology of this study is hinges on the availability of information which are key in answering posed questions. some important philosophical question that emerged were What if information required was centered on areas where there are language barriers? What if such information become inexistant? Will the research discontinue or change direction? Therefore, information was sourced directly from project participants via

semi-structure interview, as well as the use of survey questionnaires and archival data to give reliable research results. This study however adopts pragmatism as the most suitable research philosophy in accordance with the illustration in Table 4.2. This is because the researcher adopts both objective and subjective stance to answer the research question most efficiently. This is further emphasized in the fact that a research axiology is essential in determining the aim and hypothesis of that research.

The justification of adopting pragmatism approach lies in the use of both objective and subjective viewpoint in interpreting research findings. The objective viewpoint in this study is sought through the review of literature and books in the study area to establish the importance of cost information management in the construction industry. However, the subjective viewpoint of this study is established through data collection using questionnaire and interview to get the opinions of construction professionals on the importance of having a robust building cost information framework in the Nigerian construction industry which currently lacking.

Figure 4.1 The research onion adapted from Saunders, Lewis, and Thornhill (2009)

4.3 Research Paradigm

Pickard (2013) describes research paradigms as the 'world view' accepted by members of a specific scientific discipline which guides the research subject, the research activities as well as the nature of the research output. Similarly, Raines (2013) defines research paradigm as a research tradition which is a set of beliefs and practices. Whether one approaches a study of a phenomenon of concern in any field, using a deductive or inductive approach is determined by the research paradigm guiding the design of the study. However, Blaikie and Priest (2017) argue that research paradigms are assumptions made to provide a range of possible ways of approaching and investigating research problems. The key features of a research paradigm are its epistemological and ontological assumptions. These assumptions are made to describe and explain research from a particular point of view as well as to make sense of different findings in research. In any case, it is important to note that the choice of a research paradigm is not all about method of investigation but about the ontological and epistemological assumptions and logics of enquiry that will provide the greatest chance of answering a research question given the assumptions it entails. A research paradigm therefore is like a lens on pair of glasses through which researchers view the world (Killam 2013).

Becker and Neihaves (2007) opine that over the years, methodological diversity has been established with various research communities. However, the epistemological assumptions made by different research may vary significantly. These assumptions exert significant impacts on how concepts like reliability, validity, quality, and severity of research are presumed. The stages or phases of a research process is established on the assumptions about the nature and sources of the knowledge.
In adopting a viable methodology, the researcher must ensure the research methodology aligns with the research paradigm as different types of research are based on different types of beliefs and philosophy (Killam, 2013).

Furthermore, Thakurta and Chetty, (2015); Guba and Lincoln (1994), emphasized the significance of research philosophy/research assumptions in determining research methods and strategies. They classified research paradigms into four different categories namely:

- Epistemology (Positivism, Realism and Interpretivism)
- Ontology
- Axiology
- Methodology

4.3.1 Ontology

Effingham (2013) defines ontology in the context of metaphysics as the study of existence of something. Ontological positions of a research are usually characterized by two extremes known as objectivism and constructivism. Their differences be demonstrated by referring to two most common terms in social sciences (i.e., organisation and culture). (Bryman and Bell, 2015).

Bryman and Bell (2015) have also defined objectivism as ontological stance that suggests that social phenomena affect us as external facts beyond our influence or reach. They further define constructivism as 'an ontological stance that challenges the idea that organisational and cultural categories are pre-assumed and therefore confront social actors as external experiences that they have no position in fashioning. This basically suggests that social phenomena are not only developed through social interactions, but they are also in a continuous state modification. Hence this study adopts a pragmatic approach as the most suited approach due to the versatile nature of this research.

This study is philosophically inclined towards pragmatism due to the versatility in the method data collection (mixed method). This was also the ontology used in similar research by (Pham, 2018: Knight and Ruddock, 2008)

4.3.2 Epistemology

The type of knowledge research contributes is highly influenced by understanding of these paradigms, whereas the acceptable knowledge in a discipline is known as epistemology. It provides the fundamental approach to the study of knowledge. In other words, social epistemology is interested in the way social factors influences the

discovery and production of knowledge. Sarantakos (2013) defines epistemology as a central concept to the application knowledge. It studies the knowledge in which a subject of research is associated with and how this knowledge influences associated philosophy. Marsh and Stoker (2010) argue that epistemology position is a theory of knowledge that reflects the researcher's perspective about the nature of the world. Hence key epistemological question is the nature of the relationship between the researcher and what can be researched. Also, epistemological, and ontological positions are inevitably related given that epistemology has to do with how human agent study and analyze ontology. However, the correlation between epistemology and ontology is a highly debated issue. In fact, Hay (2007) asserted that ontological position cannot be proven, or indeed the relationship between epistemology and ontology. Rather a position which makes sense should be accepted and used consistently, while admitting that it is highly contested.

4.3.3 Axiology

Axiology is a branch of assumptions that involve assessing researcher's value on all stages of the research process (Dudovskiy, 2018). Axiology is specifically concerned with examining the role of a researcher's own value throughout the research.

Essentially, it refers to the "aim" of the research. This type of research assumption attempts to clarify if the researcher attempts to envision the world or only seeking to understanding it. In other words, axiology focuses on what a researcher values in research. This is essential because the value a researcher place on research has a significant impact on how such research will be conducted and value of the research findings.

4.3.4 Methodology

Singh and Nath (2007) described methodology research as a more formal, systematic, and objective recordings and analysis of controlled observations that may lead to development of principles, generalization or theories resulting in predictions and possible ultimate control of events. Similarly, Saunders *et al.* (2007) identifies the characteristics of research as a systematic interpretation of data collected with a clear purpose for discoveries. Every research project is based on certain philosophical

assumptions about the nature of the world and how to obtain knowledge about the world (Myers, 2013). These philosophical assumptions become the basis for everything that follows. Building cost information being the focal point of this study is not a widely researched area. Several researchers have pioneered design science research methodology in information system, yet over the past 15 years, little design science research has been done in this area.

The methodology therefore incorporates the ontology, epistemology and axiology which helps to ultimately guide the researcher on the choice of research philosophy for this study. The table presents a summary of research philosophy and their applicable method of data collection as described by Saunders *et al.* (2009).

4.3.5 Questions Defining Research Paradigms

According to Guba and Lincoln (1994) research paradigms are "*basic belief systems based on epistemological, ontological and methodological assumptions*". According to them, researchers are required to respond to three fundamental questions which are interconnected and can define their research paradigm. These questions include:

1. **The epistemological questions:** *What is the nature and form of the reality?"*
2. **The ontological questions:** *What is the nature of knowledge?" How is knowledge acquired? Is it belief, truth, and justification?*
3. **The methodological questions:** *What is the best way to acquire required knowledge?*

Table 4.2 illustrates the summary of the main research paradigms and their responses to the three fundamental research questions highlighted above.

Table 4.2: Comparison of main research paradigms (adapted from Guba and Lincoln, 1994)

	Positivism	**Post-Positivism**	**Critical Theory**	**Constructivism**
Epistemology	Dualist-Objectivist	Modified dualist/ objectivist	Transactional/ subjectivist	Transactional/ subjectivist
Ontology	Realism	Critical realism	Historical realism	Relativism-local and specific constructed realities
Methodology	Experimental/ Mainly quantitative methods	Modified experimental/may contain qualitative methods	Dialogic/dialectical	Hermeneutical/ dialectical

Table 4.3: Summary of Research Philosophy and their Applicable Method of Data Collection Adopted from Saunders e. al. (2009),

	Axiology	**Popular data collection techniques**
Positivism	Research is undertaken in a value-free way, the researcher is independent from the data and maintains an objective stance	Large samples, highly structured measurement, quantitative can also utilize qualitative
Realism	Research is value loaded; the researcher is subjective cultural experiences, world views and upbringings. These affects the findings of research	Method adopted must suit the subject matter, qualitative or quantitative
Pragmatism	Values play a significant role in result interpretation; the researcher adopts both objective and subjective perspective	Mixed or Multiple method designs, qualitative and quantitative approach
Interpretivism	Research is value bound; the researcher is part of what is being researched, and cannot be separated, hence will be subjective	Small samples, in-depth investigations, qualitative.

4.4 Research Reasoning

Another key factor to be considered in a research methodology in design a research methodology. It is basically a process of logically exploring existing knowledge to evaluate arguments, construct explanations and formulate fair judgement to justify a research position. Research approach involves the procedures and strategies that span the steps from broad postulation to comprehensive method of data collection, interpretation, and analysis (Creswell, 2014). According to Trochim (2013), there are two broad approaches of research reasoning in logic namely:

- Deductive Approach
- Inductive approach

4.4.1 Deductive Approach

This approach involves initial step of analyzing existing knowledge in the research area in bid to find existing knowledge gap upon which a hypothesis is formulated. This process can be done during the research through experiments, survey, observation, case study etc.). The postulated hypothesis will be tested against the research outcomes and if positive, the research is considered as a support for the hypothesis. On the other hand, if the hypothesis is negative, the research is considered to be challenging the hypothesis and will require further explanation. Figure 4.2 illustrates deductive research reasoning.

Figure 4.2 Deductive research (Source: Hayes, 2000)

4.4.2 Inductive Research

The inductive approach involves a less structured methodology. This approach is usually not limited to a single question and tends to be more objective This approach looks out for possible results. Unlike the deductive approach, it begins with data collection and then data interpretation by the researcher to formulate a theory. In some approaches such as grounded theory, even preliminary literature reviews are not recommended (Glaser, 1978).

Figure 4.3 Inductive research (Source: Hayes, 2000)

As illustrated in Figures 4.2 and 4.3, the main difference between the two approaches is in their use of existing data. The deductive approach builds a hypothesis based on the existing literature and then conducts the data collection and analysis to test its hypothesis, while inductive approach conducts data collection and data analysis to come up with a theory. Deductive research can be considered associated with objectivism and positivism. By constructing its hypothesis based on the existing body of knowledge, it accepts that there is only one objective truth, and any scientific research will present the only objective truth.

Collins (2010) also explains that a research project will include a theory although the theory may or may not be precise in the design structure of the proposal. He further describes deductive research study as one in which a theoretical conceptual structure is developed and verified by experimental while an induction approach involves the collection data and further development of theory because of the data analysis. Table 4.4 illustrates the differences between inductive and deductive approach as explained by Collins (2010).

Table 4.4: Differences between Deductive and Inductive Approaches adapted from (Collins, 2010)

Deductive Approach	Inductive Approach
More Scientific principles	Gives an understanding of the meanings people attach to various contexts
Move from theory to data	Gives an understanding of the research context
Emphasis on quantitative data	Emphasis on qualitative data
A structured approach	A flexible approach which allows a change of emphasis as the project continues
The researcher is separate from the research process	The researcher is part of rather than separate from the research process
Need to generalize results by selecting samples of sufficient size	Less need to generalize results
The need to explain causal relationship between variables	Less need to explain causal relation between variables

Given the differences in approach, it can be observed that the inductive approach lays more emphases on the close understanding of the research context, collection of qualitative data, as well as a more flexible approach to allow for changes in research emphasis as the study progresses. Hence, referring to this research, an inductive approach would be required to appropriately achieve the research objectives and answer the research questions. The researcher will rely on qualitative data obtained via interviews and historical cost data to achieve this.

4.5 Research Approaches

Research approaches can be described as plans and procedures for research that encompass all steps from extensive assumptions, to detailed data collection methods, analysis, and interpretations (Groover, 2015). There are various research approaches that could be used in management research, some of which have a positivist position and others a phenomenological position.
However, the choice of method is guided by one's research questions, objectives, the extent of existing knowledge on the area of interest, the amount of time and other resources available (Collins 2010).

Further research explains the significant features and principles of research approaches which has been classified into three major groups namely, quantitative, qualitive and mixed methods. According to Guba (1990), quantitative approach includes positivism and pos-positivism world view, qualitative approach includes transformative and constructivism world view and mixed method approach yields to pragmatism.

The type of research approach may vary depending on the discipline and nature of research problems. For instance, when a researcher adopts a quantitative research approach, such researcher will need to choose a quantitative research design which specifies what, when, where and how much, in terms measuring the research objectives, achieving the research aim and for better understanding (Yin, 2003). Similarly, Creswell (2014) also explains that the selection of a research approach whether qualitative, quantitative, or mixed method depends on the type of study, the research questions as well as the researchers control over actual research event. He further explains that any research method and strategy adopted should appropriately answer the research questions.

4.5.1 Quantitative approach

According to Neuman (2002), quantitative research is an organized experimental examination of occurrences that are noticeable through the application of computational, statistical, or mathematical techniques. Similarly, Dornyei (2007) argues that quantitative data can be presented in statistical form or percentages which are analysed by the researcher with the aim of obtaining objective results with

references to larger size of population sample. On the other hand, qualitative research employs the use of audio/visual based data, text, or narratives to evaluate and describe meaning of specific concepts based on the participants involved in the research analysis (Creswell 2013). Furthermore, while quantitative research helps to validate and ascertain the true hypothesis, qualitative research can be used to generate information and produce hypothesis based on case study (Creswell and Clark 2007). Given the above discussion, this study explored quantitative method in certain areas to analyze the current practice of building cost information management and its impact on project delivery in Nigeria.

4.5.2 Qualitative approach

This study also deployed qualitative methods in collecting and analyzing data using primary and secondary data sources. The qualitative method is an inductive approach that examines data to facilitate the generation of hypothesis and formulation of theories (Thomas 2006). It is also an essential approach used in investigating knowledge gaps presented by problems and offering feasible solutions to solve them (Flick 2009). Creswell (2013) further emphasizes that this method is often time consuming, and the outcomes are rather perceptive than accurate, when compared with quantitative approach, hence qualitative study means to research, identify, and understand the separate entities in social issues. Table 4.5 illustrates some differences between qualitative and quantitative research approaches postulated by Blaxter et al. (2010) and Bryman (2012).

Table 4.5: Differences between qualitative and quantitative research approaches adapted from Blaxter et al. (2010) and Bryman (2012).

Qualitative Approach	Quantitative Approach
Inductive: generation of theory	Deductive: testing of theory
Concerned with understanding behaviour from actor's own frames of reference	Seeks the facts/causes of social phenomena
Interpretivism	Natural science model, in particular positivism
Naturalistic and uncontrolled observation	Obstructive and controlled measurement
Constructionism and Subjective	Objectivism
Close to the data: the 'insider' perspective	Removed from the data: the 'outsider' perspective
Grounded, discovery oriented, exploratory, expansionist, descriptive, inductive	Ungrounded, verification oriented, reductionist, hypothetico-deductive
Process-oriented	Outcome-oriented
Valid: real, rich, deep data	Reliable: hard and replicable data
Un-generalizable: single case studies	Generalisable: multiple case studies
Holistic	Particularistic
Assumes a dynamic reality	Assumes a stable reality

Qualitative approach involves the researcher having a social interaction with individuals(participants) during the process (coombes, 2001). This approach tends to follow the inductive pattern, which involves concentration on individuals and interpretation (Creswell, 2013). Other characteristics of qualitative approach identified by Robson (2011) include the verbal presentation of findings which are less arithmetical, applying an inductive approach to data collection and analysis.

Qualitative approaches are fundamentally subjective and closely connected with both constructivism and interpretivism paradigms in so any ways that they aim to explain individual occurrences.

4.5.3 Mixed Approach

Mixed method has now become popular and widely accepted in other forms of research outside social sciences and due to the increasing research design and complexity. Creswell and Creswell (2018) describe mixed method approach as that which involves gathering both numerical information (e.g., on instruments) and text information (e.g., from interviews) such that the final output reflects both quantitative and qualitative information. Mixed methods however require a higher skilled level of data collection and analysis. It also creates room for criticism of other types of research and if not properly administered can result to misuse of vital information which could greatly impact a research outcome. Hence, no paradigm proposes or restricts the use of one research method; instead, they often suggest the use of a robust and highly effective research methods which fully integrates elements of both qualitative and quantitative methods.

Interpretation in mixed methods is continuous and often spans through the various phases of a research process. The researcher also implements suitable data collection tool available to them and population sample sizes differs based on the method adopted. Research questions may also become research questions and or hypotheses depending on the experience, process, literature, and prior knowledge around the research. The main advantage of mixed method is that it makes up for the flaws of using a single design. To further strengthen the choice of mixed methods for this study, the key objectives of this methods as well as the weaknesses are depicted in Table 4.6:

Table 4.6 Criteria for Evaluating Qualitative and Quantitative Research adapted from Creswell and Creswell (2018)

Features	Advantages	Weaknesses
• **To address theoretical perspective at different levels** • **To address questions at different levels** • **To overcome the weaknesses of a single design** • **To complement the strengths of a single design** • **To serve a theoretical perspective** • **To develop and test a new instrument** • **To explore a phenomenon** • **To explain and interpret**	• Position research in a transformative framework • Helps in designing and validating an instrument • Helps to generalize qualitative data to an extent • Useful when unexpected results arise from a prior study • Easy to describe and report	• Little guidance on transformative methods • Difficulty in deciding when to proceed in sequential designs • Some designs generate unequal evidence • Resolves discrepancies between various types of data • Time-consuming

Types of Mixed Method Research

Researchers benefit from being familiar with the different categories of mixed methods. These classifications represent different area of study, and they use different terminologies. Although writers have emphasized different features and used different terminologies, there appear to be more similarities than differences among these categorizations. Studies about mixed method research have concentrated more in the classification of different types of mixed methods. According to Creswell (2011), there are four main types of mixed method research designs are.

- Triangulation Design
- Explanatory Design
- Exploratory Design
- Embedded Design

The use of each of the designs depend largely on the nature of research. Furthermore, choosing a method may not just be based on the type of research question (what, how and why) asked or the research problem as all methods have their advantages and disadvantages. Hence, research methods should also be justified by how well it addresses the practical limitations that are inarguably set on the study e.g., access to data, time, and resource constraints. The adopted method should be applied adequately such that the important elements of the study are not constrained or missed out, thereby ensuring that that it suits the problem under investigation.

4.6 Adopted research approach and strategy

This section describes the research process and procedure adopted in this study from the data collection through the development and validation of building cost information management framework are illustrated in the flow diagram in the following figure.

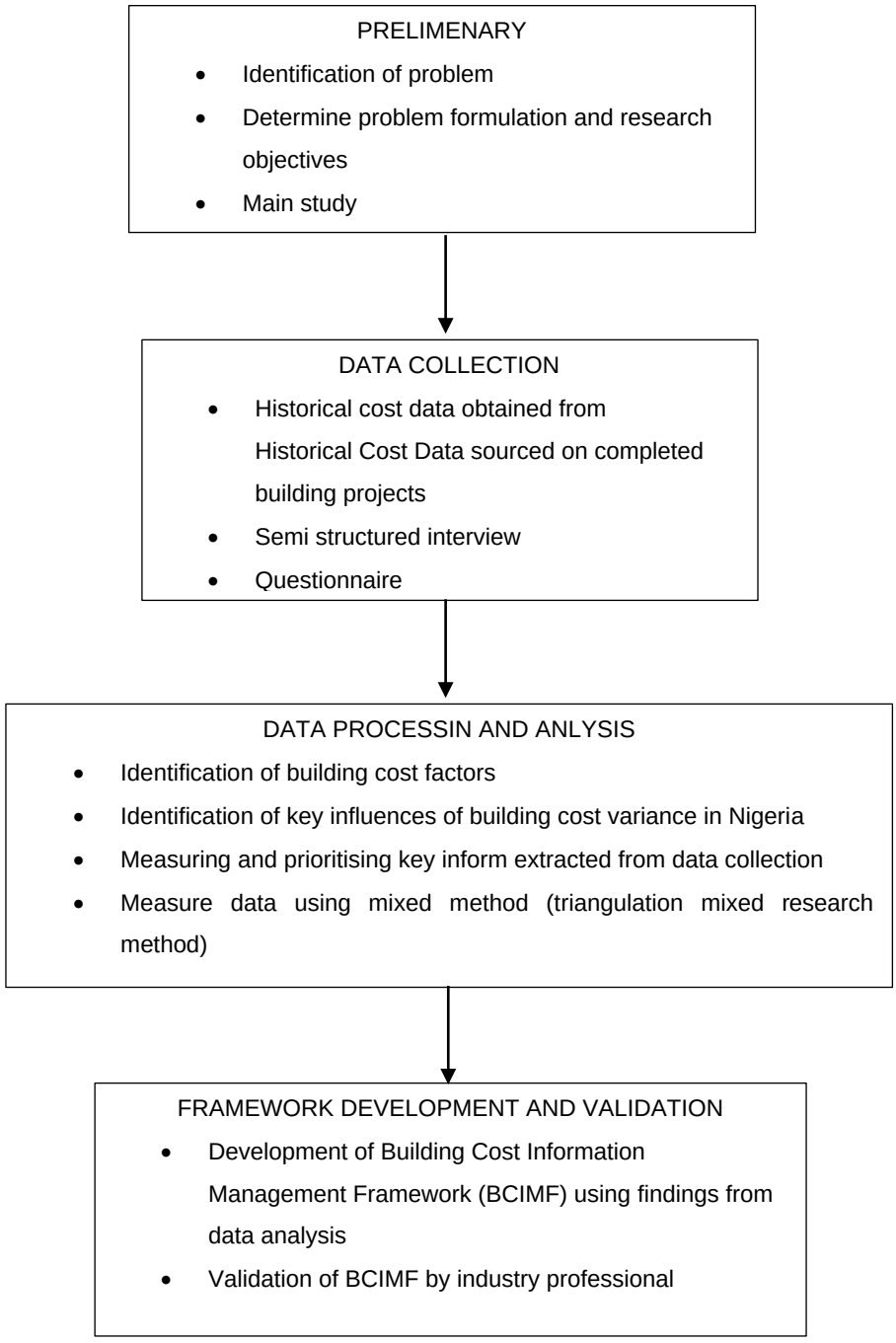

Figure 4.4: Flow diagram of research approach

4.7 Research Purpose

A research purpose is an assertion of “why” a study is being conducted, or the aim of a study. The aim of a study may be to describe or identify a perception or to predict or explain a solution to a situation which indicates the type of study to be conducted (Goddard and Melville 2004).

According to Kumar (2005) the purpose for research could be classified based on what the research intends to accomplish. This is accomplished through description, exploration, explanation, and correlation.

4.7.1 Descriptive

Descriptive research can used in defining characteristics of a phenomenon being studied. It addresses the question “what” question in research.

According to Shields et al. (2013), descriptive research may be considered as simply the attempt to identify, establish or describe what is to be researched, with the researcher having no controls over the variables. Similarly, Nassaji (2015), maintain that the goal of descriptive research is to describe a phenomenon and its characteristics and its more concerned with what is being done rather than how or why. Hence, the data collection tools often used in descriptive research are surveys and observations (Gall, Gall, and Borg, 2007). In descriptive research, data may be collected qualitatively but often analysed quantitatively to determine relationships.

Descriptive research needs a definite subject and requires extensive review of previous knowledge around the research area.

4.7.2 Exploratory

Exploratory research can be described as one which attempts to determine something new and remarkable by working through a particular topic. This type of research tends to fall into two categories: those that generate new ideas or propose new hypothesis: those that make a provisional first analysis of a new topic (Swedberg, 2020). Exploratory research tends not to offer final and conclusive solutions to existing problems, or offer conclusive evidence, but helps to understand the problem. Hence,

in such research, the researcher should be to be open to change direction as result of new information and/or new insights (Saunders et al., 2012).

Given the nature of exploratory to be propose new topics, more information is therefore required to understand it. This means that the less developed an area, the more like the need to adopt and exploratory research. It requires deep investigation, creativity, and analysis of all sources of information. Also, it addresses the question what using qualitative methods.

Essentially, exploratory research is the initial study, which forms the basis for more definite research (Singh, 2007).

4.7.3 Explanatory

This type of research transcends descriptive and explorative research in identifying or studying a phenomenon. According to brains et.al. (2011) explanatory research attempts to go above and beyond to answer the question why. It builds on both descriptive and exploratory research approaches. This type of research is quite complex in the sense that researchers are often not completely certain that there are no factors influencing the casual relationships, especially where research is about human behavior and motivations.

Explanatory research allows the researcher to have a broad knowledge of the topic under study and subsequently refine research questions to further strengthen the conclusions of the study (Given, 2012). Some of the tools of data collection in explanatory research include Literature review, focus groups, case studies and in-depth interview. This type of research is considered most valuable in social research where there is need to convey new data about an aspect of a study. Hence it is essential for researcher carrying out this type of study to have sufficient information to conduct the study.

4.7.4 Correlation

This type of research is a non-experimental which involves the measurement and assessment of two variables to determine the statistical relationship between the variables (Jackson, 2012). Typically, correlation studies are quantitative in nature involving two variables within the same subject group. In the type of research, the

researcher only measures and observes the variables without having to alter them or subject them to external factors (McCombes, 2019). The tools for data collection in correlative research include archival data, surveys, and observations. The data collection method in this research could be both quantitative and qualitative.

The three main type of correlation research are:

- Positive correlation
- Negative correlation and
- Zero correlation

4.8 Research Position

After reviewing several literatures, it was discovered that there is currently no national building cost database which construction stakeholders can easily access to benchmark/estimate building projects in Nigeria. Therefore, the research was centered on the development of a reliable building cost information management framework that can be used as benchmark for building cost estimation. To achieve this aim, a detailed historical building data was obtained from construction professionals using a template adopted from the UK BCIS to further examine the underlying issues. On this account, the research position of this study is situated within the pragmatism approach whereas from the reasoning perspective the study has conformed to both deductive and inductive approach as it explores past literature with aim of generating a system which has previously not existed. The study also adopts mixed method of qualitative and quantitative strategy for data collection.

4.8.1 Research Design

According to Gorard (2013), research design refers to the way research project or program is organized from its commencement with the aim of maximizing the possibility of generating evidence that provides a cogent answer to the research question for a given level of resource. As such, it is essential to choose the right methodology when undertaking research to ensure that specific research questions,

objectives and aims can be achieved and research findings validated. The purpose of designing and undertaking research can be characterized into two main groups i.e.

1) the research aim and objectives
2) the type of contribution the research intends to make.

The theoretical framework within which this study is conducted is therefore referred to as the research design.

Given the intricate nature of the Nigerian construction industry and building cost information which the study is centered on, this study employed a mixed method of qualitative and quantitative research approach for data collection to enhance the design of a robust building cost information management framework for the Nigerian construction industry. The research was simply designed to follow two border lines i.e., fixed design - quantitative approach and flexible design - qualitative approach (Robson, 2003).

The first part of the study consisted of an online survey questionnaire which was piloted to explore the factors that may potentially have a significant impact on the survey results. Some of these factors include validity of research, clarity of the questions asked, evaluation of sample population etc. The second part of the research design is the use of semi-structured interviews with key stakeholders in the Nigerian construction industry (such as clients, contractors, consultants, project managers etc.) to get their opinion on building cost information management and the current practice in the Nigerian construction industry.

One might debate that quantitative research is weak in considering the settings or context in which people live and quantitative researchers' interpretations and personal biases are seldom discussed. Qualitative research on the other hand, makes up for these weaknesses and is often seen as deficient because of the difficulty in generalizing findings to a large group due to the limited number of participants studied. Hence, the study adopted mixed methods to harness strengths that offset the

weaknesses of both qualitative and quantitative approach (Creswell, 2017). The strength of one approach therefore makes up for the weakness of the other approach.

The researcher envisaged difficulty in the comparative analysis of interview responses. As a result, a robust approach and less conflicting outcomes, mixed methods were deployed for data collection and analysis. When designing research, the researcher must ensure that both the knowledge generated, and the data collected is valid and reliable. The validity of a research is about the quality of the research and its conclusion. In other words, it has to do with the trustworthiness of the research findings while reliability has to do with how consistent the research representation is. Also, research generalisability ensures that the results can be repeated in a similar setting with similar outcome. Bryman and Bell (2011) opine that a quantitative research use both reliability and validity. They argue that qualitative research adopts alternative terms which appear to be parallel with that of quantitative research. Hence, the criteria for assessing qualitative research include credibility, dependability, transferability, and comfortability. Table 4.7 illustrates the evaluation criteria for both quantitative and qualitative research.

Table 4.7 Criteria for Evaluating Qualitative and Quantitative Research (Adapted from Bryman and Bell 2011)

Quantitative Evaluation	Qualitative Evaluation	Description
Validity	Credibility	How believable are the findings?
Validity	Transferability	Do the findings apply to other contexts?
Reliability	Dependability	Are the findings likely to apply other times?
Objectivity	Comfortability	Has the researcher allowed his/her values to intrude to a high degree?

There have been many criticisms about qualitative research being methodologically weak in terms of validity and reliability. Hence, to strengthen the data collected and research findings, measures were put in place which are further discussed later in this chapter. This design provides the researcher with an opportunity to gather wide range of data from respondents on the impact of building cost information in the Nigerian construction industry. The overall research design and flow of process are illustrated in Figure 4.8.

Table 4.8: Different data collection methods with their advantages and disadvantages

	Advantages	Disadvantages
Surveys	• Good for collecting descriptive data • Relatively inexpensive to use • Can cover a broad range of topics • Can be easily analysed using a wide range of existing software	• Designing a good survey can tasking and time consuming • Inputting data can take longer than expected thereby affecting research time frame. • Surveys may sometimes be self-opinionated (and maybe biased).
Interviews (Semi-structured, structured etc.)	• Allows for face-to-face contact with respondents. • Provides opportunity for in-depth investigation e.g., through probing. • Allows interviewer to help clarify and explain further which increases the possibility of useful responses.	• Information could sometime appear cumbersome and monotonous. • Being consistent across interviews can be challenging. • Requires good interviewing and communication skills. • Interpreting interviews can be challenging.
Archival Data (Documentary evidence, case studies etc.)	• Inexpensive • Unaltered • Useful for determining	• Record keeping practices may change over time. • Data may not be up to date and could be misleading.

Focus Groups	• In-depth information. • Possibility of obtaining insight information from a diverse group of people that may not be possible from individuals. • Relative low time and cost investment	• Results could be influenced by group dynamics. • Interpretation of group discussion can be challenging.
Observations	• Provides insight into interaction between individuals and their settings (both physical and social settings • Takes record of actual behavior vs self-reports	• Requires clarity on the area under investigation. • Requires good observation skills and constancy across observations
Test/ Experiments	• Provides objective information on what is known and what can be done. • Can be assessed or scored in a straightforward manner. • Can be designed to match a given curriculum or set of skills.	• May be superficial. • Result may be too complex and necessarily test for student's knowledge. • Maybe biased against some test takers. • May be subject to manipulation and corruption.

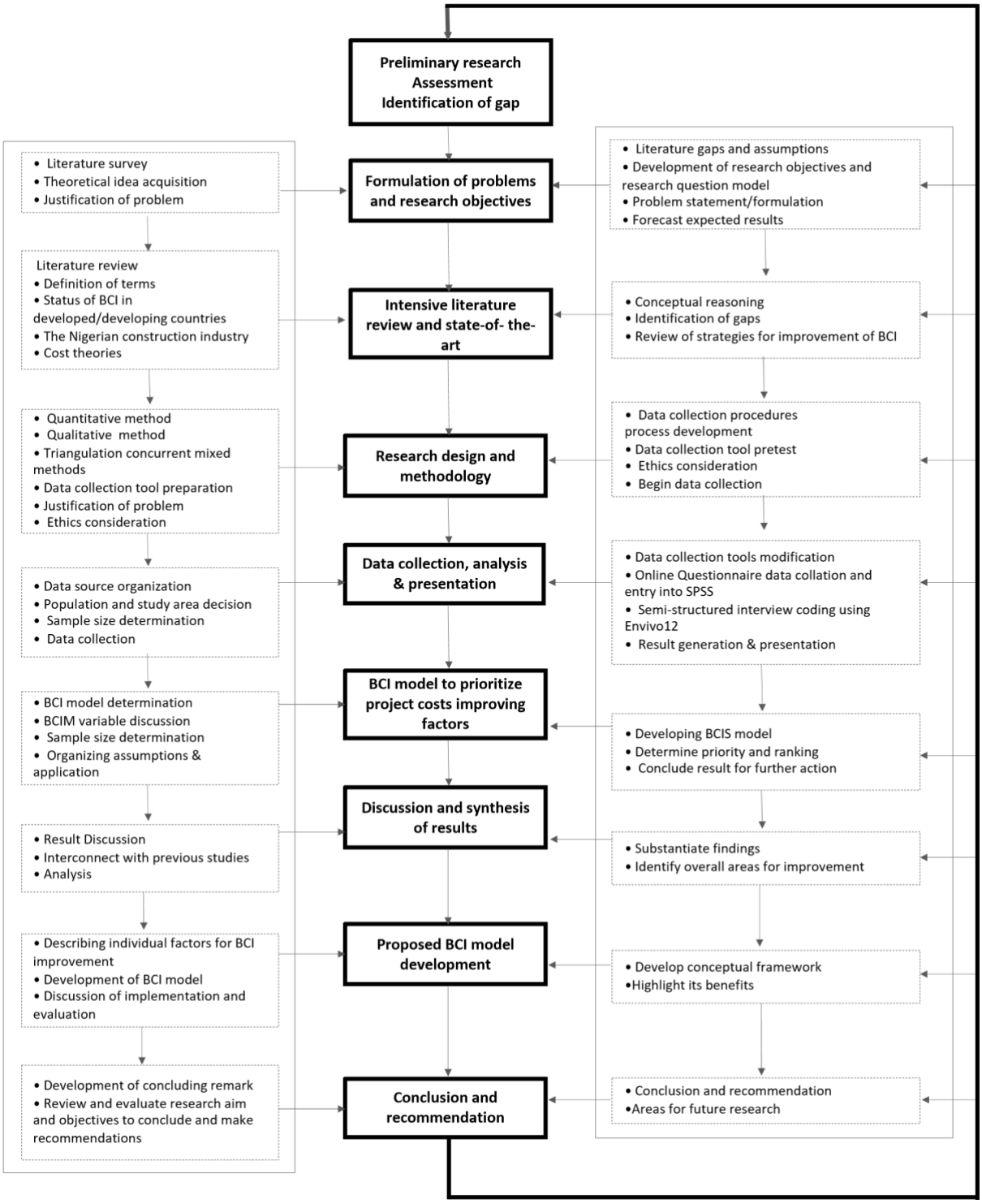

Figure 4.5 Research method and processes

The use of mixed method design in this study enables the researcher to understand the contradictions between qualitative findings and quantitative results, as well as ensuring that the study findings are grounded in participants' experience. The mixed method adopted for the study is further discussed in this chapter.

This study is classified under explorative and descriptive mixed research from the logic of the type of knowledge the research ascertains. The study falls under descriptive research because it attempts to investigate and understand first the underlying problems of building cost information (through extensive literature review). It therefore explains the reality with regards to existing problems. On the other hand, the study is explorative because it explores mainly the building cost data and indices to develop a building cost information framework. Nonetheless, the main aim of this study is to develop a holistic building cost information management framework that will enhance project cost estimation, cost control, and cost management at every phase of building projects.

4.8.2 Intended Research Contribution

Moving forward to enhance building cost information management in the Nigerian construction industry, it is therefore important to develop an effective building cost information management framework that can be easily accessible to construction stakeholders. Hence, the research contributes to knowledge as follows:

1. The building cost information management framework developed can bring about an improved management of not only government procurement processes but also building construction in Nigeria as a whole, thereby ensuring transparency, monitoring, and control of project costs, fair selection of bidders reduced cost of transaction and increased efficiency construction.

2. An extensive and systematic search through selected journals and published articles in building cost information management spanning through a period of 10 years was done and after carefully reading through, it was discovered that the field of cost information management in the Nigerian construction industry

has not been widely researched. This also underlines the lack of research in building cost information management in Nigeria and the uniqueness of this study. Hence, the study provides an understanding of building cost related information for the various function involved in building cost estimation and forecasting.

3. The developed building cost information management framework will contribute to building cost management by enhancing cost transparency and alignment of cost information to building projects.

4.9 Research Methods

Table 4.5 reflects the basic classification of research questions (who, what, where, how and why) as mentioned by Yin (2003).

Table 4.9 Relevant Situations for Different Research Strategies (Yin, 2003)

Strategy	Form of research questions	Requires control over research events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, What, Where, How many, how much	No	Yes
Archival analysis	Who, What, Where, How many, how much	No	Yes/No
History	How, why	No	No
Case study	How, why	No	Yes

4.9.1 Adopted Research Method

The study addresses practical problems of building cost information management in the Nigerian construction industry to enhance the current practice. In addition, this study develops a reliable cost information management framework to evaluate and addresses the current problem ensuring that the research aim, and objectives are achieved. This required reviewing literatures in the study area and collecting data using diverse methods. To design a reliable cost information management framework a mixed method approach was adopted to collect data.

Following the selected research paradigm for this study, the principles of mixed methods were deployed as the main research method. The chosen pragmatic paradigm also allows for variety of data collections and analysis, different worldviews, different assumptions, and multiple methods in mixed research. This study also deployed data collection techniques such documentary evidence (archival cost data) questionnaire and interviews from pragmatic approach. This implies that the research the questions and paradigm are determining factors in selecting the suitable methods for data collection and analysis.

To achieve the mixed method design, a two-way evaluation design process was used. This evaluation included both online questionnaires administered to construction practitioners and semi-structured interviews conducted with selected construction professionals, majority of who were quantity surveyors (54.55%). Both methods were designed to address the current issues bothering on cost information management in the Nigerian construction industry. Thus, evaluation design depicts a concurrent mixed-method design. The evaluation also demonstrates various analysis strategies for comparing qualitative and quantitative results. Furthermore, the deliberate affiliation of questionnaire and interview from different perspectives provided the researcher a better understanding on issues of cross-perspective triangulation.

Given the comprehensive information required for a detailed analysis of this study, qualitative approach was perceived to be the most suitable approach for certain aspects of the study. Therefore, qualitative approach was deployed as part of the mixed method approach to design a reliable building cost information model for the

Nigerian construction industry. Some of the qualitative approach applied in this study include comparative analysis, qualitative interviews, model design etc.

4.9.1.1 Triangulation Design

Creswell and Clark (2003) describe triangulation design as one of the most known approach to mixing designs This design is mostly used where there is need to collect different but complementary data on the same topic to gain better understanding of the research problem. The essence is to bring together the different strengths and noncoinciding weaknesses of the quantitative approach (trends, large sample size, generalization) with those of qualitative approach (in depth, details, small sample size). Furthermore, the design is used when a researcher intends to directly compare qualitative findings with quantitative statistical results or to validate qualitative data with quantitative results.

This study deployed the concurrent triangulation mixed method where interview and questionnaire components were administered concurrently but independently. The questionnaire was designed to identify specific underlying factors responsible for building cost variance across the different geographical regions in Nigeria, while the interview was designed to investigate the reliability of the sources of building cost information in Nigeria. The conceptual framework of this study focused specifically building cost information needs in construction and was developed from reviewing literatures and examining the in-house building cost information management platform designed by individual construction organisations in Nigeria.

In using both qualitative and quantitative methods, data collection was centered around the sources and nature of building cost information and well as the management of these information, including the degree to which the current practice of information sourcing, interpretation, exchange, reporting met needs for building cost performance and accountability in Nigeria. Each set of data was presented and analysed separately from which and integrated summary of major findings and recommendations was drawn.

The different categories of triangulation summarized by Creswell (2011) are illustrated in Figures 4.6 (a), (b), (c), (d), and (e). However, for the purpose of this study the concurrent triangulation design (Figure 4.6b) was deemed appropriate.

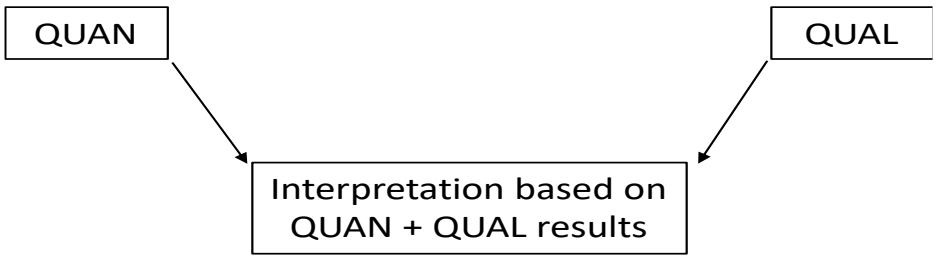

Figure 4.6 a: QUAN-QUAL

Source: Creswell (2011)

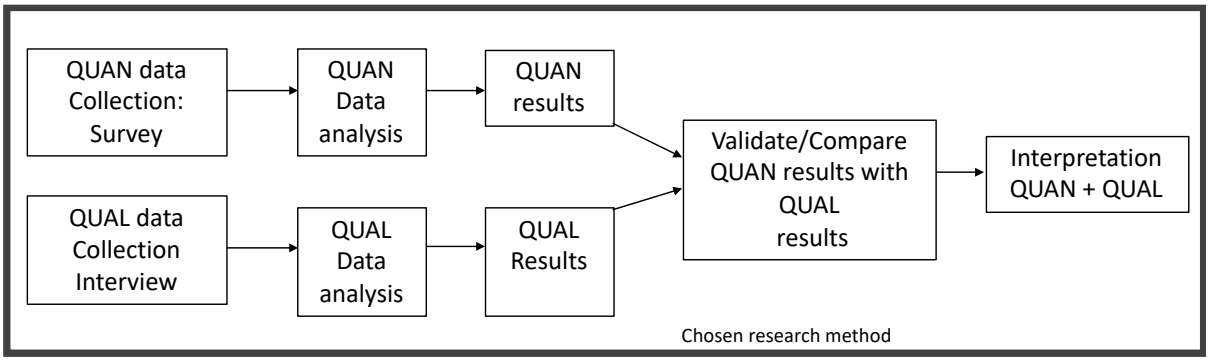

Figure 4.6 b: Concurrent Triangulation

Source: Creswell (2011)

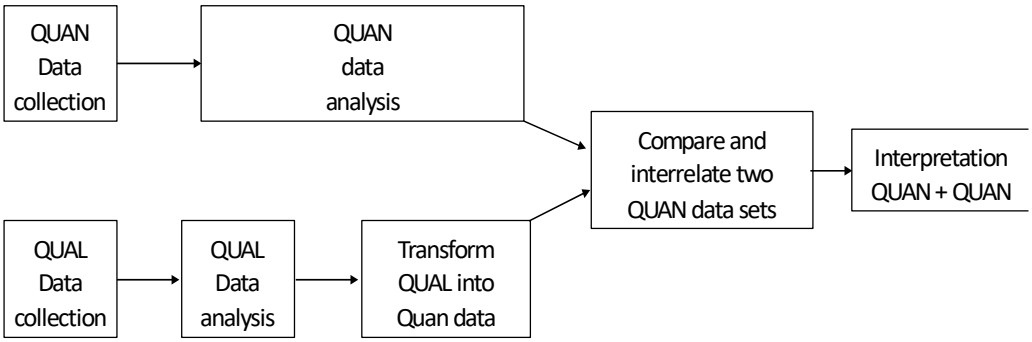

Figure 4.6 c: Data Transformation Triangulation

Source: Creswell (2011)

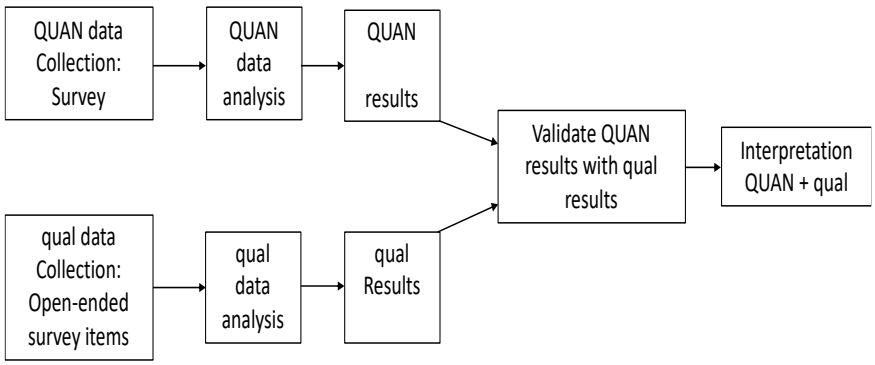

Figure 4.6 d: Validating Quantitative data Triangulation

Source: Creswell (2011)

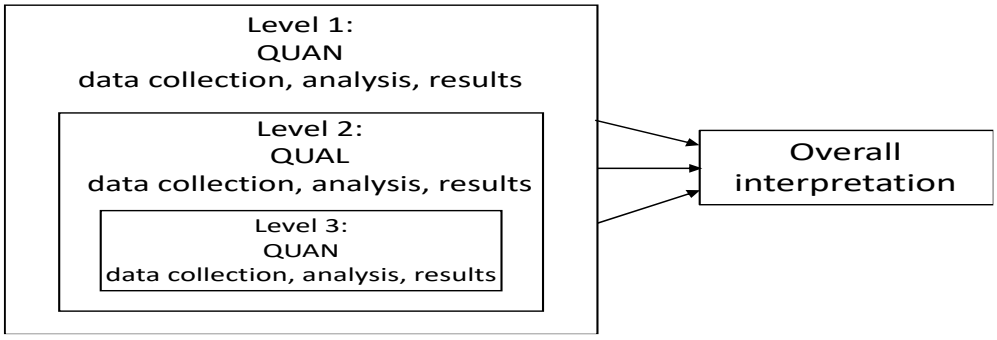

Figure 4.6 e: Multilevel Model Triangulation

Source: Creswell (2011)

4.9.2 Justification for Choice of Research Method

This study is based on developing a building cost information model for the Nigerian construction industry. One of the objectives includes investigating the underlying causes of building variances across different locations in Nigeria which involves gathering historical cost data of building projects executed across the different geographical locations in Nigeria. This data is further analysed using quantitative tools such factor analysis, Cronbach's alpha reliability analysis etc. to determine the degree of influence of each factor on building cost variances. This provided the researcher with better understanding of the underlying problems with the aim of designing a robust

and reliable cost information model to address the problem. The study also involved collection of qualitative data through semi-structured interview of construction professionals. This offered the researcher an opportunity to gather relevant information on the subject area from an individual, organisational, and industry-oriented perspective. Hence, the use of mixed method enabled the researcher to gather data from a variety of respondents on the impact of building cost information building construction projects in Nigeria. This method also allowed for a robust analysis of both qualitative and quantitative for increased confidence in research data O'Donoghue and Punch (2003). The use of concurrent triangulation method for this study also increased the credibility and validity of research findings.

4.9.3 Research questions and the choice of research method

As discussed above, the research questions asked should determine the most appropriate strategy. 'What' questions are predominantly concerned with asking how many or how much. 'Who' and 'where' research questions suggest the use of fixed strategies such as surveys. 'What' questions suggest a more flexible strategy. Hence the research questions and the appropriate strategy to answer them is presented in Table 4.9

Table 4.10: The Research Questions and the Choice of Strategy

Strategy	Form of research questions	Requires control over research events	Focuses on contemporary events
Experiment	How can the management of building cost information enhance the successful and efficient delivery of building projects?	Yes	Yes
Survey	What are the factors influencing building cost variances in the Nigerian construction industry?	No	Yes
Archival analysis (Documentary evidence)	What are the existing building cost information structures and how are they managed?	No	Yes/No
History	How does the management of building cost information impact the delivery of building projects in Nigeria?	No	No
Case study	Does the source of building cost information impact the delivery of building projects in Nigeria?	No	Yes

On the other hand, the research is also classified as descriptive because it attempts to understand the underlying problems around study by reviewing existing building cost information management and its influences on construction policy development in the Nigerian context. In any case, the research aim is primarily the development of a building cost information management system to enhance building cost estimation of projects in Nigeria. Hence, the research is more mixed in nature using concurrent triangulation mixed method.

4.10 Methods of Data Collection

Strauss and Corbin (1998) assert that the data collection methods include: observations, interviews, records, and documents. They maintain that qualitative study is more analysed through data interpretations. Arguably, they agree that certain data may be quantified as with census or background information, they also emphasized that majority of the data should be interpreted.

As earlier discussed in the previous sections above, this study deployed quantitative and qualitative data using both primary and secondary sources. Also, semi-structured interviews, questionnaires and archive building cost data collection methods were considered as appropriate to meet this study aim and objectives.

4.10.1 Population Sample and Pilot Study

Saunders, Lewis, and Thornhill (2009) opined that the sampling methods are categorized into two main groups i.e., probability (also known as representative) sampling or non-probability (also known as judgmental). The population sample for this study comprised of professionals in the Nigerian construction industry. To eliminate bias and enhance the generalisability of this study, the selection of participants was based upon key factors such construction/civil Engineering sector and geographical location. This increased the robustness of the data collection process, thereby giving more weight to the validity of the research. The reliability of the study was also ensured by selecting experts in the construction sector making sure that respondents were experienced and knowledgeable in the field of building construction. Data was obtained from professionals in the form of questionnaire, interview responses and archival building cost information. This was done to ensure that the sample size selected, and quality of study participants truly reflects the underlying circumstances surrounding the phenomena in the Nigerian construction industry with regards to the study objectives.

4.10.2 Pilot survey

An initial pilot survey was conducted to validate the study questionnaires to be distributed to study participants. Analysis of the results from pilot survey enabled the researcher to scrutinize the survey questions in terms of validity and reliability of the study. This involved re-organizing questions from the questionnaire, checking the grammatical composition of questions for a large audience and assessing the relevance of questions to the study aim and objectives.

A key observation made by some respondents of the pilot survey was the that questions designed to address the building cost information management in the Nigeria construction industry and there were no underlying factors responsible for building costs variances across the different geopolitical region in Nigeria. Hence, the study objectives were reviewed to address the underlying factors responsible for building cost variances in different locations within Nigeria. The questions were also amended to align with the reviewed study objectives. Please see appendix 1 for pilot questions and reviewed questions.

4.10.3 Questionnaire Survey

Questionnaire was also deployed to collect data from construction practitioners on the impacts of clients on building costs and building construction operations. The questionnaire has been designed in line with the research aim and objectives to address the underlying factors responsible for building cost variances in the Nigerian construction industry. The questionnaire also covered other areas of the study such as the, the current trend and practices of building cost information management in Nigeria, the impact of type of client on the building cost information management etc. The questionnaire was categorized into 2 sections – the descriptive section which covers the variables associated with the study subject (building cost information) and the demographic information section which comprises of participants information such as level of education, years of experience and industry sector etc.

Holt *et al.* (2014) emphasize the importance of considering data to be generated and the data analysis tool to be used when designing a scale. Hence, the questionnaire

for this study has been designed to provide participants with several options to determine their level of agreement or non-agreement with questions using the Likert scale format. Some of the questions were intentionally reversed to examine the reliability of the response from participants and ensuring that participants answer questions appropriately and correctly (see appendix 1) pilot survey was initially conducted, after which the questionnaire was reviewed and modified based on results and observations from pilot survey.

The questionnaire survey was administered online to reach more professionals and for ease of gathering data. Also, various academic journal databases in the subject area such as Google Scholar, Scopus, Academic and Wiley Online Library etc. were explored to review literatures for in-depth understanding of building cost information management and global practice.

4.10.4 Sampling and Participants

The population sample for the survey comprised of building construction professionals and civil engineers from the different geopolitical regions in Nigeria. This was done to account for participant spread and to minimize geographical bias in this study. The selection of participants from different geopolitical regions in Nigeria also enhanced the reliability of this study as building cost information sourcing and management varies from region to regions in Nigeria. Hence, the input of these professionals from different region in Nigeria serves as reliable and valid source of data for this study. Another determining factor for participant selection was years of experience of the professionals (i.e., minimum of 5 years' experience in building projects and construction). The inclusion of the factor for selecting participants also increased the reliability of the study findings as cost information management across different regions in Nigeria varies.

Also, participants were selected based on their occupation in the Nigerian construction industry. Selection was limited to professionals who are more into the costing aspect of building projects and construction. The researcher ensured that study participants were purposively considered for interview were professionals involved in building

construction related to the scope of the study from different parts of Nigeria with diverse experiences in the construction industry. Participants also work in different construction organisations of different types and sizes both public and private sectors. The population sample size for the survey was $\sum_n = 27$. A total of 50 questionnaires were distributed via online survey, out of which 27 were fully responded to, thereby reflecting 54% response rate.

4.10.5 Questionnaire design

The questionnaire design focuses primarily on obtaining question relating to the development of a reliable building cost information framework for the Nigerian construction industry. The study questionnaire was designed in line with the study aim and objectives. The questionnaire was classed into two sections: the demographic and the descriptive section. It is important to note that the demographic information is highly essential in ensuring that the researcher gain a better understanding of the various factors that influences participants responses.

Holt *et al.* (2014) opine that it is highly essential to consider data to be generated, as well as the tools and techniques of analysis when considering the scale design. Hence, questionnaire for this study was designed such that respondents have the option(s) to ascertain their level of agreement or disagreement to various questions asked in the description section. This was designed using Likert scale ranging from 0 to 6 where (a) 0= very strongly disagree, (b) 1= strongly disagree, (c) 2=disagree, (d) 3= agree, (e) 4= strongly agree, (f) 5= very strongly agree and 6= “unsure” option regarded as an invalid response. Some questions were intentionally reversed to ensure a high level of validity and reliability of responses.

Also, the questionnaire comprised a total number of 29 questions out of which 23 were descriptive and 6 demographic questions (see Appendix 3 for sample of questionnaire). Furthermore, numerical values were assigned to each Likert scale option to ensure an even distribution of chosen scale thereby reflecting the actual scores in percentage. However, no value was assigned to the unsure option since it reflects indecisive response. A significant level of percentage represents high cost of

building projects with government clients compared to private clients. This was calculated using the maximum possible value (5) of degree.

4.10.6 Data Collection Procedure

Participants were selected from reputable construction industries across Nigeria to ensure that the study reflects the current trend in the Nigerian construction industry. Questionnaire was designed to factor the current issues related to building costs information in Nigeria and questionnaire and further distributed online using an online survey web link.

Data was collected from cost professionals in the Nigerian construction industry using convenience sampling technique through existing contacts known to the researcher. A link to the online survey web was e-mailed to the participants via the Coventry university email system.

This method was deemed efficient for distribution due to the proximity of participants and it was very useful in terms of saving time and reaching more participants. Participants were informed of the option to keep their identity anonymous for data protection reasons. Hence, a copy of Participant Information Sheet/Consent was sent alongside each questionnaire to ensure that participants had full information and understanding of their participation in the study. Based on the described sample above. The data collected had a response rate of 54%. Table 4.11 reflects the summary of questionnaire distribution and response rate.

Table 4.11: Questionnaire Distribution and Response

Questionnaire Distribution and Response Summary		
Reponses	**Number**	**Percentage**
No. of Complete responses	27	54%
No. of Incomplete Responses	23	46%
Total No of questionnaire distributed	50	100%

4.*10.7* Archival Data

The consideration of archive data emanates from obtaining an original data which gives the researcher more control over what data was collected. In addition, archive building cost data was sourced from various construction organisations in Nigeria to evaluate the current trend and procedure for sourcing building costs information sourcing and its management. To ensure that the study aim, and objectives were met, these archive building cost data were sourced from construction professionals. The building cost data spans across the six geopolitical regions in Nigeria was obtained to establish the different approaches used in sourcing and managing building cost information by construction practitioners across Nigeria.

4.10.8 Data Collection Procedure

The data collection template for the archival data was designed in line with the UK Building Cost Information Services (BCIS) cost indices. This facilitated obtaining relevant building cost information data from construction professional (mainly quantity surveyors) in Nigeria (see appendix 4 for archival data template). The template was later distributed to study participants via email to be filled. These data were collected and collated using Microsoft Excel. The collated data was grouped and categorized according to location (i.e., six geopolitical regions in Nigeria) for further analysis.

4.*10.9* *Semi-*structured Interview

According to Yin (2009), semi-structured interviews are the most used forms of interviews. This study adopted semi-structured interview as one of the methods of data collection where interviewees were asked questions in line with study topic following a pre-established interview protocol. Construction professionals were also interviewed to get their opinions on the study findings to validate the study. The interview process was designed to be flexible to accommodate further probing questions that could arise during the interview. It was also designed such that the interview process is conventional and to allow follow up questions and two-way conversation about the topic (interviewer's views usually kept vague). This gives rise to other topics and links that arise during the interview. The qualitative interviews involved participants form the Nigerian construction industry majority of which are

quantity surveyors and others building surveyors and civil engineers. Interview questions were designed to validate some of the findings from literature review.

4.11 Sampling and Participants

The researcher considered purposive sampling appropriate for the qualitative interview because it provides the researcher the justification to make generalization from the sample under study. However, to avoid researcher bias, a careful identification and selection of sample units was done based on criteria such as expert experience, theoretical framework etc. The qualitative interview also considered cases related to the subject area that will help answer the research questions appropriately (Saunders, Lewis, and Thornhill 2009). The participant group which encompasses quantity surveyors and construction practitioners in Nigeria were carefully considered for interview to investigate the general perspective on building cost information and current trend in the Nigerian construction industry.

Most of the interviewees have various professional qualifications and affiliations in the construction field some of which include Royal Institute of Chartered Surveyors (RICS), Nigerian Institute of Quantity Surveyors (NIQS), Association for Project Management (APM), Chartered Institute of Building (CIOB) etc. A total of 15 participants were contacted from a sample population that comprise construction professionals, 12 of which responded and accepted to participate in the interview. This makes a response rate of 80%.

4.12 Data Collection Procedure

Collecting information in the form of interview involved getting in touch with professionals to partake in the in the study. The procedure was quite daunting and time consuming. Due to researcher's proximity to the interviewees, the interview had to be carried out through the means of recorded telephone interview as opposed to face-to-face. Although the use of telephone interview has faced some criticism as it is perceived not create any room for rapport between the interviewer and interviewee, Vogl (2013) argue that there is no difference in motivation and rapport between face-

to-face and telephone interviews. Vogl (2013) attributes the difference in responses to sensitive question to the interviewer's personality. Hence to provide a more balanced distribution of control between interview participant, interview was designed to encourage free flow of communication during the interview. This also gives the participants greater control to channel conversation towards areas perceived to be very essential to study.

The participants were sent a copy of the interview question prior to the interview to enable them to fully understand the areas to be covered during the interview. Also, a copy of the participant information sheet/consent form was sent before the interview date to ensure that each participant is aware of what is required of them as participant as well as their rights as participant. A total number of 12 participants out of the 15 contacted were interviewed.

The interview commenced with an introduction from the researcher and running through the consent form to ensure interviews consented. The interviewees were assured of their confidentiality and data protection, interviewees were also assured of their right to opt out at any point without being penalized in any way. In addition, the researcher assured the interviewees that information provided will be used only for the study. The interview was started with the general questions which included the interviewees details and years of experience. This was followed by detailed questions. The understanding and explanation of key issues bothering on building cost information management in Nigeria were explored. This included their understanding of 'the impact of building cost information in the Nigerian construction industry', 'factors influencing building cost variances across Nigeria', the impact of types of clients on building costs etc. The interview concluded with running a question through interviews on what they think about having a reliable building cost information management database in Nigeria like the BCIS used in the UK. All the interviewees gladly responded that it is a welcomed idea. The researcher ensured that were comfortable in their opinions and reflecting through their wealth of experience.

Each of the interviews lasted between 40 to 55 minutes depending on the interviewee's interest to elaborate on the subject and was recorded using an inbuilt phone recorder. Each recorded interview (qualitative data) was initially transferred to the Nvivo12 software to store, classify, and code the sets of data. This is to ensure that audio

record of the interview was well understood and documented appropriately. However, the found it difficult to show the process of coding and analysis without revealing too much of the research findings. Also, researcher observed that data from Nvivo did not reflect the true narrative of the qualitative data intended for the study as originally rich qualitative data was further narrowed by the software (Nvivo) into mere rigid data which was only interpreted in codes. Hence the researcher resorted to manual, transcription, interpretation, conceptualization, and examination of qualitative data to uphold reliability and validity of data for the study. Resorting to manual transcription but was worth it in the long run in the analysis due to the nature of the questions asked. It must be acknowledged that it was a really challenging but an appreciated learning process.

4.13 Interview Design

The interview for this study was designed in a semi-structured manner to answer research questions and align with study objectives. The interview comprised 11 questions together with a few other probing questions asked during the interview to obtain further information about the study area. The interview questions were grouped into different sections based on the study which include **Introduction** (general questions about interviews background and experience), **Influencing Factor** (questions related to factors affecting building cost information in Nigeria), **Problem** (questions addressing the issue of building cost information sourcing and management in Nigeria), **Specific Questions** (question about individual interviewee's organisation and their adopted in-house building cost information management methods) and finally **Conclusion** (concluding questions about developing a reliable building costs information management framework for the Nigerian construction industry). (See appendix 5 for interview template). Figure 4.7 shows interview plan and design process.

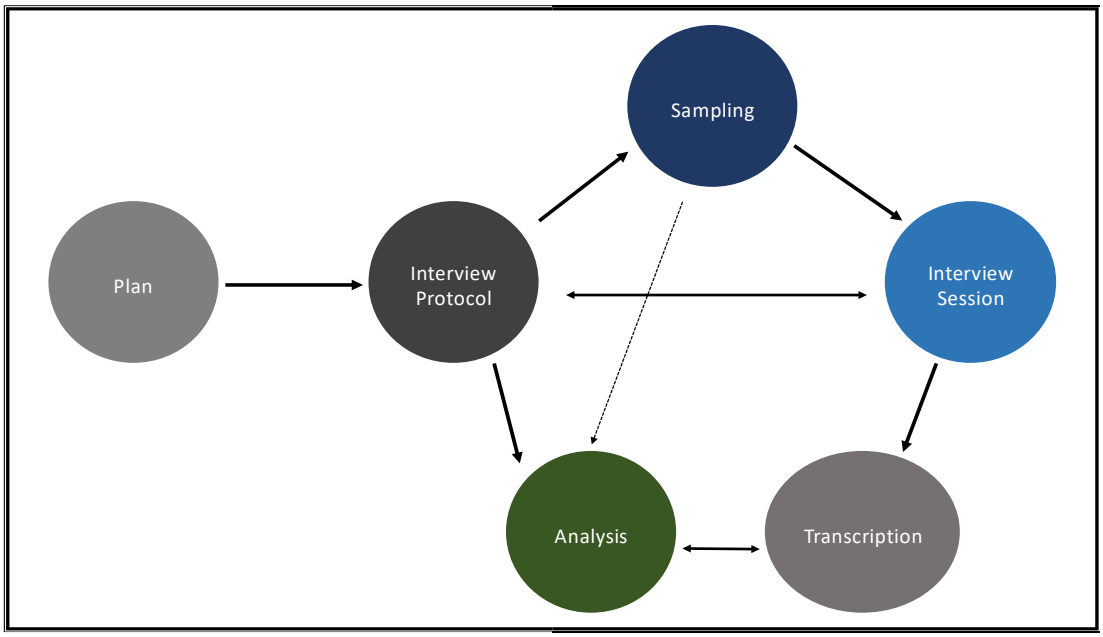

Figure 4.7: Interview Plan and Process

4.14 Data Analysis Techniques

The main aim of data analysis is to make sense of the collected data

The data analysis for this stage of the study was done using qualitative and quantitative techniques. Excerpts from the qualitative data was analysed using comparative and content analysis. The quantitative data gathered was presented and analysed using descriptive statistics, reliability analysis, factor analysis etc.

4.14.1 Qualitative Data Analysis

Flick (2014) described qualitative data analysis as the interpretation and classification of non-numeric (e.g., verbal, or visual) material make reports about implicit structures and dimension to make meaning (subject or social meanings) of what is represented. Hence the qualitative analysis of this study aims describe the phenomena of the subject area in greater detail.

4.14.2 Comparative Analysis

According to Beynon (2008), comparative analysis offers researchers sets of variables based on research questions. It enhances the understanding of the study environment by placing its known structures and trends against those of other system thereby enabling the researcher to critically evaluate and contrast them (Esser and Vliegenthart 2017). Thus, this study utilized comparative data analysis technique to investigate; key theoretical frameworks of the area under study, underlying factors of BCI, strengths and weaknesses of various building cost information management structures used by professionals in the Nigerian construction industry. The comparatively analysis also enable the researcher to critically evaluate the UK BCIS success factor. This offers the researcher access to a variety of alternative options and solutions to facilitate the development of a reliable BCI framework for the Nigerian construction industry. This study therefore aims to bridge the gap in the building cost information in the Nigerian construction industry by developing a reliable BCI framework thereby enhancing building cost management and best practice in Nigeria.

4.14.3 Content Analysis

The interview data were analysed using content analysis for easy interpretations of discussions between the interviewer and interviewees, in addition to better understand points discussed during the interview.

Interview data were scrutinized thematically to examine the impact of building cost information in the Nigerian construction industry as well as to validate BCIM framework. The transcription took an average of 7.5 to 8 hours for a 40-55-minutes interview to a detailed level to ensure a robust analysis of interview details. This was also because the researcher resorted manual transcription and interpretation of data which is highly time consuming. The analysis commenced by firstly coding interview data and evaluating data with literature for key concepts relating to study aim and objectives. This was done by organizing the raw interview data to make sense of it and codes were assigned accordingly to data. researcher also ensured that data were organized and presented in one format. Secondly, the coding process was followed by categorizing themes, cross-examination of data. Hence repeated phrases by

interviewees provided a high level of confidence throughout data processing. Including words, sentences and phrases relating to the study objectives and contents was very essential and serves as a guide in coding interview data. Also, excerpts from interview were coded individually given the perspective and diverse level of experience of interviewees. Content analysis has been perceived to be useful in analyzing interview data where there is need to identify keywords, themes, and paragraphs. It also involves the process of collecting examples, noticing, and analyzing concepts to find a common ground, hence the adoption of these technique for interview analysis of this study (Elo *et al.* 2014).

This study also considered other qualitative data analysis techniques such as the Jefferson and the thematic data analysis. However, the Jefferson was resource/time consuming and too cumbersome (Smith *et al.* 2005). Thematic analysis on the other hand is more appropriate in the analysis of narrative accounts of life stories and was considered not appropriate for this study. Hence the content analysis was deemed most appropriate technique for analyzing this study.

4.15 Quantitative Data Analysis

Welman *et al.* (2005) opine that data analysis by way of statistical techniques aids researchers in investigating variables as well as their relationship, effect, and pattern of involvement within the research world. Quantitative data analysis process or any type of data analysis process can be quite lengthy and time consuming. Quantitative research relies heavily on sample result whose results can be generalised to some degree of validity and reliability to the target population (Auriacombe 2007) However, the early stage of data analysis usually requires the researcher to examine and describe the collected data in summary followed by detailed analysis of data using various data analysis technique. The data analysis techniques used in this study will be further discussed below:

4.15.1 Descriptive Statistics

According to Bryman (2012) descriptive statistics is a methodical technique used in quantitative research to examine and describe components of data set. It centers more on barely sample summary using nonparametric statistics (Saunders, Lewis, and Thornhill 2009). This study utilized some descriptive statistics such as mean, median, mode, variance, and standard deviation to describe and process collected questionnaire data.

4.15.2 Factor Analysis

Factor analysis is statistical technique used to extract relationships among several variables which allows for many intercorrelated variables to be reduced to fewer proportions (Schuster and Yuan 2005). One of the aims of factor analysis is to determine if the observed variables that can be described entirely in terms of much smaller variables known as *factors*. The data obtained from the questionnaire revealed several factors influencing building cost information management in the Nigerian construction industry. Hence, the given that the quantitative data of this study contain many variables, the researcher deemed it appropriate to utilize factor analysis to group the variables into smaller units for further analysis. Also, the factor analysis was used in this study to detect the structure in the relationship between variables. Therefore, factor analysis is applied in this study to classify variables, reduce the number of variables, and to detect the structure of variables.

4.15.3 Reliability Analysis (Cronbach's Alpha test)

Reliability analysis is a measure of consistency or stability of an information or test score. It is a measure of how well a test measures accomplishment. This study utilized Cronbach's alpha (□) coefficient of internal consistency (Taber 2017). This is done to test the reliability of data collected through questionnaire. Reliability analysis is essential in assessing the quality of measurement technique used for data collection, and the consistency of response result by participants. To test the internal consistency of study, a reliability analysis was conducted using SPSS. This test was run in two stages; to examine the reliability of the raw data obtained from questionnaire and to

treat the data for further analysis. Reliability analysis as illustrated by Cronbach and Shavelson (2004) is represented in Table 4.12

Table 4.12: Internal consistencies of Cronbach's alpha reliability test values

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

4.15.4 Pearson correlation

According to Bryman (2012), Pearson's correlation is a statistical test that measures the statistical association or relationship between two continuous variables. It proves to be a very essential tool for measuring the association between two variables of interest. Hence, this study deployed the Pearson correlation to examine the impact of building cost information on the Nigerian construction industry. This includes examining the factors such as location, materials, labor, client type, project complexity, information source etc. affects building costs information management in Nigeria.

The Pearson correlation coefficient symbol is represented by "p" when measure in population and "r" when measured in a sample. It ranges from -1 to +1 where +1 indicates perfect positive linear relationship between variables, 0 indicates no linear relationship between variables and -1 indicates perfect negative linear relationship between variables (Benesty *et al.* 2009). Figures 4.8(a), (b), and (c) illustrate the various representation of Pearson correlation relationships adopted from (Lane 2013).

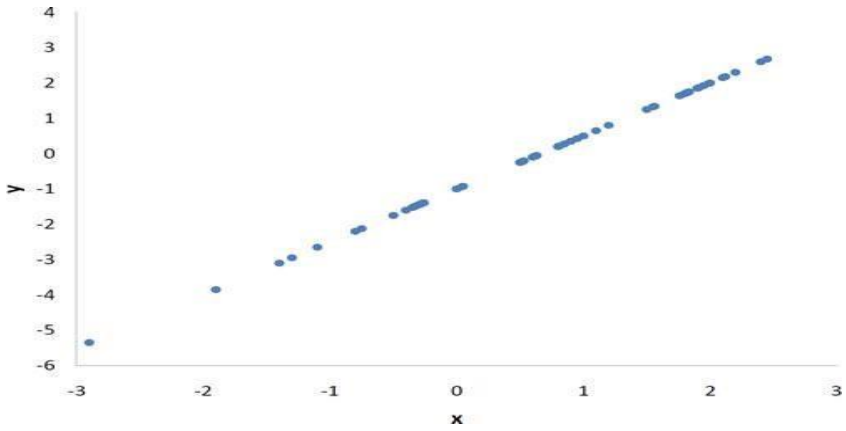

Figure 4.7(a). Perfect positive linear relationship (+1)

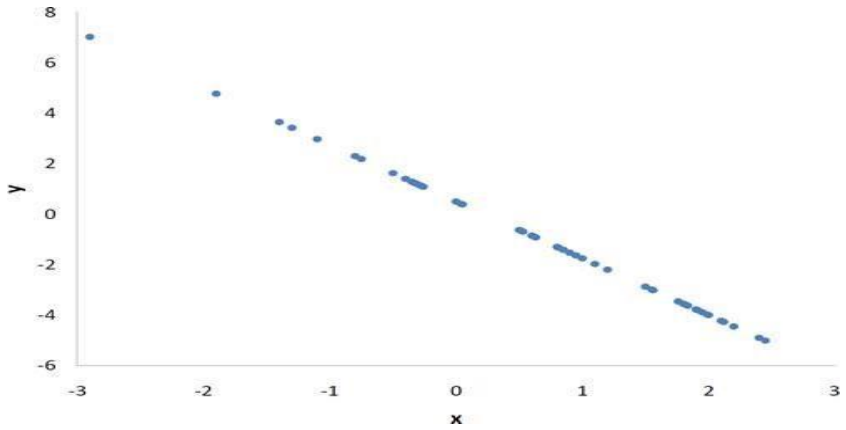

Figure 4.7(b). Perfect negative linear relationship (-1)

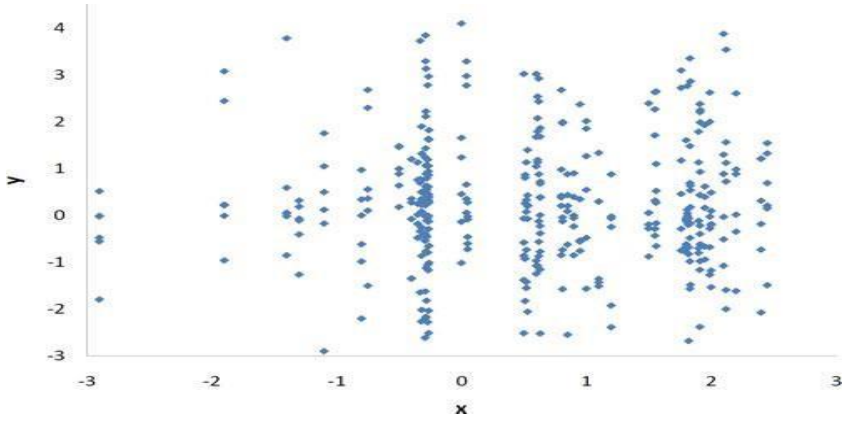

Figure 4.7(c). Scatter plot with no relationship between variable (0)

4.15.5 T-test Analysis

According to Kim (2015) a T test is statistical procedure which involves comparing the means of two groups. It is often used to determine whether distinction between means of the two samples is statistically significant. It is helpful in analyzing a single group of participants on two variables or two groups of participants on a single variable.

A T-test provides can be used to determine the probability output of comparing two means (Westfall 2020). It is however important to note that if this probability is less than 0.05, then the difference is significant, and as such is not caused by chance. There are two types of T-tests: single sample T-test; and two-sample T-test.

The single-sample T-test is also known as one-sample T-test. In this type of test, the observed mean is compared to an anticipated mean of the population (e.g., hypothetical mean).

The two-sample T-test is hypothesis test for answering questions regarding the mean where data are obtained from two variable samples of separate observations each from a fundamental normal distribution. For instance, in this study the researcher utilized the two-sample T-test to ascertain whether the mean of some variable in the data differ (that is the mean between the costs of public project differ from that of private projects.

4.16 Triangulation

According to Flick (2009), triangulation involves taking different perspectives on a subject matter of a study or a research question by a researcher with the aim of validating the research. In other word, triangulation is described as the application of several sources of data collection method in a systematic and organized way to enhance the validity of a study. Denzin (1984) identifies four types of triangulations namely:

1. **Data Triangulation**. This involves the use different data sources and should not be interchanged with using different methods for generating data. Denzin

further distinguishes between 3 sub data triangulation methods and suggests studying occurrences at different dates, places and from different people.

2. **Investigator Triangulation**. This type of triangulation involves the use of different interviewers and observers to detect and minimize researchers' biases in research.

3. **Theory Triangulation**. In this type of triangulation, data is approached with sets of hypothesis and theories in mind, placing side by side various theoretical perspective to assess the strength of a research.
4. **Methodological Triangulation**. Here, Denzin, differentiate two sub types (between-method and within-method triangulation). An of the first sub type is the combination of questionnaire survey with a semi-structured interview, while an example of the second sub type is the use of subscales for measuring an element in a questionnaire survey.

Flick (2009) emphasizes that triangulation is essential in qualitative research, however it is not a necessity. Consequently, it is suggested that combining methods for triangulation enhances validity and reliability of research findings.

Fusch, Fusch and Ness (2018) observed that there have been debates in the research community on the misconception about triangulation; while some believe that it causes discrepancies given the strength of various approaches, others are of the opinion that it enhances consistency across data sources and approaches. For instance, Draper and Swift (2011), posited that researchers who adopt triangulation approach tend to bring their personal milieu and values which demonstrates subjectivity and the relationship between researcher and participants further noting that this is perceived by some researchers as strength while others perceive it as a weakness in research.

The interviews conducted in this study provided a perspectives of construction professionals in relation to building cost information management issues in Nigeria and may not necessarily reflect the totality of the research problem. This study therefore considered the use of; questionnaire, archival data and semi-structured

interviews as the principal methods of obtaining valid and reliable scientific data. Consequently, this study utilized the data triangulation methods as this involves the use of various source of data.

4.16.1 Validity

Colton and Covert (2007) asserted that validity and reliability are two key indications of testing mechanism accuracy and credibility of quantitative research. In other words, validity is described as the degree to which an instrument measures what it is intended. It is customarily used in quantitative research; however, many scholars argue validity is insignificant in qualitative research (Maxwell and Mittapalli 2010).

To maintain trustworthiness or true knowledge of this study, validity was addressed throughout the research process, particularly, in three main capacities: **formulation** (design of interview questions, interview procedure, and data recording), **presentation** (duplicability, valid explanation, and data organisation) and **interpretation** (purposeful discussion of data) (Guba and Lincoln 2005).

The following precautions were further taken to ensure validity of the quantitative research. The questionnaire was developed based on knowledge gained through critical review of literatures. Piloting the instrument (questionnaire) ensured that it was subjected to scrutiny of both construction practitioners and reasoned academic, this approach also exemplifies content validity in accordance with Colton and Covert (2007).

Also, both multiple choice questions with multiple answer questions and close-ended statements of the questionnaire were developed in line with research aim and objectives. Collected data was subjected to suitable statistical test before further interpretation and analysis was done.

Questions were also designed to keep participants in focus to fully complete the questionnaires to the best of their knowledge.

4.16.2 Reliability

According to Chiang (2015), reliability refers to the consistency of a measure. Reliability involves replicating a study tools and procedure to enhance accuracy. It queries whether the findings of a study remain same if the exact research is repeated. Reliability ascertains the consistency and accuracy of a research measurement. Reliability also helps identify any error or bias from study participants or researcher.
Joppe (2000) argues that a research instrument is considered reliable if the study result can be replicated under a similar methodology. It is therefore highly unlikely that it can be affiliated with qualitative research since it is mainly concerned with replicability repeatability.

Reliability in quantitative research with regards to: (a) measurement stability over time (b) measurement similarities in a specific time (c) the degree of accuracy of measurement after repetitions.

Although reliability may not be widely applicable in qualitative research, it is however suggested that realist qualitative research demonstrate certain features of reliability if define based on “meaning of consistency” through triangulation of interview data.
This study consequently applied reliability in qualitative data for continuous comparison through analysis and consistent transcription of interview data to avoid the study deviating from the true meaning of reliability. It also ensures reliability by repeating some question to gauge participants responses to the rephrased question. This study also upholds reliability through the clear presentation of literature review and research findings for better and accurate evaluation.

Furthermore, the research methodology adopted for quantitative research suggests that reliability was maintained throughout the research process. Archival building costs data obtained from reputable private and government construction practitioners are also deemed to be reliable given that these are building costs data of real projects constructed across different geopolitical regions in Nigeria. Also, piloting the questionnaire using construction and academic experts in the subject area to ensure a robust design of the overall questionnaire as well as achieve a reliable result.

Nonetheless, statistical tools such as Cronbach's Alpha, Pearson correlation etc. were also utilized.

4.17 Ethical consideration

Ethics in research are guidelines and principles that enable researchers to uphold and determine what is morally justifiable. Ethics apply at every stage of a research as upholding ethics in research is particularly essential as the research community is mainly dependent on confidentiality, professionalism, trust, and goodwill of participants. To uphold ethics in this study, the researcher ensured that the study was conducted in line with the high ethical guidelines of the Coventry University where this study was conducted. Some of the key areas for ethical considerations in this study include informed consent, privacy and confidentiality, risks, data protection etc. Researcher ensured that participants data and information was highly protected and used solely for research purpose. Furthermore, the researcher ensured that both internal and external validity for questions were certified to help in achieving study aim and objectives. The researcher ensured that participants understood their rights and obligations to participate or to and/or to opt out should they deem it fit to opt out of the research.

Coventry University's checklists for good practice and ethics were accurately completed during ethics application. The ethics application for this study was approved before the commencement of data collection process. See appendix 6 for ethics approval certificate.

To uphold sound ethical conduct, the researcher designed informed consent form/participant information sheet using the Coventry University template and guidelines which had been approved by the Director of Studies for this research and the Faculty Research Ethics Leader. Copies of consent form/ participant information sheet were sent to participant ensuring that participant fully understand the purpose and nature of the research so they can freely decide whether to participate. Participant's identity was also kept confidential in accordance with the data protection

guidelines explained in the consent form, hence the intentional omission of participants personal information in all research documents.
All electronic data were strictly managed, coded strongly passworded to protect it from unlawful and unauthorized access as well as protection against accidental loss or damage following the Coventry University's good ethical research practice as illustrated in Figure 4.8.

Lastly, all obtained data file will be destroyed after the completion of this study.

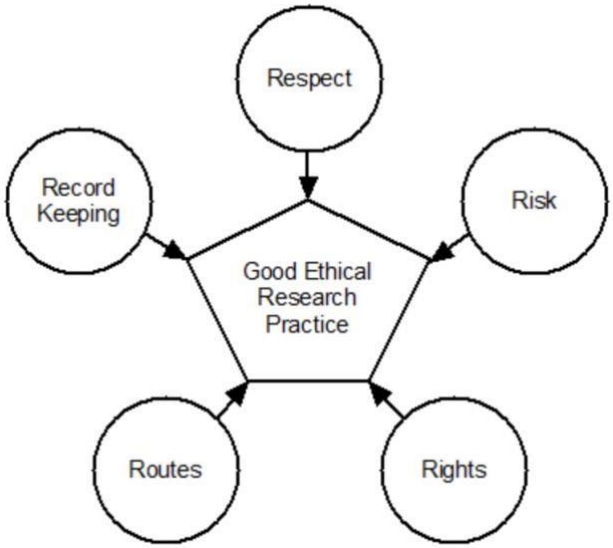

Figure 4.8 Good Ethical Research Practice (Ethics 2018)

4.18 Summary

This chapter details the information on the adopted research design and development of methodology for this study. The research design and methodology adopted for this study was informed by the knowledge gained and understating from review of several literature and other supplementary findings.

This study deploys both objective and subjective stance to answer the research question most efficiently. Hence, this study adopts pragmatism philosophy as the most suitable research philosophy. Given the differences in approach, it was observed that the inductive approach lays more emphasis on the close understanding of the research context, collection of qualitative data as well as a more flexible approach to

allow for changes in research emphasis. Hence, an inductive approach was adopted to appropriately achieve the research objectives and answer the research questions.

As discussed earlier in this chapter, using quantitative method of data collection alone was considered not enough in obtaining the required data for this study. Therefore, mixed method has been used for obtaining the data. The method of data collection as well as the analytical tool adopted was also discussed in detail. Also, the reliability, validity and ethical procedures explored in this study were also discussed.

Chapter Five

Data collection, presentation, and analysis

5.0 Preliminary survey

The preliminary survey for this study was carried out using a structured questionnaire. It sought to research the view of professionals in the Nigerian construction with regards to building cost information management.

The preliminary study aims to evaluate the factors influencing building cost information management in Nigeria, the current practice, level of existing knowledge among professionals with respect to building cost information management. Pilot survey is designed to access the existence of building cost information management database in Nigeria and to examine whether the development of framework for building cost information management will be beneficial in building cost estimation and finally to assess whether the implementation of the BCIM framework could be useful in monitoring and controlling of building construction cost and its significance (if any) on project delivery within estimated budget.

The questionnaire was categorised into four sections. The first section of the questionnaire includes general questions cantered around the background of respondents (i.e., educational background, profession, organisational type, year(s) of experience, etc). The second section includes questions tailored to obtaining building cost information, sources of cost, frequent use of the available sources of cost information in Nigeria, and how reliable these sources are etc. The third section includes questions carefully designed to critically examine the management of building cost information with respect to the factors affecting cost information management and building cost variances in the Nigerian construction industry. Finally, the fourth section includes question to determine: the existence of building cost information management systems used by practitioners, how these systems are updated, efficiency of these system, assertion of the quality of these systems in terms of (reliability, accessibility, relevance and applicability, regular updates, user friendly) and to establish whether there is a national building cost information database.

5.1 Sampling Method and Sample Frame

The research used a homogeneous sampling method to draw knowledge from practitioners in the Nigerian construction industry and to collect data. The target population in this case include quantity surveyors, Suppliers, Valuers, Architects, Builders amongst others with wealth of knowledge in building costing and estimation. The target population include practitioners in the construction industry from different geographical regions in Nigeria. The Practitioners also work for different organizations ranging from small, medium, to large in both public and private sectors. A total of 5 out 35 respondents work for a public organization while 30 respondents work for a private organization as shown in Table 1 below

5.2 Data collection and analysis

The data was obtained by administering carefully structured questionnaires to practitioners in the Nigerian construction industry and an extensive literature search in the subject area. The justification for the designed questionnaire was presented in accordance with the aim and objectives of this study. The questionnaire was carefully designed to obtain information relating to cost information management practices in the Nigerian construction industry.

The questionnaire was carefully structured in line with research objectives and was categorized into four different sections to encapsulate the subject areas discussed in the in the literature review of the study.

5.2.1 Responses

Table 5.1: Questionnaire Responses

Responses	Number Received	Percentage
Fully Completed	38	84.5%
Partially Completed	7	15.5%
Total Received	45	100.0%

In line with the above-mentioned sampling method, the questionnaire was administered using a web base survey system called Smart Survey. A total of 45 responses were received from the survey out of which 38 were fully completed responses and 7partially completed responses. However, only the fully completed responses were analysed. Subsequent sections present the analysis and interpretation of excerpts from data collection. Microsoft software such as Excel and Word were used for word processing and the development of charts and graphs.

5.2.2 Respondents organisational type

Table 5.2: Respondents' Organizational Type

Type of Organization	Respondents
Public	**5**
Private	30
Total respondents	**35**

A total number of 5 respondents which constitute 14.29% of the respondents work with public organization while a total of 30 respondents constituting 85.71% work with public organization.

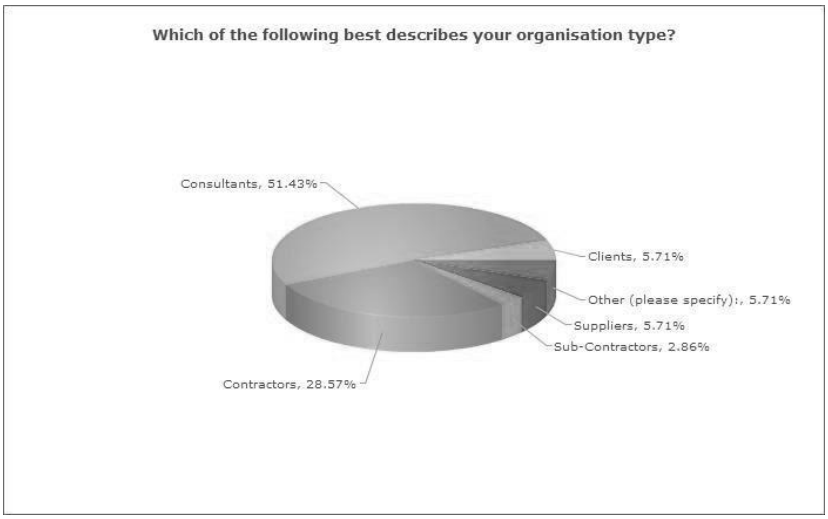

Figure 5.1: Respondents organisational type

A critical study of study participants reveals that many the respondents are consultant which make up 51.43% of the total respondents, and 28.57% of the respondents are contractors, 5.71% are clients, 5.71% are suppliers, 5.71% operate in other field other than provided options (this includes a combination of client and contractor) and the least percentage of respondents which 2.86% are sub-contractors as presented in Fig 5.1above.

5.2.3 Sources of Cost Information - Usage Frequency

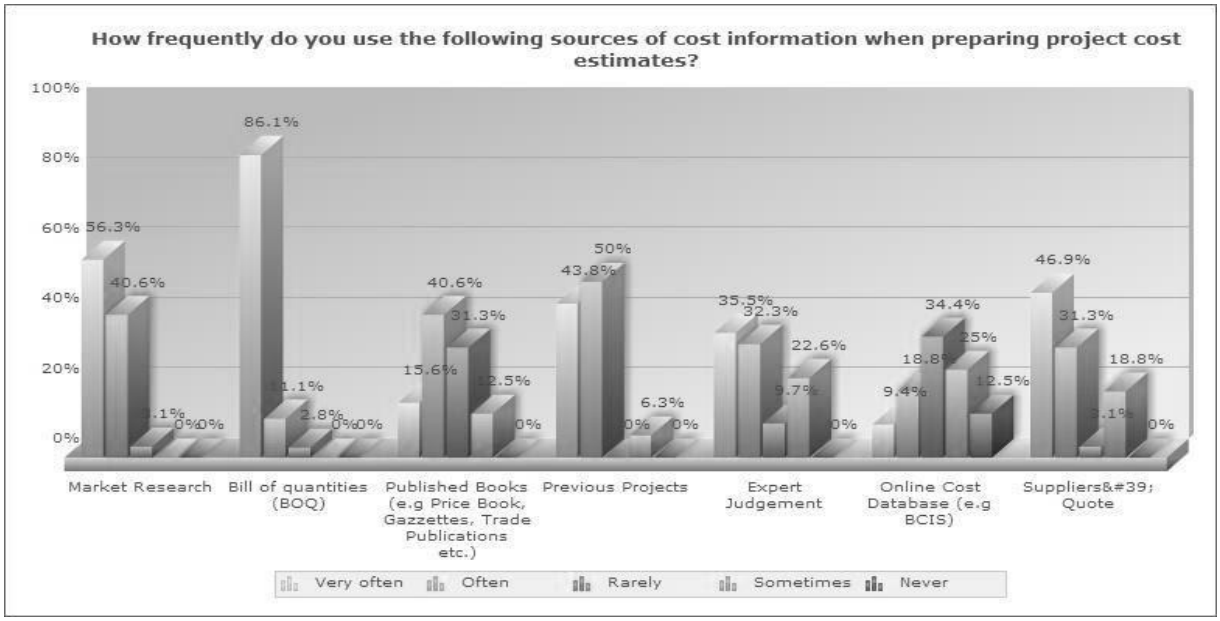

Figure 5.2: Evaluation of existing building cost information management

Justification of question

This question was asked to evaluate the existing building cost information sources available to construction professionals in Nigeria**.**

Majority of the respondents are of the opinion that having a well-managed and effective source of building cost information management will impact the delivery of construction project within the estimated budget.

The research result shows that 86.1% of the respondents use Bill of quantity as the main source of information used in the construction industry and 56.3% of the respondents use market research as their source of cost information, also a few of the

respondents representing 43.1% rely on suppliers' quote as their source of cost information and 43.8% of the respondents rely on quotes from previous project as their source of cost information. Finally, 35.5% of the respondents rely on expert judgements as their source of cost information and 15.6% use published data as their source of cost information while 9.4% use online cost database as their source of cost information.

Other sources of cost information specified by respondents include:

Q-MATE ESTIMATING SOFTWARE.

Further critical analysis also reveals that most of the industry practitioners' use an in-house organizational source of cost information and vast majority of the respondents rated the quality of their organization's cost information system as being high. This implies that it could still be improved from 'High' rating to 'Very high'.

5.2.4 Quality of Organisational Cost Information

Table 5.3: Quality of organization's Cost Information

	How would you rate the quality of your organization's cost information management in terms of the following?									
S/N		**RATING**					**Total Frequency (N)**	**Rank Sum**	**Importance Index = Rank Sum/5N**	**Rank Order**
		4	3	2	1	0				
1	**Validity**	8	18	8	1	0	35	71	0.406	4
2	**Consistency**	9	19	6	1	0	35	77	0.440	2
3	**Reliability**	9	18	7	1	0	35	74	0.423	3
4	**Generalisability**	4	19	11	1	0	35	82	0.469	1

Justification of question

This question was asked to identify the quality of information building cost information management structure used by individual construction firms in Nigeria as well as to understand how this firms effectively manage cost data for their projects.

Deducing from table xx above, the rating 4,3,2,1 and 0 represent “Very effective”, “Effective”, “Not sure”, “Ineffective “and “Very ineffective respectively.

The research result revealed that quality of the organisation cost information is most effective in the areas of generalisability. In other words, most the of the in-house building cost information structure can be generalised across projects in different locations within Nigeria. However, this cost information may not necessarily be valid for specific project according to the result obtained.

5.2.5 Cost Information Indices

Table 5.4: building cost indices

	Asides the cost of material, labour, plants/machinery, profit and overhead, to what extent are the following indices considered when computing cost information?									
S/No.		**Very Often**	**Often**	**Sometimes**	**Not Often**	**Never**	**Total Frequency (N)**	**Weighted Sum**	**Importance Index =Weighted Sum /5N**	**Rank Order**
	RATING	**4**	**3**	**2**	**1**	**0**				
1	Location	28	5	2	0	0	35	84	0.480	1
2	Inflation	9	14	9	2	0	35	68	0.389	5
3	Project time frame	14	15	4	0	2	35	75	0.429	4
4	Project type/complexity	16	18	1	0	0	35	79	0.451	2
5	Construction method	16	14	4	1	0	35	78	0.446	3

Justification of question:

The question was asked to know the cost indices used by construction professionals in updating building cost information to benchmark and forecasting building project cost

The result of this research shows that asides the cost of material, labour, plants/machinery, profit and overheads, other indices which are most often considered when computing cost information include Location, project type/complexity, construction method, project time frame and inflation, respectively.

5.2.6 Building cost information management

Factors affecting Cost Information Management in the Nigerian Construction Industry

Justification of question

The question was asked to examine the factors influencing building cost information management in Nigeria. The responses are represented in Likert severity index as shown in table 5.4

Table 5.5 below reflects the various factors affecting building cost information management in the Nigerian construction industry and the impact of each on cost information management. Also, the table below shows the factors affecting cost information management as rated by the respondents in descending order of impact, i.e., from the highest impact to the lowest impact.

This is further analysed using Likert ranking and severity index to critically appraise the level of impact each of the factors and their impact construction cost information management.

Table 5.5: Factors influencing building cost information management

	From your experience to what extent do these factors affect the management of cost information in your organisation?									
S/No.		**Very high**	**High**	**Average**	**Low**	**Very Low**	**Total Frequency (N)**	**Weighted Sum**	**Importance Index = Weighted Sum/4N**	**Rank Order**
	RATING	5	4	3	2	1				
1	Economic instability and inflation	45	72	15	2	0	134	562	1.049	7
2	Inefficient cost information	65	36	24	4	1	130	550	1.058	3
3	Lack of cost information database	65	36	21	6	0	128	544	1.063	1
4	Organisational culture	15	44	30	10	4	103	365	0.886	10
5	Computer literacy/Training	20	32	21	16	5	94	328	0.872	11
6	Poor knowledge of project cost estimation	30	44	21	8	5	108	410	0.949	7
7	Poor record keeping and general administration	25	48	27	2	7	109	409	0.938	8
8	Poor communication/feedback system	30	44	15	10	5	104	396	0.952	16
9	Project complexity	35	20	39	12	1	107	397	0.928	9
10	Undue Political influence/Change in government policies	60	40	21	0	3	124	526	0.060	2
11	Project site location	50	48	24	4	1	127	523	0.030	5

From the foregoing, arranged in descending order of impact, the factors affecting construction cost information management in Nigeria are as follows:

- Lack of cost information database
- Undue political influence and change in government policies
- Inadequate cost information
- Economic instability and inflation
- Project site location
- Poor communication and feedback system
- Poor knowledge of project cost estimation
- Poor record keeping and general administration
- Project complexity Organizational culture
- Computer literacy and training

5.3 Research findings and discussion of results

Results obtained have been summarized and presented with the aim of developing an effective BCIM framework to enhance the performance of the building cost information management practices in the Nigerian construction industry. The result interpretation is based on the research objectives. And findings from literature review which also inferred that the in-house building cost information management structures used by individual construction organisations in Nigeria and existing cost management practices of construction professionals are not comprehensive enough to provide best cost information data, timely and accurate building cost estimates, robust tender and contract cost documentation and post-contract cost control; hence the reason for the overpriced building cost of projects in Nigeria (Ojo, Ogunsina and Ogusemi 2020).

Similarly, knowledge drawn from the literature revealed that the greatest constraints identified against adequate management of building cost information are with respect to insufficient design information and unavailability of relevant database (Akintoye, Ajewole and Olomolaiye, 1992).

Therefore, the main purpose behind having a robust BCIM database is to enhance building cost management and for accurate and efficient building cost estimation in Nigeria. It is against this backdrop that an informed decision was taken to embark on the main study with the aim of assessing cost management practices of building projects, by the development of a framework building cost information management for estimating and benchmarking the cost building projects in Nigeria. Based on the knowledge drawn from the extensive review of literature and findings from research, the following represent the value of the research study and/or the contribution to knowledge with respect to building cost information management in Nigeria.

5.4 Chapter summary

This chapter described the preliminary survey and analysis of key factors affecting the management of building cost information in Nigeria. Knowledge obtained from the industry practitioners revealed that main factors affecting building cost information management are Lack of cost information database, undue political influence and change in government policies, inadequate cost information, economic instability and inflation, project site location, poor communication and feedback system, poor knowledge of project cost estimation, poor record keeping and general administration, project complexity, organizational culture, computer literacy and training. This research seeks to add to the body of knowledge in construction cost management and information management. Furthermore, the study participants asserted that the development and subsequent implementation of a robust building cost information management framework will aid the improvement of building cost management in the Nigerian construction industry. This assertion aligned with findings from literature review to narrow down the study and assisted in refining the major study to the development of framework for building cost information management in Nigeria. Hence, data presentation, analysis and key findings from the major study is discussed in the next chapter.

Chapter Six
Archival and Documentary Data Analysis

6.0 Introduction

This chapter presents the descriptive analysis of documentary and archival data which serves as secondary data sourced from previous completed building projects across different geographical regions in Nigeria. It explores the understanding of building cost information management in Nigeria, the current trend and cost performance of building projects using historic cost data of selected completed public and private building projects across different regions in Nigeria.

The outline of the historical cost data was designed using a template like the Building Cost Information Service (BCIS) used the UK construction industry. This established experimental themes which display similarities and differences that could ultimately be incorporated in the development of building cost information model for the Nigerian construction industry.

This chapter also addresses objective one, part of objective two, and objective five which include:

- To examine the impact of types of clients on building cost information in the Nigerian construction industry
- To investigate the underlying cause(s) of building cost variance around different geographical region in Nigeria.
- To comparatively analyze Building Costs in the Nigerian and UK Construction industry.

The first section reflects a commentary on the different elements of the historical building cost data such as project location, cost variances, preliminaries, government policies, additional variation etc. The analysis in this stage mainly involves data document observations and reviews. The second section presents the underlying issues associated with sources of building cost information in Nigeria.

Lastly, the third section presents an overview analysis of all archival data, the methods of collection and conclusion drawn from analysis. this establishes empirical themes which reflects differences as well as similarities.

6.1 Background details of participants

The participants for this study were identified and selected using purposeful sampling through professional networking. Also, completed building cost data used was obtained from 11 participants. The choice of obtaining building cost data from different geographical locations in Nigeria was premised on the fact that location has a significant impact on the major components of building costs and price, such as labor, materials, plant and overhead (Oladapo and Aibinu, 2008). Details of participants professional background are presented in Table 5.1. As reflected in the table, the study participants were construction professionals, comprising of 54.55% quantity surveyors, 18.18% architects, 18.18% civil/structural engineers and 9.09% builders. The participants also work with reputable construction organisations involved in both private and public construction projects in Nigeria. Hence, the building cost data they provided was deemed reliable for use in this study.

Table 6.1: Participants' professional details

Profession	Frequency	Percentage (%)
Quantity surveyor	6	54.55
Architect	2	18.18
Builder	1	9.09
Civil/structural engineer	2	18.18
Total	**11**	**100%**

As illustrated in table 6.1b, the participants are qualified members of their respective professional associations, with adequate post-qualification experience, involved in both public and private construction project activities in Nigeria.

Table 6.1b: Participants' professional affiliation details

Profession (%)	Frequency	Percentage
Member Nigerian Institute of Quantity Surveyors	6	54.55
Member Nigerian Institute of Architect	2	18.18
Member Nigerian Society of Engineer	2	18.18
Member Nigerian Institute of building	1	9.09
Total	**11**	**100%**

6.2 Analysis of Archival and Documentary Data

A recap of how the archive data were collected has been presented in section 4.6.3 of the methodology chapter. Obtaining real-time building cost data in Nigeria was quite challenging due to the lack of building cost information database. However, building cost data were obtained via professional networking in different regions in Nigeria with the help construction professionals like Quantity surveyors, cost managers, builders, professional bodies NIQS, ex colleagues etc. A template was designed using BCIS format. This is done to establish a comparison between the Nigerian cost information and the UK cost information system.

The analysis was conducted to achieve the first objective of this which is to examine the impact of types of clients on building cost information. A total of 11 different historical cost data of building projects across Nigeria was obtained. The analysis of these data was based on the different elements. Table 6.2 presents an overview of archival cost data from selected building projects across the geo-political zones in Nigeria.

Table 6.2: Historical Building Cost Data from the Nigerian Construction Industry

South-South

S/N o	Projects	Project Location	Project Duration (Weeks)	Client	Type of Contract	Gross Floor Area (m2)	Tender Price ('000,000)	Original Contract Costs	Final Costs	Contract Cost/Final Project Cost (%)	Estimate Preliminary / Final Contract Cost (%)	Ratio of Contingency /Sub-total	Additional Variation	Variance between Contract Cost and Final Cost (%)	Tender / Contract Award Price Ratio
1	Project 1	(GRA- Port Harcourt)	264	Private	Bespoke	2,100	205.00	175,450,500.00	555,235,541.52	0.32	1.05	3.15	379,785,041.52	68.40	0.32
2	Project 2	(Woji, Port Harcourt)	nil	Private	JCT	-		205,010,608.04	216,888,489.56	0.95	2.68	8.07	11,877,881.52	5.48	0.95
3	Project 3	(Pet. College Delta)	256	Government	JCT	1,875		257,914,156.51	291,717,213.90	0.88	1.99	6.00	33,803,057.39	11.59	0.88
						1,988		**Average**	**354,613,748.33**	0.72	1.90	5.74		28.49	0.72
South West															
1	Project 1	(Kotun, Lagos)	24	Private	JCT	980		210497297.7	276914364	0.76	2.10	6.32	66417066.31	23.98	0.76
2	Project 2	(Festac-Lagos)	-	Private	JCT	-		118451138.5	145301067.4	0.82	4.00	12.04	26849928.93	18.48	0.82
3	Project 3	(Victoria Island, Lagos)	52	Private	JCT	672		141315407.7	165815407.7	0.85	3.50	10.55	24500000	14.78	0.85
						826			**196,010,279.68**	0.81	3.20	9.64		19.08	0.81
	North Central														

2	Project 1	(Jabi, FCT)	276	Private	JCT	1000	701	675450110	475285699.4	1.42	1.22	3.68	-200164410.6	-42.11	1.42
4	Project	(Wuse2-FCT)	52	Private	JCT	2175	-	614361040.6	680946967.7	0.90	0.85	2.57	66,585,927.12	9.78	0.90
2	Project 10	(National Comm. Annex -FCT)	176	Government	Bespoke	3875	-	2631768111	3251827408	0.81	0.18	0.54	620,059,297.34	19.07	0.81
						2350	**Average**		**1,469,353,358.35**	1.04	0.75	2.26		-4.42	1.04
	Other Northern region														
1	Project 6	(Sabon -Gari) **Northern Nigeria**	24	Private	JCT	1,126	-	182,056,383.60	182,966,743.16	1.00	3.17	9.56	910,359.56	0.50	1.00
2	Project 11	(Fed. Govt. College-Jigawa)	136	Government	JCT	1,875	-	58,704,399.61	87,350,925.90	0.67	6.65	20.03	28,646,526.29	32.79	0.67
						1,501			**135,158,834.53**	0.83	4.91	14.80		16.65	0.83

6.2.1 The Construction Projects Surveyed

A total of 11 completed public and private building projects are distributed across 6 geopolitical regions in Nigeria as illustrated in Table 6.3. Also, Table 5.4 presents the highest contract cost of projects surveyed which is N2,631,768,111 (£7,018,048.30) with a final building cost of N3,251,827,408 (£8,671,539.75) and the lowest contract recorded is N58,704,399.61 (£156,545.07) with a final building cost of N87,350,925.90 (£232,935.80). The Federal Capital Territory (Abuja) with high concentration of public projects records the highest contract cost and final cost stated above whereas the Jigawa state northern Nigeria records the lowest building construction cost and final cost. Also, the maximum project duration and minimum project duration as illustrated in Table 6.2 are 276 weeks and 24 weeks respectively.

Table 6.3: Project locations covered by study

S/No	Location	Zones	Frequency	Percentage (%)
1.	Abuja (FCT)	North-central	3	27.27
2.	Delta	South-south	1	9.09
3.	Jigawa	North	1	9.09
4.	Kano	North	1	9.09
5.	Lagos	South-west	3	27.27
6.	Port Harcourt	South-south	2	18.18
Total			**11**	**100%**

Table 6.4: Range of building contract cost and final cost

S/No Build contract cos and final cost	N	Range (N)	Minimum (N)	Maximum (N)
Initial contract cost	11	2,573,063,711.39	58,704,399.61	2,631,768,111
Final cost	11	3,164,476,482.10	87,350,925.90	
3,251,827,408				

Analysis of Table 6.2 above provides an insight on certain factors influencing building cost data for public and private building projects across different geopolitical zones in Nigeria. The table presents nature of projects, project location, duration, gross floor area etc.

6.2.2 Project Location Analysis

Mere inspection of the building cost information in different regions reveal that on average, final cost of building in South-West and North-Central region seem to more expensive compared to another region in Nigeria. The data is somewhat like what is available in BCIS in relation to location perhaps due to location factors. For instance, in the South-West, project data obtained were from Lagos and North-central data were from Abuja (the Federal Capital of Nigeria).

However, there is somewhat dissimilarity in average gross floor area to average final building cost in various regions in Nigeria. For instance, average cost gross floor area for South-South region based on 3 projects obtained as illustrated in the Table 5.2 is 1,988(m^2) and final building cost is N356,613,748.33 million compared to the South-west region with 3 similar projects of an average gross floor area of 826(m^2) and final building cost of N196,010,279.68 million. However, it is imperative to note that the gross floor area of each project presented are significantly different hence different comparison may not be accurate.

6.2.3 Contract Type Analysis

Table 6.2 also shows that 2 out of the 11 projects representing 18% of the total projects obtained used bespoke contract type while 9 projects representing 82% of the total projects used modified JCT contract. This is not surprising because is one the commonwealth countries where JCT contract is predominantly used in project execution. This further reinforces the report by Taiwo (2018) which suggests that JCT is commonly used amongst building professionals in the Nigeria construction industry. Further analysis of this projects reveals that one of the key issues in executing JCT contracts in Nigeria is the lack of cost information system or the poor format of record keeping in JCT contracts and even other contract types (Taiwo 2018). These issues and many others constitute the legal and technical challenges confronting the Nigeria construction industry that is constantly evolving on daily basis. Hence, an urgent need for a complete overhaul of the laws regulating the Nigeria construction industry.

6.2.4 Client Type Analysis

The type of client for building construction projects in Nigeria has always played a significant role on the overall cost and time performance of projects as far back as the 80's. A study by Adekunle (1980) revealed that in Nigeria, a total of N5.6 billion of public funds was set aside to be spent on government building/civil engineering construction alone during the 4th National Development plan for a five-year period, whereas the private sector spending on building construction within the same period was estimated to be N3.7 billion. This shows a significantly high cost of building projects for public clients compared to private clients. Similarly, Omoregie and Radford (2006) reported that Nigerian building projects especially government projects experience a minimum average cost escalation of 14% every year.

An illustration in Table 6.1 of client types based on the archive data obtained indicates that 7 out of 11 projects were for private clients which represents 63% of the total building projects while 3 projects representing 27% of total projects were for public clients. This may also be due to abandonment of many public building projects arising from project cost escalation. However, in terms of final projects costs, public projects seem to have higher final project costs than private clients. Further analysis reveals

that the ratio of initial building costs to final building costs reflects a disproportionate value. This further buttresses Omoregie and Radford (2006) report on constant project cost escalation of public project.

The average ratio of initial project costs and final project costs show across various regions in Nigeria. Also, average contract costs to final costs across the regions include South-South (0.72), South-West (0.81), North-Central (1.04) and Northern region (0.83). Perhaps, this may be orchestrated or influenced by disproportionate and unexplained high volume of variation order. Conceivably, there are many other reasons responsible for the high proportion of variation order. For instance, Project1 in the South-South region executed in Port Harcourt has an initial contract sum of N175,450,500.00 (£467,868) and a final contract sum of N555,235,541.52 (£148,062.77), showing an increase by N379,785,041.52 (£1.012,760.11). This reflects a significant increase by 216.5% from the original contract sum.

Further analysis reveals that South-West projects have an average of increment of project from 17% to 31% due to variation changes. Projects in North-Central region have an average increment of project cost due to variation changes from 10% to 29% while other Norther regions have an average increment in building cost ranges between 0.5% to 49%. The effect of building cost increment has resulted in abandonment of many building projects in Nigeria. It is however important to note that the federal government in Nigeria is often perceived to be involved in the most complex projects making up for 38.4% of the market (Ayangade, 2005) followed by the state government seen to be responsible for about 19.2% of the projects in the industry.

6.2.5 Project Duration Analysis

According to Elinwa and Joshua (2001), many building projects in Nigeria experience time overrun from their initial duration by between 50% and 420%. Their study also identified improper planning, mode of financing and delayed payment of completed work as the most influencing factors among others responsible for the high proportion of building project time overrun in Nigeria.

However, an analysis of project duration illustrated in Table 6.1 above reveals that, average project duration in the South-South region ranges from 256 weeks to 264 weeks while in the South-West average project duration ranges between 24 weeks to 52 weeks. The average project duration in the in the North-Central region ranges between 52 week and 276 weeks while the other Northern region project duration ranges between 24 week and 136 weeks.

A closer look at the table shows that on the average, government projects seem to have higher project duration ranging between 136 to 258 weeks. Findings from analysis illustrated in Table 6.1 revealed that there are two specific factors influencing building cost variances across different regions in Nigeria. These factors include.

- Location
- Client type

6.3 Assessment of Factors Influencing Building Cost Information in Nigeria

The third objective of this study is to critically examine factors that affect building cost information in the Nigerian construction industry. An evaluation of the archival building cost data revealed building cost performance is mainly influenced by location and client type among others where public projects records very high final cost compared to the initial contract sum. Also, similar significant cost variances have been recorded with similar projects in different geographical locations in Nigeria. These revelations indicate the abuse cost management practice and public procurement system Nigerian (Olatunde 2007; Achilike and Akuwudike 2016). In addition, this practice contributes to the high rate of building cost overrun in the Nigerian construction industry. A further aggravating situation is that construction cost estimators are often faced with the challenge of insufficient and unreliable building cost information, many construction contracts are not estimated accurately (Akintoye and Olomolaiye, 2008).
Again, with the public projects.

The major factors influencing building cost information management have been categorized into five which include geographical, social cultural, financial, political, technological factors respectively.

6.4 Comparative Analysis of Nigerian and UK Building Projects in the Study Area

According to Ayangade (2009), the construction industry worldwide is generally regarded as the lifeline of its respective economy as it transcends all aspects of human activities. The Nigerian construction industry contribution has not measured up to those of the developed countries like the UK due to reasons such as methods of construction, corruption, lack of building cost information management database etc. The same researcher Ayangade (2009) noted that the construction industries of other western countries contribute about 22% to their respective GDPs, however the case is different in Nigeria as it contributes to its economy just slightly below 16%. Although, this could be balanced by the somewhat high employment of 20% it affords for its large population of 140 million population compared to the western countries with 12% employment. This study however conducted a comparative analysis of building projects in Nigeria and the UK, to establish the differences and similarities between and them as well as to ascertain the factors responsible for these differences. Table 6.5 presents comparison between selected Nigerian projects and sample of UK building projects obtained from the **BCIS.**

Table 6.5 Comparison between Nigerian building Project and UK building project

Nigeria Project Cost Analysis															UK Project Cost Analysis												
S/No	Projects	Project Location	Project Duration (Weeks)	Client	Type of Contract	Gross Floor Area (m2)	Tender Price	Original Contract Costs	Final Costs	Contract Cost/Final Project Cost (%)	Estimate Preliminary / Final Contract Cost (%)	Ratio of Contingency/ Sub-total	Additional Variation	Percentage Variation (%)	Tender / Contract Award Price Ratio	Projects	Project Location	Project Duration (Weeks)	Client	Type of Contract	Gross Floor Area	Budgeted Cost	Final Cost	Budgeted /Final Project Cost (%)	Estimated Preliminary/Budgeted Cost (%)	Ratio of Contingency/Sub-total	Additional Variation	Variance between Budgeted Cost and Final Cost (%)	Tender Cost/Contract Award Cost Ratio
			Private Projects															Government Projects											
1	Project 1	(Kotun, Lagos) **South West Nigeria**	24	Private	JCT	980.00	_	210,497,297.65	276,914,363.96	0.76	2.10	6.32	66,417,066.31	23.98	0.76	Project 1	Colchester, Essex	25	Colchester Hospital University NHS Foundation Trust	JCT Intermediate Building Contract 2011 edition	900.00	1,431,699.00	1,554,833.00	0.92	0.09	0.05	123,134.00	7.92	1.00
2	Project 2	(Jabi, FCT) **North Central Nigeria**	276	Private	JCT	1000	700,500,000.00	675,450,110.00	475,285,699.40	1.42	1.22	3.68	-200,164,410.60	-42.11	1.42	Project 4	Whitburn, Bathgate, Lothian	68	West Lothian Council	-	1,311.00	2,981,261.00	3,590,508.00	0.83	0.09	0.05	609,247.00	16.97	1.00
3	Project 3	(GRA- Port Harcourt) **South South Nigeria**	264	Private	Bespoke	2100	205,000,000.00	175,450,500.00	555,235,541.52	0.32	1.05	3.15	379,785,041.52	68.40	0.32	Project 5	Castle Morpeth	14	Northumberland County Council	Contract: JCT Design and Build Contract 2016 edition	2,741.00	4,264,987.00	5,870,000.00	0.73	0.07	0.02	1,605,013.00	27.34	1.00
4	Project 4	(Wuse2-FCT) **North Central Nigeria**	52	Private	JCT	2175	-	614,361,040.58	680,946,967.70	0.90	0.85	2.57	66,585,927.12	9.78	0.90	Project 7	Edge Hill, Liverpool, Merseyside	43	The Rutherford Cancer Centre	NEC3 priced contract 2013 (option A or B)	1,084.00	4,441,015.00	5,288,590.00	0.84	0.14	0.04	847,575.00	16.03	1.00
5	Project 5	(Festac-Lagos) **South West Nigeria**	-	Private	JCT	-	-	118,451,138.48	145,301,067.41	0.82	4.00	12.04	26,849,928.93	18.48	0.82	Project 8	Pinhoe, Exeter, Devon	43	Summerfield Developments (SW) Ltd	-	2,424.00	2,731,607.00	3,472,381.00	0.79	0.17	0.01	740,774.00	21.33	1.00
6	Project 6	(Sabon -Gari) **Northern Nigeria**	24	Private	JCT	1126	-	182,056,383.60	182,966,743.16	1.00	3.17	9.56	910,359.56	0.50	1.00	Project 10	Dennystown, Dumbarton, Dumbartonshire	67	West Dunbartonshire Council	JCT Standard Building Contract 2011 edition	1,146.00	1,425,485.00	1,558,863.00	0.91	0.13	0.06	133,378.00	8.56	1.00
7	Project 7	(Woji, Port Harcourt) **South South Nigeria**	-	Private	JCT	-	-	205,010,608.04	216,888,489.56	0.95	2.68	8.07	11,877,881.52	5.48	0.95														
8	Project 8	(Victoria Island, Lagos) **South West Nigeria**	52	Private	JCT	672	-	141,315,407.66	165,815,407.66	0.85	3.50	10.55	24,500,000.00	14.78	0.85														
		Mean construction period	**115**							**Mean Prelim**	**2.32**	Mean Additional variation value private building projects	**47,095,224.30**											**Mean Prelim**	**0.12**	Mean Additional variation value for Government building projects	**676,520.17**		

		(weeks) private construction																															
			Government Projects																**Private Projects**													
1	Project 9	(Pet. College Delta) **South South Nigeria**	256	Government	JCT	1,875		257914156.5	291,717,213.90	0.88	1.99	6.00	33,803,057.39	11.59	0.88	Project 2	West End, Edinburgh, Lothian	39	Charlotte Baptist Chapel Ltd	JCT Standard Building Contract 2011 edition	2,190.00	1,748,180.00	1,915,133.00	0.91	0.07	0.95	166,953.00	8.72	1.37
2	Project 10	(National Comm. Annex - FCT) **North Central Nigeria**	176	Government	Bespoke	3,875.00		2631768111	3,251,827,407.94	0.81	0.18	0.54	620,059,297.34	19.07	0.81	Project 3	Kemsley, Sittingbourne, Kent	26	Pickerings Plant Ltd	JCT Design and Build Contract 2016 edition	745.00	910,977.00	2,356,596.00	0.39	0.24	0.01	1,445,619.00	61.34	1.00
3	Project 11	(Fed. Govt. College- Jigawa) **Northern Nigeria**	136	Government	JCT	1,875.00		58704399.61	87,350,925.90	0.67	6.65	20.03	28,646,526.29	32.79	0.67	Project 6	Parkgate, Locks Heath, Hampshire	72	Locks Heath Free Church	JCT Design and Build Contract 2016 edition	1,667.00	3,105,670.00	3,633,248.00	0.85	0.16	0.00	527,578.00	14.52	1.22
		Mean construction period (weeks) Government construction	**189**							**Mean Prelim**	**2.94**	**Mean Additional variation value for Government building projects**	**227,502,960.34**		**0.85**	Project 9	Churchill, Somerset	63	Churchill Academy & Sixth Form	JCT Design and Build Contract 2016 edition	1,844.00	3,162,613.00	3,464,429.00	0.91	0.09	0.00	301,816.00	8.71	1.00
								479,179,922.98	**575,477,257.10**							Project 11	Scotland (Western and Northern Islands)	84	private	NEC3 priced contract 2013 (option A or B)	3,131.00	4,650,586.00	5,390,427.00	0.86	0.09	0.00	739,841.00	13.73	1.00
																								Mean Prelim	**0.13**	**Mean Additional variation value private building projects**	**636,361.40**				
																						2,804,916.4	**3,463,182.55**								

The comparative analysis revealed the average building project duration in Nigeria to that of similar projects in the UK from the BCIS seem significantly higher. Perhaps this may be informed by the many factors some of which include socio-cultural issues, proximity to site, poor record keeping culture, method of construction, availability of materials etc. It is however important to note that most government projects in the UK use NEC contracts as oppose JCT widely used in the Nigerian construction industry. This may also influence the difference in average project duration.

Analysis of preliminary costs in Table 5.1 above also revealed a striking cost information. For example, the estimated preliminary cost to final building cost shows an average of 1.90% for South-South, 3.20% for South-West, 0.75% for North-central and 4.91% for other northern region respectively. The analysis revealed a significant disparity in these preliminaries figures which may be due to lack of consistency in precontract estimating exercise.

However, a similar study of preliminary costs to final building costs of UK projects shows a pattern of similarity to Nigerian projects. Perhaps this may also be due to some factors such as site delivery management, traffic management and tight construction sites etc. as these are commonly experienced in UK construction. Preliminaries can therefore vary quite broadly within locations depending on the construction type and location.

In terms of contingency, table 6.2 above reflects huge dissimilarity and inconsistency in contingency cost provision in the Nigerian building projects compared to contingency costs provision in UK building projects. The analysis shows an average an average contingency cost for UK projects ranges from 0.00 to 0.95 while contingences costs provision for similar projects in Nigeria ranges from 2.25 to 14.80. Arguably these are unexplained cost figures because the practical implication of this is that the contingency costs provision for Nigerian building projects appear to be outrageously higher than that of UK projects. Perhaps there is need for further investigation of cost provisions made for contingencies in Nigerian building projects.

6.4.1 T-test Analysis for variables

Objective number of this study is to comparatively analyze building cost in Nigeria and the UK. To achieve this objective and for thorough understanding, independent t-test analysis was conducted to compare the mean of building costs and project duration variables in Nigeria to similar building projects in the UK. The independent t-test can be used to understand building costs and duration variations in Nigeria compared to similar projects in the UK.

Table: 6.6 Actual Building project Costs and Duration data with similar gross floor area for Nigeria and UK scheme

			Project duration		Budgeted cost		Final Project costs		BUDGETED COST/FINAL PROJECT COST (%)		Preliminary Costs		Sub-structure cost		Super-strucure cost		Variance between tender sum and final project costs	
S/No.	Gross floor area for building project in Nigeria	UK similar gross floor area	Building Project duration in Nigeria in weeks	Building Project duration in UK in weeks	Building Project in Nigeeria	Building Project in UK	Building Project in Nigeria	Building Project in UK	Building Project in Nigeria	Building Project in UK	Building Project in Nigeria	Building Project in UK	Building Project in Nigeria	Building Project in UK	Building Project in Nigeria	Building Project in UK	Building Project in Nigeria	Building Project in UK
1	672	745	52	39	141,315,407.70	910,977.00	165,815,407.66	2,356,596	0.85	0.39	7,170,000.00	215,315	7,119,340	146,292	60,450,876	358,436	24,500,000	1,445,619
2	980	900	24	25	210,497,297.65	1,431,699.00	276,914,363.96	1,554,833	0.76	0.92	5,806,500.00	121,957	14,888,172.98	19,573	88,298,557.22	468,572	66,417,066.31	123,134
3	1000	1,084	276	43	675450110	4,441,015.00	475285699.4	5,288,590	1.42	0.84	6,705,445.87	605,795	14,888,172.98	320,628	88,298,557.22	1,913,048	-200,164,410.60	847,575
4	1126	1,146	24	67	182056383.6	1,425,485	182,966,743.16	1,558,863	1	0.91	8,335,915.00	192,074	None	0	None	923,823	910,359.56	133,378
5	None	1,311	152	68	118,451,138.50	2,981,261	145,301,067.41	3,590,508	0.82	0.83	6,110,173.83	282,433	19,967,585.68	268,728	53,972,589.56	945,944	26,849,928.93	609,247
6	None	1,667	225	72	205,010,608	3,105,670	216,888,489.56	3,633,248	0.95	0.85	10,500,000.00	590,357	19,946,950	214,176	66,859,915	1,154,208	11,877,881.52	527,578
7	1875	1,844	256	63	257914156.5	3,162,613	291,717,213.90	3,464,429	0.88	0.91	16,785,225.00	276,700	75,895,666	251,089	85,900,700	1,156,198	33,803,057.39	301,816
8	1875	2,190	136	39	58,704,399.61	1,784,180	87,350,925.90	1,915,133	0.67	0.91	9,850,524.00	131,583	19,888,202	None	21,002,230	None	28,646,526.29	166,953
9	2175	2,424	52	43	614,361,040.60	2,731,607	680,946,967.70	3,472,381	0.9	0.79	65,084,758.61	474,914	23,149,298.50	136,773	288,287,,058.81	1,327,184	66,585,927.12	740,774
10	2500	2,741	264	56	205,000,000	4,264,987	175,450,500	5,870,000	0.32	0.73	6,705,445.87	301,275	14,888,172.98	428,388	88,298,557.22	1,657,406	379,785,041.52	1,605,013
11	3875	3,131	176	84	2,631,768,111	4,650,586	3,251,827,407.94	5,790,427	0.81	0.86	209,000,555.00	436,000	480,149,289.50	176,144	718,287,058.81	1,376,638	620,059,297.34	436,000
	1786	**1744**	**149**	**54**	**481866241**	**2808189**	**540951344**	**3499546**	**0.9**	**0.8**	**32004958**	**329855**	**69078085**	**196179**	**141263227**	**1128146**	**96297334**	**630644**

Table 6.6 illustrates the breakdown of selected building projects in Nigeria and UK and gives an indication of cost performance of building projects in Nigeria and the UK. A total of 11 completed projects in Nigeria were selected to compare with selected projects of similar floor area and type in the UK. Hence, projects gross floor area was the main point of consideration for comparison. Little emphasis was placed on method of construction since the choice of construction method would naturally vary from country to country due to cultural barriers, working condition, use of machineries etc.

6.4.1.1 T-test analysis for Building project duration

Using SPSS version 25 building project duration with similar gross floor area in Nigeria and UK schemes were selected and subjected to t-test analysis. Table 6.7 (and b) present outcome of independent t-test analysis.

Table 6.7a: T-test output for Building Project duration between Nigeria and UK schemes

independent t-test Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Nigeria	11	148.8182	98.76924	29.78005
UK	11	54.4545	17.90175	5.39758

Table 6.7b: T-test output for Building Project duration between Nigeria and UK schemes

independent t-test Statistics						
	Test Value = 1					
	t	df	Sig. (2tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Nigeria	4.964	10	0.001	147.81818	81.4641	214.1723
UK	9.903	10	0.000	53.45455	41.4280	65.4811

Interpretation of Table **6.7 (a and b)**

Table 6.6 illustrates the breakdown of selected building projects in Nigeria and UK and gives an indication of cost performance of building projects in Nigeria and the UK. A total of 11 completed projects in Nigeria were selected to compare with selected projects of similar floor area and type in the UK. Hence, projects gross floor area was the main point of consideration for comparison. Little emphasis was placed on method of construction since the choice of construction method would naturally vary from country to country due to cultural barriers, working condition, use of machineries etc.

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UK	11	54.4545	17.90175	5.39758

Table 6.7b: T-test output for Building Project duration between Nigeria and UK schemes

independent t-test Statistics						
	Test Value = 1					
	t	df	Sig. (2tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Nigeria	4.964	10	0.001	147.81818	81.4641	214.1723
UK	9.903	10	0.000	53.45455	41.4280	65.4811

Interpretation of Table **6.7 (a and b)**

The table reveal that building project duration mean for Nigeria and UK are statistically different because the value in the Sig. (2-tailed) row is less than (0.05). Detail looks at the table show that building project duration in Nigeria is significantly higher compared to building projects with similar gross floor area in the UK.

Statistically the study found that building project durations in Nigeria have significant higher length of completion time per weeks at (148.82 ± 98.77) based on 11 selected completed building projects in Nigeria compared to (54.45 ± 17.90) for similar building projects in the UK selected from the BCIS. These findings suggest that the cost building in Nigeria is significantly high compared to the UK. In addition, this could be due to factors including importation of building materials, inflation, exchange rate etc. Omergie and Radfort (2005), further emphasized that price fluctuation and limitation in exchange rate are some of the most severe causes of project cost escalation in Nigeria.

Table 6.8: Comparison of Budgeted building costs in Nigeria and UK

Budgeted cost	
Building Project in Nigeria	**Building Project in UK**
141,315,407.70 (£376,841.09)	910,977.00
210,497,297.65 (£561,326.13)	1,431,699.00
675,450,110 (£1,801,200)	4,441,015.00
182,056,383.6 (£485,483.69)	1,425,485
118,451,138.50 (£315,869.702)	2,981,261
205,010,608 (£546,694.95)	3,105,670
257,914,156.50 (£687,771.084)	3,162,613
58,704,399.61 (£156,545.07)	1,784,180
614,361,040.60 (£1,638,296.11)	2,731,607
205,000,000 (£546,666.67)	4,264,987
2,631,768,111 (£7,018,048.30)	4,650,586
481,866,241 (£1,284,976.64)	**2,808,189**

Table 6.8 illustrate snapshot of budgeted building costs extracted from generic table 6.6 above. It will be statistically irrelevant to compare building costs data in one country to another without due consideration for exchange rate, development factors, labor rate, cost of building materials, culture, use of machinery, equipment, method of construction, etc. However, for the purpose of this study and specifically this analysis due consideration was given to exchange rate between Nigeria currency (Naira – N) and British currency (pounds - £). At as the time of this analysis official exchange rate for £1 = N375. Thus, budgeted costs of building projects in £ is presented in Table 6.8 for effective comparison.

Table 6.8.1(a and b) present outcome of independent t-test analysis for budgeted building costs in Nigeria and UK.

Table 6.8.1a: T-test output for Budgeted Building Cost between Nigeria and UK schemes

independent t-test Statistics of Budgeted Building Project costs				
	N	Mean	Std. Deviation	Std. Error Mean
Nigeria	11	1284977	1972469	594722
UK	11	2808189	1299513	391818

Table 6.8.1b: T-test output for Budgeted Building Cost between Nigeria and UK schemes

independent t-test Statistics of Budgeted Building Project costs						
	Test Value = 1					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Nigeria	2.161	10	0.056	1284976	-40147	2610098
UK	7.167	10	0.000	2808188	1935163	3681213

Interpretation of **Tables 6.8.1 (a and b)**

The table reveal that budgeted building costs mean for Nigeria and UK are statistically different because the value in the Sig. (2-tailed) row is less than (0.05). Detail looks at the table show that budgeted building costs in Nigeria is slightly lower compared to budgeted building costs with similar gross floor area in the UK. Note: budgeted building costs values are based on official exchange rate of £1 to N375.

Statistically the study found that budgeted building costs in Nigeria have slightly lower mean costs per project at (1,284,977 ± 1,972,469) based on selected 11 completed building projects in Nigeria compared to (2,808,189 ± 1,299,513) for similar building projects in the UK. However, the interesting part of the statistical data is that Nigeria budgeted building cost has a higher standard deviation at 1,972,469 compared to the UK building projects with standard deviation at 1,299,513. Meaning that budgeted building cost data in Nigeria are more spread from the mean. The possible implication for high standard deviation is that budgeted building costs in Nigeria are likely to be characterized by inconsistency and inaccurate estimation.

Table 6.8.2: T-test Analysis for Final Building Costs

	Final Project costs		
Building Projects	**Final Building Costs in Nigeria (N)**	**Final Building Costs in Nigeria (£) Equivalent**	**Building Project in UK**
Project 1	165,815,408	442,174	2,356,596
Project 2	276,914,364	738,438	1,554,833
Project 3	475,285,699	1,267,429	5,288,590
Project 4	182,966,743	487,911	1,558,863
Project 5	145,301,067	387,470	3,590,508

Project 6	216,888,490	578,369	3,633,248
Project 7	291,717,214	777,913	3,464,429
Project 8	87,350,926	232,936	1,915,133
Project 9	680,946,968	1,815,859	3,472,381
Project 10	175,450,500	467,868	5,870,000
Project 11	3,251,827,408	8,671,540	5,790,427
	540,951,344	**1,442,537**	**3,499,546**

Table 6.8.2 illustrates a T-test analysis of final building costs extracted from generic table 6.6 above. The T-test was conducted to compare final cost of building projects in Nigeria and the UK to determine the cost performance and variability between building projects in Nigeria and the UK and their level of significance.

Table 6.8.2(a and b) present outcome of independent t-test analysis for final building costs in Nigeria and UK.

Table6 .8.2a: T-test output for Final Building Cost between Nigeria and UK

independent t-test Statistics of Building Final Project costs				
	N	Mean	Std. Deviation	Std. Error Mean
Nigeria	11	85346.5455	163126.52589	49184.49816
UK	11	329854.8182	172290.61105	51947.57380

Table 6.8.2b: T-test output for Final Building Cost between Nigeria and UK

independent t-test Statistics of Building Final Project costs						
	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Nigeria	1.735	10	0.113	85346	-24244	194935
UK	6.350	10	0.000	329854	214107	445600

Interpretation of **Tables 6.8.2 (a and b)**

Tables 6.8.2 (a and b) reveal that final building costs mean for Nigeria and UK are statistically different because the value in the Sig. (2-tailed) row is less than (0.05), where sig values for Nigeria and UK are 0.11 > 0.05 and 0.00 < 0.05 respectively, indicating statistically significance difference between the groups.

Also, a critical look at the table shows that final building costs in Nigeria is lower compared to final building costs with similar gross floor area in the UK. Note: final building costs values are based on official exchange rate of £1 to N375.

The study statistics show that final building costs in Nigeria also have lower mean costs per project at (85,346.55 ± 163,126.53) based on selected 11 completed building projects in Nigeria compared to (329,854.82 ± 172,290.61) for similar building projects in the UK. However, the Nigeria building cost has a lower standard deviation at 163,126.53 compared to the UK building projects with standard deviation at

172,290.61. This could possibly be due to several factors ranging from the procurement route used in the UK which may be more cost intensive compared to Nigeria where the traditional procurement route is the predominant procurement route.

Table 6.8.3: T-test Analysis for Building Preliminary Costs

	Building Preliminary Costs		
Building Projects	**Building Preliminary Costs in Nigeria (N)**	**Building Preliminary Costs in Nigeria (£) Equivalent**	**Building Preliminary Costs in UK**
Project 1	7,170,000.00	19,120	215,315
Project 2	5,806,500.00	15,484	121,957
Project 3	6,705,445.87	17,881	605,795
Project 4	8,335,915.00	22,229	192,074
Project 5	6,110,173.83	16,294	282,433
Project 6	10,500,000.00	28,000	590,357
Project 7	16,785,225.00	44,761	276,700
Project 8	9,850,524.00	26,268	131,583
Project 9	65,084,758.61	173,559	474,914
Project 10	6,705,445.87	17,881	301,275
Project 11	209,000,555.00	557,335	436,000
	32004958	**85,346.56**	**329,854.82**

Table 6.8.3 illustrates the T-test analysis of preliminary costs conducted to compare preliminary cost building of projects in Nigeria and the UK and determine their variability and level of significance.

Tables 6.8.3(a and b) present outcome of independent t-test analysis for preliminary costs of building projects in Nigeria and UK.

Table 6.8.3a: Independent T-Test Statistics of Building Preliminary Costs

independent t-test statistics Building Preliminary Costs				
	N	Mean	Std. Deviation	Std. Error Mean
Nigeria	11	85346.5455	163126.52589	49184.49816
UK	11	329854.8182	172290.61105	51947.57380

Table 5.8.3b: Independent T-Test Statistics of Building Preliminary Costs

independent t-test Statistics for Building Preliminary Costs						
	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Nigeria	1.735	10	0.113	85346	-24244	194935
UK	6.350	10	0.000	329854	214107	445600

Interpretation of **Tables 6.8.3 (a and b)**

A critical look at Tables 6.8.3 (a and B) a p value of 0.00 revealed a statistically significant difference between the Nigerian preliminary costs of building projects and preliminary cost of projects in the UK.

Furthermore, analysis of Tables 6.8.3 (a and b) revealed that preliminary cost of building projects in Nigeria is significantly lower at (8534.55 ± 163126.53) compared to preliminary cost of similar building with similar gross floor area in the UK at (329,854.82 ± 172,290.61). Again, this difference could be due several factors

influencing construction project procedures which varies from country to country. For example, Odusami and Onukwube (2008) assert that it is extremely difficult for quantity surveyors to accurately estimate preliminary costs due to inadequate design information. Hence a lower preliminary cost of the building projects in Nigeria in this case may not necessarily be an indication of good cost appraisal but an underestimation.

6.8.4 T-Test Analysis for Array of Building Sub-Structure Costs

	Building Sub-structure Costs Analysis		
Building Projects	**Building Preliminary Costs in Nigeria (N)**	**Building Preliminary Costs in Nigeria (£) Equivalent**	**Building Preliminary Costs in UK**
Project 1	7,119,340	18,985	146,292
Project 2	14,888,172.98	39,702	19,573
Project 3	14,888,172.98	39,702	320,628
Project 4	105,565,855	281,509	112855
Project 5	19,967,585.68	53,247	268,728
Project 6	19,946,950	53,192	214,176
Project 7	75,895,666	202,388	251,089
Project 8	19,888,202	53,035	385,564
Project 9	23,149,298.50	61,731	136,773
Project 10	14,888,172.98	39,702	428,388
Project 11	480,149,289.50	1,280,398	176,144
	72395155	**193,053.75**	**223,655.45**

Table 6.8.4 illustrates analysis of building sub-structure costs of projects in Nigeria and the UK to determine their variability and level of significance.

Tables 6.8.4(a and b) present outcome of independent t-test analysis of sub-structure building costs in Nigeria and UK.

6.8.4a: Independent t-test statistics for Building Sub-structure Costs

independent t-test Statistics for building substructure costs analysis				
	N	Mean	Std. Deviation	Std. Error Mean
Nigeria	11	193054	369735	111479
UK	11	223655	122525	36943

6.8.4b: Independent t-test statistics for Building Sub-structure Costs

independent t-test Statistics for building sub-structure costs analysis						
	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Nigeria	1.732	10	0.00	193053	-55338	441444
UK	6.054	10	0.00	223654	141341	305968

Interpretation of **Tables 6.8.4 (a and b)**

Analysis of Tables 6.8.4 (a and b) revealed that the costs of sub-structure of building projects in Nigeria and UK are statistically difference significant given the p- value of or sig (2-tailed) value of 0.00. Also, the findings also revealed that

Sub-structure costs of building in Nigeria also have lower mean costs per project at (193,054 ± 369,735) based on selected 11 completed building projects in Nigeria compared to (223,655 ± 122,525) for selected similar building projects in the UK.

However, the Nigeria building sub-structure cost has a higher standard deviation of 369,735 compared to that of UK building projects with standard deviation of 122,525.

This indicates that sub-structure building cost data in Nigeria are more spread from the mean. The possible implication for high standard deviation is that sub-structure building costs in Nigeria are likely to be characterized by variations and inaccurate estimation.

Table 6.8.5: T-test Analysis for array of building super-structure costs

	Building Super-structure Costs Analysis		
Building Projects	**Building Preliminary Costs in Nigeria (N)**	**Building Preliminary Costs in Nigeria (£) Equivalent**	**Building Preliminary Costs in UK**
Project 1	60,450,876	161,202	358,436
Project 2	88,298,557.22	235,463	468,572
Project 3	88,298,557.22	235,463	1,913,048
Project 4	750,562,563	2,001,500	923,823
Project 5	53,972,589.56	143,927	945,944
Project 6	66,859,915	178,293	1,154,208
Project 7	85,900,700	229,069	1,156,198
Project 8	21,002,230	56,006	2,520,633
Project 9	288,287,058.00	768,765	1,327,184
Project 10	88,298,557.22	235,463	1,657,406
Project 11	718,287,058.81	1,915,432	1,376,638
	210019878	**560,053.01**	**1,254,735.45**

Table 6.8.5 illustrates analysis of building super-structure costs of projects in Nigeria and the UK to determine their variability and level of significance.

Tables 6.8.5(a and b) present outcome of independent t-test analysis of sub-structure building costs in Nigeria and UK.

Table 6.8.5a: Independent T-Test Statistics for Building Super-Structure Costs Analysis

independent t-test Statistics for building super-structure costs analysis				
	N	Mean	Std. Deviation	Std. Error Mean
Nigeria	11	560053	715266	215661
UK	11	1254735	621627	187428

Table 6.8.5b: Independent T-Test Statistics for Building Super-Structure Costs Analysis

independent t-test Statistics for building super-structure costs analysis						
	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Nigeria	2.597	10	0.027	560052	79530	1040574
UK	6.695	10	0.000	1254734	837120	1672349

Interpretation of Tables 6.8.5 (a and b)

The test result in Table 6.8.5b revealed a statistically different relationship between the mean super-structure costs of Nigerian projects and UK super structure costs given that the p-value or sig (2-tailed) value is 0.02 < 0.05 and 0.00 < 0.05. Like result from sub-structure analysis, the super-structure costs of building in Nigeria also have lower mean costs per project at (560,053 ± 715,266) based on selected 11 completed building projects in Nigeria compared to (1,254,735± 621,627) for selected similar building projects in the UK. Again, the Nigeria building super-structure cost has a higher standard deviation of 715,266 compared to that of UK building projects with standard deviation of 621,627 as illustrated in table 6.8.5b. This indicates that super-structure building cost data in Nigeria is more spread from the mean. The possible consequence for high standard deviation is that super-structure building costs in Nigeria are likely to be characterized by variations and inaccurate estimation.

6.8.6: T-test Analysis for Variance between tender sum and final project costs

	Variance between tender sum and final project costs Analysis		
Building Projects	**Variance between tender sum and final project costs in Nigeria (N)**	**Variance between tender sum and final project costs in Nigeria (£) Equivalent**	**Variance between tender sum and final project costs in UK**
Project 1	24,500,000	65,333	1,445,619
Project 2	66,417,066.31	177,112	123,134
Project 3	-200,164,410.60	-533,772	847,575
Project 4	910,359.56	2,428	133,378
Project 5	26,849,928.93	71,600	609,247
Project 6	11,877,881.52	31,674	527,578
Project 7	33,803,057.39	90,141	301,816
Project 8	28,646,526.29	76,391	166,953
Project 9	66,585,927.12	177,562	740,774
Project 10	379,785,041.52	1,012,760	1,605,013
Project 11	620,059,297.34	1,653,491	436,000
	96297334	**256,792.89**	**630,644.27**

Table 6.8.6 illustrates analysis of tender sum/final costs of building variances. Tables 6.8.6 (a and b) illustrates the analysis of tender sum and final project cost to determine the variability and measure the deviation between tender sum and final project costs for selected building projects in Nigeria and the UK.

Table 6.8.6a: Independent T-Test Statistics for Variance Between Tender Sum and Final Project Cost Analysis

independent t-test statistics for Variance between tender sum and final project costs Analysis				
	N	Mean	Std. Deviation	Std. Error Mean
Nigeria	11	256793	583654	175978
UK	11	630644	504947	152247

Table 6.8.6b: Independent T-Test Statistics for Variance Between Tender Sum and Final Project Cost Analysis

independent t-test Statistics for Variance between tender sum and final project costs Analysis						
	Test Value = 1				95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Nigeria	1.459	10	0.175	256792	-135313	648896
UK	4.142	10	0.002	630643	291416	969871

Interpretation of **Tables 6.8.6 (a and b)**

Analysis of Table 6.8.6b revealed that the mean cost variability of tender cost/final project cost for Nigerian and UK building projects are statistically different because the p-value or sig (2-tailed) is less than (0.05). Furthermore, the mean variance between tender sum and final projects cost in Nigeria is significantly lower at (256,793 ± 583,654) compared to mean variance of similar projects in the UK at (630,644 ± 504,947) as illustrated in Table 6.8.6a. However, the standard deviation for Nigerian projects is higher at 583,654 compared to UK projects which indicates the variance ratio of tender sum/ final project cost in Nigerian projects have greater spread. Consequently, the Nigerian building cost variances between tender sum and final project cost could be characterized by unreliability and inaccuracies.

Table 6.8.7: T-test Analysis for budgeted / final costs ratios of building projects in Nigeria and UK

Building Projects	**Ratio of budgeted / final costs of building projects in Nigeria**	**Ratio of budgeted / final costs of building projects in UK**
Project 1	0.85	0.39
Project 2	0.76	0.92
Project 3	1.42	0.84
Project 4	1	0.91
Project 5	0.82	0.83
Project 6	0.95	0.85
Project 7	0.88	0.91
Project 8	0.67	0.91
Project 9	0.9	0.79
Project 10	0.32	0.73
Project 11	0.81	0.86
	0.9	**0.8**

Table 6.8.7 illustrates analysis of budgeted cost/final costs of building variances. Tables 5.8.7 (a and b) illustrates the independent analysis of tender sum and final project cost to determine the variability and measure the deviation between budgeted cost and final project costs for selected building projects in Nigeria and the UK.

Table 6.8.7a: Independent T-test Ratio Analysis of budgeted/Final Cost of Building projects in Nigeria and UK

independent t-test Statistics for Ratios between budgeted / final costs of building projects in Nigeria and UK				
	N	Mean	Std. Deviation	Std. Error Mean
Nigeria	11	0.8527	0.26165	0.07889
UK	11	0.8127	0.15186	0.04579

Table 5.8.7b: Independent T-test Ratio Analysis of budgeted/Final Cost of Building projects in Nigeria and UK

independent t-test Statistics for Ratios between budgeted / final costs of building projects in Nigeria and UK						
	Test Value = 1					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Nigeria	-1.867	10	0.091	-0.15	-0.32	0.03
UK	-4.090	10	0.002	-0.19	-0.29	-0.09

Interpretation of **Tables 6.8.7 (a and b)**

The table reveal that the mean variance of budgeted building costs/final costs for Nigeria and UK are statistically different given that the value in the Sig. (2-tailed) row is less than (0.05). Table 6.8.7a show that the standard deviation of budgeted costs/final building costs variance in Nigeria is higher at 0.26165 compared to budgeted costs/final cost of similar projects with similar gross floor area in the UK indicating a wider spread of variance ratio in Nigeria than UK.

Statistically the study findings revealed that budgeted costs/final cost variance ratio in Nigeria have slightly higher mean per project at (0.8527 ± 0.26165) based on selected 11 completed building projects in Nigeria compared to (0.8127 ± 0.15186) for similar building projects in the UK.

6.5 Summary

The focus of the data collection for this stage is to address objective one and two of this research. The analysis reveals a clear difference between the Nigerian building costs information and the UK building cost information considering the factors responsible for these differences. Some of the factors discovered include Location, Client Type, Type of Contract Used (e.g., JCT or NEC) etc. The analysis also revealed a lot of cost discrepancies in the Nigerian building projects compared to UK projects.

Some of the cost discrepancies ascertained include variance budgeted cost and final cost of building projects, preliminaries costs, additional variation etc. However, UK building projects was discovered to also have high preliminary costs which was down factors like, traffic management and tight construction sites etc.

After analyzing various element of building costs from both Nigeria projects and the UK projects, as well as their impacts on building cost information management in the construction industry, client types, additional variation and high preliminary cost among others were considered as the most significant factors influencing building cost variances and building cost information management in general especially in the Nigerian construction industry where there is no reliable national cost database for building cost estimation and appraisal.

Also, the mean cost performance between Nigerian building projects and the UK building projects were analysed. The result revealed that the Nigerian building cost performance and the UK building cost performance are statistically different based on 11 selected building projects both form Nigeria and the UK.

Finally, it could be concluded that this stage of analysis has addressed objective one and partially addressed objective five. Hence further analysis of data to address objective two other objectives of this study will be discussed in the subsequent chapters of this study.

Chapter Seven
Qualitative Data Analysis

7.0 Introduction

This chapter provides the findings from qualitative data analysis. The method of data collection for this chapter was semi-structured interview as discussed in detail in chapter 4. This chapter explores the understanding of building cost information management, the current practice, whether there is national building cost database in Nigeria, and if yes how reliable is it, and the understanding and knowledge of the building cost model considered in this research.

The study begins with explanation of the study participants' profile and sample representativeness. Then, it presents a brief description of structure of interview, data obtained from interview, and method of analysis; after which the research validity was ascertained. Furthermore, this chapter analyses participants' views on building cost information and how important it will be to develop a framework for building cost information management for the Nigerian construction industry. Subsequently, the qualitative data was subsequently transcribed into manuscript using NVivo 12 software to sort participants' responses and key words from the interview. However, the researcher deemed it appropriate to resort to manual transcription and evaluation of qualitative data, hence codes from NVivo was discarded and not used for the qualitative analysis of this study. Findings and results are presented and interpreted using extracts, tabulation, and charts. All data collected from interview were obtained from professionals in the Nigerian construction industry to understand the impacts of building cost information on the successful delivery of building projects in Nigeria. The chapter focused mainly on, examining the underlying causes of cost variances around different geographical regions in Nigeria, investigating various factors influencing building cost information management in the Nigerian construction industry, and analyze the effect of type of client on building cost information.

The interview discussion reflects the practitioner's perspective of building cost information in the Nigerian construction industry and the issues bothering on the management of these information.

7.1 Participants' Profile and Sample Representativeness

The semi-structured interview was designed with sets of questions aimed at addressing study objectives. A total of 12 construction professionals were interviewed as illustrated in Table 6.1. The professionals were randomly selected using simple random sampling method where participants were randomly contacted based on their job affiliation and experience in the construction industry (Onwuegbuzie and Leech 2007). However, some participants who were previously known by the researcher as experienced industry professionals were easily contacted and selected using convenience sampling method (Etikan et al. 2016). The selected study participants were contacted through telephone calls to participate in the interview.

This study also explored, and study utilized a biased sampling method, the grounds that some of the study participants were known to the researcher. Likewise, some participants were recommended via networking and referrals, as well as other professional network in the construction industry. However, this does not in any way affect the validity of this study as most of the participants selected for this study have worked at management level in reputable construction and contract consulting organisations within and outside Nigeria. They also have wealth of experience in building cost estimation. In addition, due to the sensitive nature of this study, it is imperative to note that some study participants might offer biased responses with regards to sourcing building information for pricing building projects. However, the researcher catered for "biased responses" by using probing questions based on participants' responses to ascertain those responses are valid as possible. It should be noted that, is extremely difficult to obtain construction cost data from countries such as Nigeria.

7.1.1 Participants Academic Qualifications

Most of the interview participants have bachelor's degree and some others have master's degree i.e., a total of 7 out of the 12 participants have their bachelor's degree, 3 participants out of 12 have their master's degree while 2 participants have their HND (i.e., Higher National Diploma). However, majority of these participants have long years of working experience in the construction industry, with the least being 6 years of experience. Also, all the professionals interviewed were professionally qualified by their affiliation with two or more professional bodies. This indicates participants drive for professionalism and career progression, hence their vast knowledge in the field of construction.

Table 7.1. Sample representativeness and study participants' profile

	Construction	Consulting
Participants' position	**Senior QS, Construction managers,** Building survey	**Building consultants/Quantity surveyors**
Number of participants interviewed	**8**	**4**

7.2 Brief Description of Interview Data

This study utilized telephone conversations as the primary source of interview data; to minimize cost, save time and to ensure proper recording of data collected. These interview data were recorded using a built-in phone recorder; after which it was transcribed to ensure that the conversations were readable, coherent, and transparent as well as to reflect the views of the interviewees in relation to the aim and objectives of the study.

7.3 Interview Structure and Method of Analysis

This study utilized a semi-structured interview, with a set of questions designed by the researcher to gain valuable information from the interview participants concerning the key concepts relating to the study aim and objectives. The transcribed data from the interview was filtered and sorted using the NVivo 12 software. Firstly, the data was coded as a preliminary measure to categorize and examine the interview data conforming to interview questions and participants' responses. Subsequently, keywords originating from the interview conversations relating to the study aim and objectives were assessed and selected for further analysis. This essentially enhanced the researcher's ability to highlight keywords, phrases and terms that were consistently repeated by most of the interviewees. The soft copies of the interview data were used continually in the study to match, store, retrieve and examine coded themes or research parameters. Hence, to enhance the validity of this study, highlighted keywords, phrases, and terminologies facilitated the researcher to construct a narrative from the study findings. This is to enable the readers have a better understanding of the study findings, some word-based contents were compressed to reflect substantial statements made by interviewees concerning the key study variables.

The data obtained from the interview for this study was analysed using content analysis, because it provides opportunity to the researcher to directly examine communication that transpired between interviewees and the researcher, provides valuable historical and cultural perception of the study problem, easy understanding of study findings, less time consuming, etc. Other forms of qualitative data analysis such as Jefferson data analysis and the thematic analyses were also considered; but not used because of their tediousness. This requires the researcher to quote some of the statement from the interview verbatim, without trimming the textual content from the interview. Consequently, this process was considered too bulky and time/resource consuming. Also, while thematic analysis seems to be more appropriate for analyzing descriptive materials of life stories, content analysis is more concerned exploring unknown phenomena. Thus, the study adopted content analysis as a preferred choice of analyzing interview data.

7.4 Qualitative Findings

The data analysis identified a host of issues regarding building cost information in the Nigerian construction industry, its sources, reliability, validity etc. Also, it identifies the causes of building cost variances in different regions within Nigeria, the impact of types of clients on building cost information, as well as the factors influencing the management of building cost information in Nigeria by finding out interviewees' perception on the importance of developing a framework for building cost information management with regards to the profitability of construction organisations in Nigeria.

The researcher considered that, the participants may embrace various perspectives and viewpoints about the issue under study. Thus, interviewees were asked to express their views on building cost information management in respect to their working experience in Nigeria and how it affects the Nigerian construction industry. Below are some key findings and explanations as quoted by interviewees:

7.4.1 Impact of Types of Clients on Building Costs Information Management

The Nigerian construction has been faced with difficulty of completing building projects within the initial cost. According to Ameh and Ogundare (2013), Nigerian public construction projects are often characterized by inflation of contract sum and other corrupt practices which results to project cost overrun and some cases complete abandonment of project compared to private construction projects.

The first objective of this study is to examine the impact of types of clients on building cost information management. The justification of this objective is to seek the understanding and opinions of construction participants on the impact of client type on building cost information.

The Nigerian construction has been faced with difficulty of completing building projects within the initial estimated cost. Public construction projects are always plagued with time and cost overruns issues.

Study participants were asked to give their views on the impact of types of clients on building cost information management in Nigeria. The response from participants indicated that public clients seem to be aware that construction project costs are significantly inflated for various reasons. Some excepts are highlighted for understanding as follows:

> *"… government seems to support outrageous construction cost inflation in Nigeria; perhaps for political and personal reasons" ... (Senior QS Government project – Abuja)*

> *"…another problem about construction costs and client impact is the issue of project padding (i.e., deliberate project cost inflation by government officials); … this does not give much room for transparency - (Senior QS Government project – Abuja)*

> *"…government policies seem not to create an enabling environment for transparency and scrutiny of government projects as there is no policy that actually monitors building project costs and how prices vary. So, it has become a norm for government clients to inflate contract sums and the contractors usually have little or no choice but to comply for fear of being out of job. Contractor public project – Abuja)*

From the responses above, it can be deduced that government clients seem to have higher contract sum for selfish motives of the government officials involved. As such the effect of corruptible tendencies especially in government projects undermines the advantages of teamwork, commitment, trust, and competence. This further reinforce Amade (2016) assertion of corruption tendencies in the Nigerian construction industry. The impact of client type on building cost information management in Nigeria can therefore not be overemphasized as the corrupt practices of government clients leads to cost overrun, incessant collapse of buildings, project abandonment etc.

Study participants that provided the above quotes were probed further to explain why

"Project padding" (i.e., contract sum inflation) is a common occurrence in government projects. Participants responded thus:

> *"…one major reason for project padding will be lack of competency which is an essential consideration in awarding government contracts due to professional negligence and selfish intention. Quantity surveyor Government project – Abuja)*

> *"… another problem with public clients is the issue of bureaucracy where different government officials with interest in a particular government project seat on files and delay certain approvals for selfish reasons and some even manipulate contract award procedures to benefit their own candidate. Senior consultant – Jos).*

These responses clearly indicate the presence of corrupt practices in the Nigerian construction especially in government projects resulting to abandonment of public projects across different regions in Nigeria. Also, this further aligns with Anibogu and Shawakar (2011) opinion of corruption in the Nigerian construction industry. They stated that the corruption in Nigerian construction can manifest in two key areas which are in the management of finance for a project, and during the execution of the project.

7.4.2 Investigation of underlying Causes of Building Cost Variances

To address one the key objectives of this study which is to investigate the underlying cases of building cost variances across different location within Nigeria, the study participants were asked what influences building cost variances across different locations within the same country (Nigeria) and how it affects building cost information and the eventual delivery of building projects in Nigeria. Some of their responses were as follows:

> *"…one of the major causes of building cost variance is the unavailability of building materials in certain locations in Nigeria. Hence one is forced to pay more to export materials from the one location where it is available to another*

location where it is needed for building projects. These will eventually increase the final building cost compared to other locations with availability of materials. (Senior Consultant -Lagos)

"…another issue that results in cost variance is poor security especially in the northern part of Nigeria. So, executing a project in such location will require provision of good security of workers on site to avoid cases of banditry, kidnap, terrorism etc. (Building project consultant – Kano)

"…also, there are some locations in Nigeria where skilled laborers are not readily available as such estimating for a building project in such location will require the quantity surveyor(s) to make additional provision for laborer from other locations, labor welfare packages etc. all of these and more contribute to varying building costs from location to location in Nigeria (Senior project manager – Port Harcourt)

The responses from participants indicated a unanimous agreement to the fact that topography of site and unavailability of material are some of the major causes of building cost variances in Nigeria. Similarly, Hawkins (2013) stressed that there is a considerable risk of cost variances and corruption in building projects caused by challenging terrain, remote sites, and security challenges. However, some contractors are of the opinion that a better approach to consider price of a building project (BOQ) based on quantities of materials and rates including contractor's profit and overhead. Thus, this does not give room for transparency as many contractors will hide under the guise of this approach to mark-up project prices, manipulation, and exaggeration of bill of quantities.

7.4.3 Factors Affecting Building Cost Information in the Nigerian Construction Industry

Many of the interviewees have linked the lack of national building cost information database in the Nigerian construction industry to several factors some of which include corruption, bottlenecks and bureaucracy, project complexity, non-adherence to professional ethics etc. According to them, these factors influence the management of building cost information in terms of validity, reliability, and availability. Hence individual construction organisations resort to developing their own in-house building cost information management platform for managing their project costs.

When study participants were asked what these factors were: their responses reflected some major factors as it relates to building cost information management in the Nigerian construction industry some of which include location factor, inflation rate, poor communication, lack of computer literacy among others. Their responses are as follows:

> *"… managing building cost information has a lot to do with experience especially given the fact that a national building cost information database is not available here in Nigeria only recently we the professional Institute NIQS (Nigerian Institute of Quantity Surveyors) started coming up with quarterly published journals which are not still reliable because they are not regularly updated. Because you'll want to deliver a quality project hence ensuring value for money. Some of the factors influencing building cost information management however include:*

- *Corruption*
- *Socio-cultural environmental issue (e.g., Community settlement, popularly known as "Match ground" in Nigeria)*
- *Material availability*
- *Security issues*
- *Banditry*
- *Limited information*

"…one major factor that affects not only building cost information in Nigeria, but the construction industry is corruption. In the case of building cost information, clients sometimes will come up with figures [usually inflated) that they want featured in the contract sum so with this you may not really be able to do much as a contractor to alter these figures. This is very common where the client is government organisation or representative"

Also, market condition is a key factor that influence building cost information (Senior Quantity surveyor – Delta)".

Study participants all ranked corruption as top factors affecting influencing building cost information management in Nigeria as corruption seem to give birth to most other factors.

- Corrupt Practices
- Unreliable information from similar projects
- Cost of construction materials
- Unavailability of building materials
- Labor wage rates
- Site conditions
- Inflation factors
- Market conditions
- Regulatory policies on cost of materials
- Project size and complexity
- Project location

7.4.4 Reliability of Building Cost Data

Past research shows that majority of the building cost information used to benchmark building projects in Nigeria are not particularly reliable. This is because individual construction organisations in Nigeria develop their bespoke building cost information management platforms which may only be useful for their own project, as such it can't

not available construction professionals outside such organisation. To further investigate this, study participants were asked how reliable the building cost information they use are. Some of their responses include:

> *"…well, I wouldn't say the building cost information management platforms or software if I may that we use are 100% reliable because some of the rates are not particularly fluctuate quite frequently. They are either inflated suppliers quote sometime or market rates which varies from vendor to vendor. But ultimately, we have been able use our in-house building cost information management tools for many of our projects successfully" (Building Contractor – Abuja).*

> *"Talking about reliability of building cost information used in our projects.*
>
> *I would say it is not completely reliable given the complex nature of the Nigerian construction and the lack of detailed information in the early stages of building projects, it is almost impossible to have a 100% reliable building cost information" (Consultant Quantity Surveyor – Lagos).*

It is evident from these respondents that given innumerable of variables that affect the Nigerian construction, it is highly challenging for construction professionals or construction organisations in Nigeria to arrive at consistent and accurate building cost estimates. Hence, the ability of estimators to predict building costs accurately is largely dependent on their skills and experience.

7.4.5 Building cost information management framework as an important Tool for the Nigerian construction industry

One key objective is to establish a rationale for the development of BCIF in Nigeria as an important factor for estimating and managing building costs. The researcher sought to understand the interviewees opinion on having reliable national building cost

information management framework in the Nigerian industry. Some of the responses from interviewees were as follows:

> *"…it is a highly welcome idea as this will go a long in encouraging transparency and enhance building cost estimation. Also, if the system can be designed such that professionals or stakeholders accessing this system will not be able to alter it, thereby preserving the system" … (Senior Quantity surveyor – Abuja).*

> *"…if we have a reliable building cost information database in Nigeria, it will definitely improve our construction sector and enhance best practice" … (Building Contractor– Abuja).*

The response from interviewees further emphasizes the need for a robust building cost information management framework in the Nigerian construction to enhance building cost estimation and appraisal.

7.5 Summary

The sample representation of respondents was presented. Construction cost information management factors were assessed from the perspective of the respondents. 11 factors were identified to be the key factors influencing the management of building cost information in Nigeria. This was done by categorizing the most stated factors by the respondents. Table 7.2 below presents the identified factors in their order of significance as stated by interviewees.

Table 7.2 Factors Affecting Building Cost Information Management

S/No	*Factors Affecting Building Cost Information in the Nigerian Construction Industry*
1	Corrupt Practices
2	Unreliable information from similar projects
3	Cost of construction materials
4	Unavailability of building materials
5	Labor wage rates
6	Site conditions
7	Inflation factors
8	Market conditions
9	Regulatory policies on cost of materials
10	Project size and complexity
11	Project location

7.6 Findings

Findings from the interview revealed that corruption is most significant factor plaguing construction cost performance in Nigeria. According to majority of the respondents, corruption gives birth many other factors affecting construction cost performance in Nigeria. The study results also revealed a significant difference in the initial cost of

building projects (budgeted cost) and the final cost. However, the percentage of cost variations in public projects is higher in most cases compared to private building projects according to interviewees. The design of the building cost information framework is based the cost information elements identified. The research objectives 1,2 and 3 were deemed to be achieved in this chapter.

Chapter Eight
Quantitative Data Analysis

8.0 Introduction

This chapter presents analysis for the quantitative data of the study. Firstly, the chapter reviews the sample representativeness to the considered questionnaires for this study. Secondly, it evaluates the profile of the study participants and other demographic details considered in this study. Thirdly, it examines the factors influencing building cost information in Nigeria using questionnaire responses from participants. Furthermore, it evaluates respondents view on current practices of building cost information sourcing and management in the Nigeria construction industry.

This chapter deploys descriptive statistics and variety of statistical tools to critically address study objectives.

It also implements charts and tables to illustrate quantitative results in various stages of this chapter.

8.1 Sample Representativeness

The sample representativeness for this study includes professionals in the construction industry majority of whom are quantity surveyors.

This utilized a Likert-scale questionnaire which was designed to address issues related to building cost information management and its impact on the Nigerian construction industry. The questionnaire was distributed purposefully using an online survey due to proximity of study participants. However, to reduce geographical bias and ensure participant spread, participants were picked from a selection of both private and public construction practitioners working on client/consultant and contracting firms. Participants were also selected from the various geographic locations across Nigeria via professional networking.

Furthermore, the questionnaire was designed to measure specific variable in relation to the area of study. Table 8.1 presents the details of questionnaire distribution and response rate.

8.1 Tabulation of Questionnaire Distribution and Responses

Questionnaire distribution	**No of responses**	**Response percentage**
No of completed questionnaires	27	54%
No of unattended questionnaires	23	46%
Total No. of distributed questionnaires	**50**	**100%**

The variables measured by the questionnaire are categorized into five different sections; firstly, to evaluate the impact of types of clients on building cost information (question1-5), to investigate the underlying cause(s) of building cost variance around different geographical region in Nigeria (question 6-13), to examine the factors that affect building cost information in the Nigerian construction industry (question 14), to determine the sources of building cost information and measure the reliability of building cost data in the Nigeria construction industry (question 15-23). The last section of the questionnaire addresses the demographic questions about the study participants (question 24-30). Data analysis was conducted using SPSS version 25.

8.2 Participants Profile and other Demographic Data

The questionnaire for this study was designed to feature demographic questions about participants to obtain demographic data of participants. The demographic data obtained reflect a high level of knowledge on the subject area of the research based of on their level of education. The participants specified their job titles and other demographic data as follows:

8.2.1 Participants Job Title

Figure 8.1 illustrates the study participants profession and the percentage distribution of their job description. The figure illustrates that 26% of participants were quantity surveyors actively involved in building cost management, while 11% were project managers, 7% were officers in construction. Also, 15% of the participants were civil engineers involved in road constructions and infrastructures, while 4% were technicians. However, 37% of participants did not indicate their job title, which is more than one thirds of the total participants.

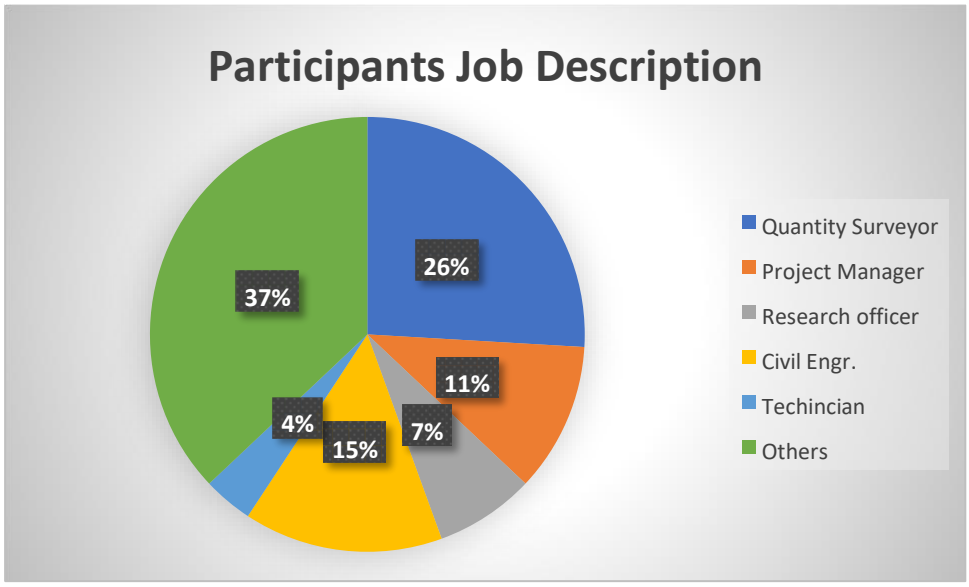

Figure 8.1: Participants Job Description

8.2.2 Participants Academic Qualification

Figure 7.2 below, illustrates that 84.6% of the participants representing many the participants achieved bachelor's degree (BSc.), master's degree (MSc.) or its equivalent. This indicates that building construction management has progressed from the general perceptions of vocational to managers who are degree holders. 15% of study participants also claimed to have obtained other forms of post graduate degree though they have not explicitly indicated what type of post graduate degree, others have achieved other forms of qualifications.

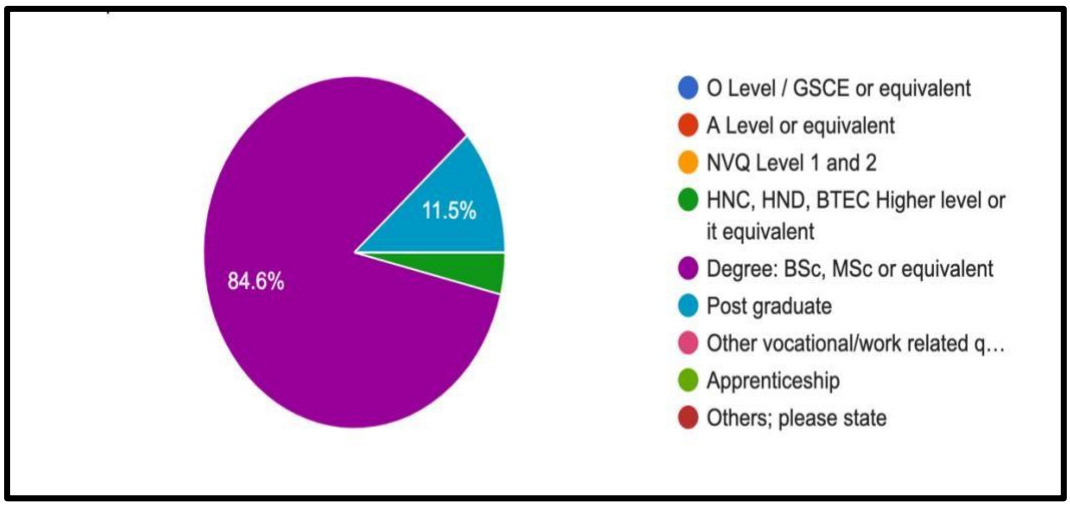

Figure 8.2: Academic qualifications of participants

The data indicates that construction professionals' endeavor to achieve a reasonable level of academic qualification. Also deducing from the level of qualification and industry experience of participants, the demographic data indicates that participants hold reasonable knowledge on the building costing and building cost information management.

8.2.3 Participants Professional Qualifications/Affiliations

Figure 7.3 illustrates study participants professional qualification and/or affiliation. 41% of the total participants representing more than 1/3 of participants are qualified members of the Nigerian Institute of Quantity Surveyors (MNIQS), which is the professional body for quantity surveying professionals in Nigeria, also 23.5% of participants have achieved membership of Council for the Regulation of Engineering in Nigeria (MCOREN) and 11.8% have MACEN membership. Others have obtained other professional qualification both within and outside Nigeria. Some of these professional bodies include MRICS, MICE, MCICMA, MCORBON etc.

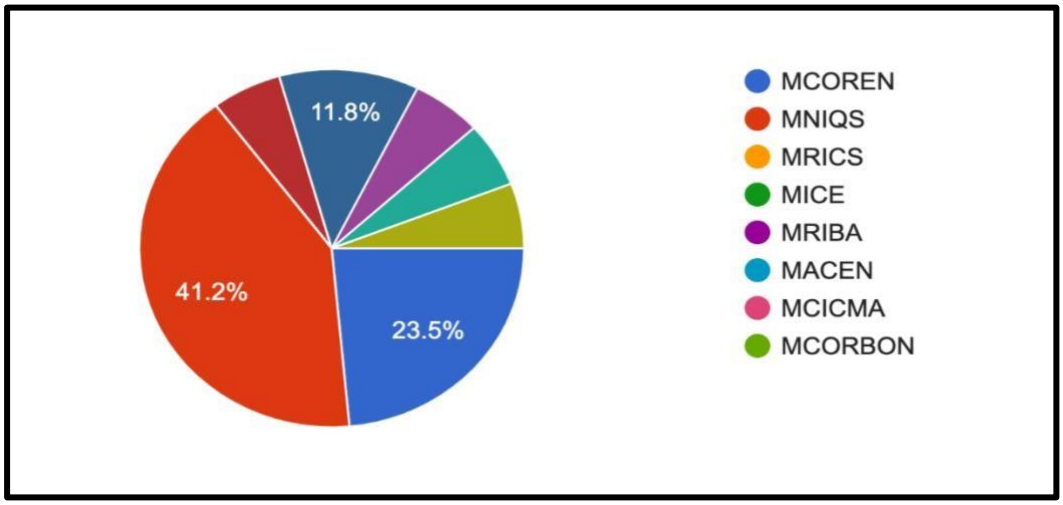

Figure 8.3: Professional qualifications/affiliations of participants

This high number of participants with professional qualifications/affiliations however indicates that a good number of construction professionals make effort to maintain and enhance the skills and knowledge required to deliver professional services to clients. It helps update their know to current trend thereby ensuring they stay relevant in the construction field.

8.2.4 Participant Organisational Type

Deducing from Figure 7.4, a significant number of the entire participants are more involved in housing projects compared to other areas of construction. Out of the 27 respondents, 13 respondents are involved in housing projects, 8 are involved in infrastructure, while 5 are involved in public building services. Also 3 of the 27 respondents are involved in private industrial building services, while 3 respondents are involved in private commercial services. Lastly 1 of the 27 respondents is involved in building refurbishment as illustrated in Figure 7.4.

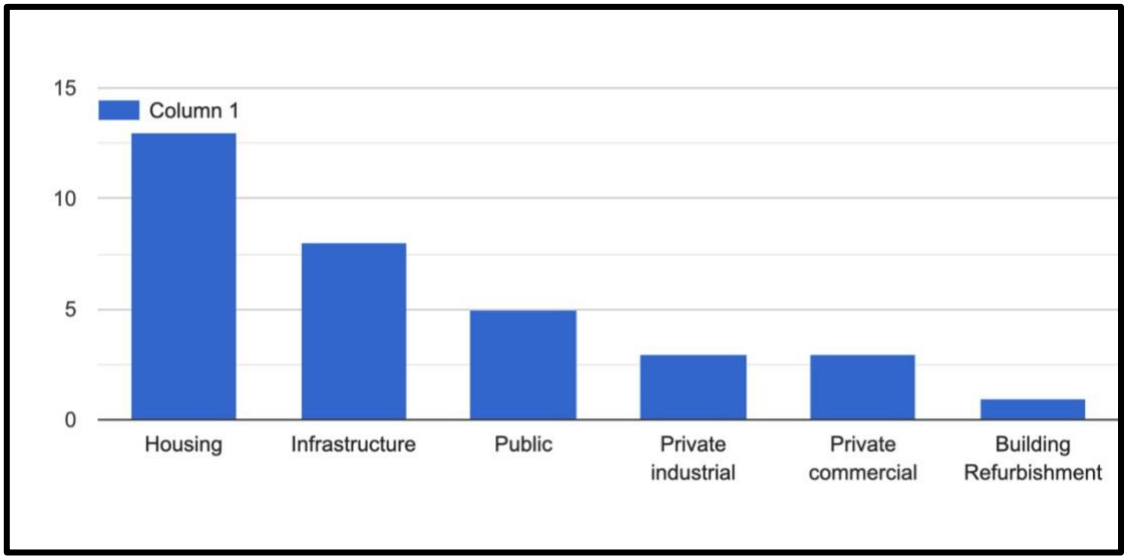

Figure 7.4: Participant Organisational Type

8.2.5 Type of Contract Used by Participants

Figure 7.5 demonstrates the type of contracts used by construction professional in Nigeria. Evaluating the figure critically, it can be deduced that the largest form of contracts used in the Nigerian construction industry is the JCT forms of contract and bespoke form of contract which is represented as other forms of contract in Figure 7.5. These findings are consistent with Taiwo (2018) assertion that JCT forms of contracts are predominantly used in Nigerian building projects alongside bespoke forms of contracts.

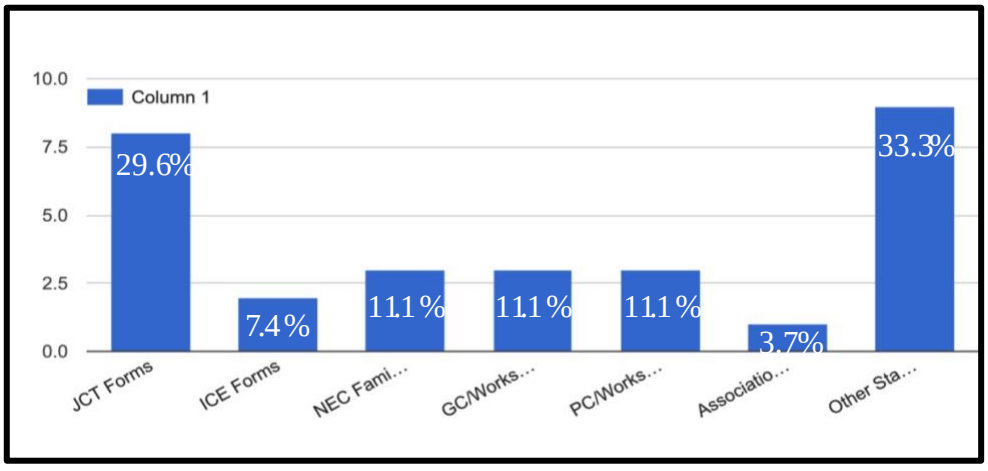

Figure 7.5 Type of Contract Used by Participants

According to Figure 8.5 29.6% of the participants utilize JCT Forms of Contracts, 7. 4% utilize ICE Forms of Contract, 11.1% participants utilize NEC Contracts, 11.1% participants also utilize GC Works Forms of Contacts, 11.1 % of the participants utilize PC works Contract while 3.7% utilize ACA contract and lastly 33.3 Participants constituting the highest utilize other forms of contracts. The data obtained however indicates that the NEC forms of contract is not widely used in executing building construction contracts in Nigerian as opposed to the UK construction where NEC forms of contract is widely used. Arguably, this may be one of the factors influencing the differences in UK and Nigerian building projects.

8.3 Reliability Analysis

To measure the reliability of the data obtained, the study used the SPSS 25 version to conduct Cronbach's alpha (□) coefficient of internal test consistency. This is because reliability is a key source of validity evidence for appraisal. Hence, the study conducted Cronbach's alpha to assess the dimensionality of the set of data obtained.

The reliability analysis for this study was carried out in two stages, first to assess the reliability of raw data obtained directly from questionnaire after which the data is treated and secondly to check the reliability of the treated data. The first stage of reliability test of raw data using SPSS involved sorting of the data collated from the questionnaire for reliability analysis. This also includes removing non-polarized responses (i.e., "unsure" responses by participants). These responses were classed as void, hence the removal. This is to ensure reliability see appendix 8 for questionnaire. Another assessment of reliability of these data was done to examine the responses of the repeated questions in the questions.

Table 8.2: Reliability Analysis of Raw Data from SPSS

Case Processing Summary

		N	%
Cases	Valid	20	64.5
	Excluded	11	35.5
	Total	31	100.0

a. List wise deletion based on all variables in the procedure.

Table 8.3: Reliability Analysis of Raw Data from SPSS

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.622	.397	20

Cronbach's Alpha Test

Table 8.4 Cronbach's alpha reliability test values adapted from Cronbach and Shavelson (2004).

Cronbach's alpha value	Internal consistency
0.9 < □	Excellent
0.8 < □ < 0.9	Good
0.7 < □ < 0.8	Acceptable
0.6 < □ < 0.7	Questionable
0.5 < □ < 0.6	Poor
□ < 0.5	Unacceptable

Table 8.4 illustrates the reliability case processing analysis extracted from the internal reliability analysis. The reliability figure produced an alpha Cronbach's value of 0.622 as illustrated in Table 8.3b using SPSS version 25. This illustration is presented in line with Cronbach and Shavelson (2004) suggestion that reliability analysis can be interpreted as demonstrated in Table 8.4.

Interpretation of Cronbach alpha value shows that internal reliability of the data is moderately good. Based on these values, the researcher sought advice from the director of the study and was asked to proceed with further analysis.

8.4 Descriptive statistics

The study parameters were analysed using descriptive statistics by characterizing the data in terms of the range (minimum and maximum), standard deviations mean values and the skewness and kurtosis. The skewness classification was done to assess the extent to which the variables are symmetrical while the kurtosis characterization was done to measure the distribution peak of variables whether they are too peaked (i.e., a narrow distribution with some responses in the center) (Hair *et al.* 2017).

When both Skewness and Kurtosis have a value figure of 0, the response pattern is normal distribution. However, skewness measurement is substantially skewed distribution if the value is lower than -1 or greater than +1, meaning that if skewness value is between (-1 and -0.5) it is considered moderately negative skewness, between (0.5 and 1) is considered moderately positive skewness distribution, while the value between (-0.5 and 0.5) is considered approximately symmetric.

However, for kurtosis, the distribution is considered too peaked where the value is greater than +1 and too flat where the value is less than -1 (Hair *et al*. 2017).

Table 8.5.: Descriptive statistics of treated questionnaire responses from SPSS

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
VAR00001	31	2.00	3.00	5.00	4.4194	.71992	-.845	.421	-.524	.821
VAR00002	31	4.00	1.00	5.00	4.0645	1.06256	-1.205	.421	1.135	.821
VAR00003	31	2.00	3.00	5.00	4.0645	.81386	-.123	.421	-1.470	.821
VAR00004	29	3.00	2.00	5.00	4.1034	.81700	-.621	.434	-.027	.845
VAR00005	31	4.00	.00	4.00	2.0968	1.10619	.114	.421	-.462	.821
VAR00006	31	5.00	.00	5.00	1.5161	.99569	.927	.421	3.935	.821
VAR00007	31	5.00	.00	5.00	2.1935	1.53665	.124	.421	-1.059	.821
VAR00008	28	5.00	.00	5.00	3.0357	1.50264	-.206	.441	-.614	.858
VAR00009	31	4.00	1.00	5.00	4.0000	.96609	-1.186	.421	1.911	.821
VAR00010	31	4.00	1.00	5.00	3.9677	.91228	-1.060	.421	2.197	.821
VAR00011	31	3.00	2.00	5.00	3.8065	.90992	-.159	.421	-.843	.821
VAR00012	29	5.00	.00	5.00	3.5517	1.29797	-.859	.434	.629	.845
VAR00013	29	4.00	1.00	5.00	3.7931	1.08164	-.649	.434	.007	.845
VAR00014	30	3.00	2.00	5.00	3.4000	.72397	.958	.427	.507	.833
VAR00015	31	4.00	1.00	5.00	3.0000	1.03280	.388	.421	-.462	.821
VAR00016	31	3.00	2.00	5.00	3.0968	1.01176	.621	.421	-.594	.821
VAR00017	31	4.00	1.00	5.00	2.5484	.99461	.835	.421	.838	.821
VAR00018	26	4.00	1.00	5.00	3.0769	1.09263	.236	.456	-.729	.887
VAR00019	27	5.00	.00	5.00	2.7778	1.42325	-.354	.448	.074	.872
VAR00020	29	3.00	2.00	5.00	3.9655	1.08505	-.468	.434	-1.223	.845
Valid N (listwise)	20									
Total Average	**20**	**3.8**			**3.32**	**1.05**	**-0.18**	**0.43**	**0.16**	**0.83**

8.6 Skewness and Kurtosis

The analysis of study raw data obtained from questionnaire responses revealed participants mean response score of 3.32 and standard deviation of 1.05. This low value of standard deviation indicates that the data points tend to be close to the mean of sets of data.

Also, deducing from Table 8.5, the analysis of data revealed skewness value of -0.18 and kurtosis value of 0.16.

The skewness value of -0.18 indicates a equitably symmetrical skewness distribution as both values fall within the range of -0.5 and 0.5. This is in accordance with the general rule of thumb for skewness distribution.

8.6.1 Normality Assessment

Normality distribution is used to describe a symmetrical bell-shaped curve with the highest frequency of score in the middle and smaller frequency of scores towards the extreme (Gravetter and Wallnau 2000). Normality can be assessed using skewness and kurtosis values. Hence the focus in this study is to determine the normality of the data using skewness and kurtosis. Table 8.6 illustrate the normality distribution of the original quantitative data set. Consequently, the normality test for the quantitative data obtained from SPSS was assessed using Microsoft Excel. Figure 8.6 illustrates the results of skewness and kurtosis which has been taken as the major determinant of the normal distribution.

Close analysis of figure 8.6, revealed a skewness of normal distribution and a high peak kurtosis.

Table 8.6: Normality Distribution

Standard Deviation Increment	Data Set	Normalize
-3	0.17	0.004220808
-2.9	0.275	0.005669078
-2.8	0.38	0.007538525
-2.7	0.485	0.0099247
-2.6	0.59	0.012936161
-2.5	0.695	0.01669362
-2.4	0.8	0.021328124
-2.3	0.905	0.026978131
-2.2	1.01	0.033785327
-2.1	1.115	0.041889139
-2	1.22	0.051419968
-1.9	1.325	0.062491252
-1.8	1.43	0.075190627
-1.7	1.535	0.08957055
-1.6	1.64	0.10563889
-1.5	1.745	0.123350091
-1.4	1.85	0.142597586
-1.3	1.955	0.163208183
-1.2	2.06	0.1849391
-1.1	2.165	0.207478264
-1	2.27	0.230448309
-0.9	2.375	0.253414524
-0.8	2.48	0.275896717
-0.7	2.585	0.297384698
-0.6	2.69	0.317356765

-0.5	2.795	0.335300311
-0.4	2.9	0.350733467
-0.3	3.005	0.363226491
-0.2	3.11	0.372421613
-0.1	3.215	0.378050045
1.5E-15	3.32	0.379945029
0.1	3.425	0.378050045
0.2	3.53	0.372421613
0.3	3.635	0.363226491
0.4	3.74	0.350733467
0.5	3.845	0.335300311
0.6	3.95	0.317356765
0.7	4.055	0.297384698
0.8	4.16	0.275896717
0.9	4.265	0.253414524
1	4.37	0.230448309
1.1	4.475	0.207478264
1.2	4.58	0.1849391
1.3	4.685	0.163208183
1.4	4.79	0.142597586
1.5	4.895	0.123350091
1.6	5	0.10563889
1.7	5.105	0.08957055
1.8	5.21	0.075190627

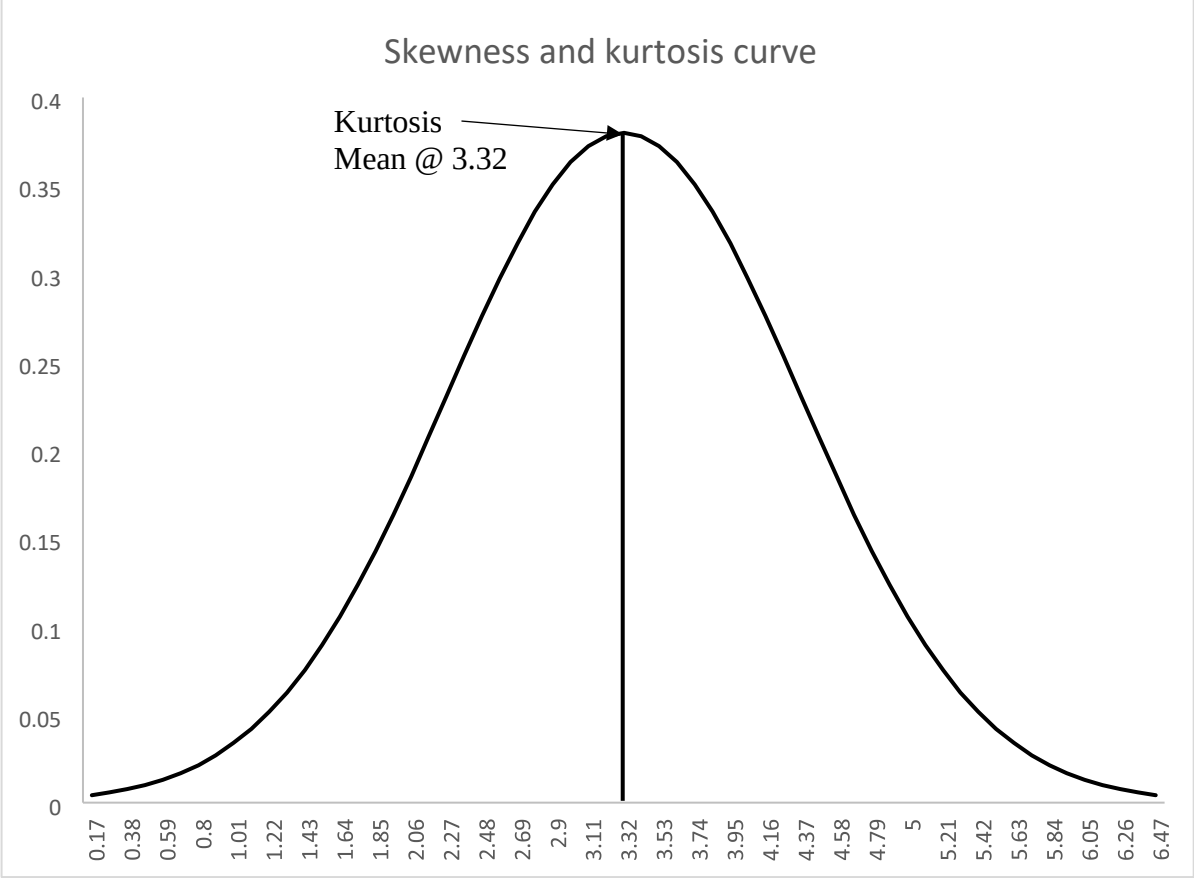

Figure 7.6: Skewness and Kurtosis curve

8.7 Classification and Analysis of Measured Variables

This section presents results and findings from study analysis of measured parameters in the questionnaire. This includes results on the impact of building cost information management on building projects in Nigeria. A total of 4 questions were reversed to ensure consistency of response from participants and to assess the level of trustworthiness displayed by participants in responding to key questions. Hence, this helps eliminate nay-sayers and yea-sayers as opined by (Farell 2011). The reversed questions were presented to participants by paraphrasing them to look slightly different from the original question but still addressing the same issue. For instance, deducing from Table 7.6 question, question 1 was put across to participants to investigate the influence of type of client (i.e., government and private client) on overall cost of building projects in Nigeria. The same question was reversed as question 2 and conveyed in a

different way to get the same view from participants. Analysis of both questions revealed mean score of 4 and a percentage mean score of 80% which indicates that 80% of study participants strongly agree that type of client influence the overall cost of building projects in Nigeria. Note, the percentage mean score in the Table 7.6 was calculated by multiplying the mean score by the 20 which was determined by dividing 100 by highest response score (5). An example of the percentage mean score calculation for question 1 is shown below.

Q1

Mean score = 4

Highest possible response score for all question = 5

Hence %mean score = Mean score x (highest response)

100

i.e. 4 x (5/100) = 20

All scores of the study participants are used to calculate the total average of response.

This section presents the study analysis of measured variables in four categories to make sense of quantitative data collected, this includes:

(i) Impact of type of clients on overall cost of building; (Q1-Q5)

(ii) Impact of location on building cost estimation across 6 geo-political regions in Nigeria; (Q6-Q12)

(iii) Factors influencing building cost information management in Nigeria; (Q13Q14)

(iv) Reliability of building cost information sources in Nigeria; (Q15-Q23)

Table 8.7: Classification and Analysis of Measured Parameters

S/No	Questions	Mean Score	%Mean Score	Standard Deviation
1	Type of client influences cost of building projects in the Nigerian construction industry	4	80	0.72
2	Government building projects are more expensive compared to private ventures	4	80	1.06
3	Costs allowances are higher in government funded projects compared to private ventures	4	80	0.81
4	On average, rates in BOQ are more expensive in government building projects compared to private ventures	4	80	0.82
5	There are no significant costs differences between government and private building projects	2	40	1.11
6	Geographical region does not significantly influence building cost in Nigeria	2	40	1.00
7	Cost of building projects in southern part of Nigeria (e.g., Lagos, Port Harcourt) is more expensive compared to northern part of Nigeria (e.g., Kano, Sokoto, Jos)	2	40	1.54
8	Rate of excavation for building projects is more expensive in central Nigeria (e.g., Abuja) compared to Cross River state (e.g. Calabar)	3	60	1.50
9	Location plays a major role in determining overall cost of building projects in Nigeria	4	80	0.97
10	The cost of building materials, labor and overhead vary significantly from one region to another in Nigeria	4	80	0.91
11	Location is a major factor that affects building cost information in Nigeria	4	80	0.91
12	Building costs for government funded projects in Nigeria are often padded due to duplicity	4	80	1.30
13	There is often bureaucratic bottleneck in tendering process especially in government funded projects	4	80	1.08
14	From your experience to what extent do the following factors affect building costs information (please tick the four most influential factors)	3	60	0.72

15	Which of the following sources of building cost information does your organisation use predominantly in estimating building cost (please tick two most predominant options)	3	60	1.03
16	Sources of building cost information are not regularly updated	3	60	1.01
17	There are limited sources of building cost information	3	60	0.99
18	Available sources of building cost information are not often reliable	3	60	1.09
19	Sources of building cost information are readily available	3	60	1.42
20	From your experience, do you think in-house construction costs data is accurate?	3	60	1.09
21	There is no national costs database for building projects in the Nigerian construction industry	3	60	1.29
22	Having a reliable national costs database for building projects in Nigeria is commendable	4	80	0.89
	Total average score	**3.32**	**66.36**	**1.06**
	Very strongly disagree = 0, Strongly disagree = 1, Disagree = 2, Agree = 3, Strongly agree = 4, Very strongly agree = 5 and Unsure was assigned no numerical value			

8.7.1 Impact of Type of Clients on Building Costs information management

The first objective of this study is to examine the impact of type of client on building cost information management. This section however evaluates the analysis of measured variables in the study questionnaire regarding the impact of client type on the overall cost of building projects in Nigeria.

Participants were asked five questions relating to the influence of client type on project costs (in a Likert scale format ranging from very strongly agree to very strongly disagree). This to examine practitioners' perception on the impact of client type on the overall cost of building projects in the Nigerian construction industry by indicating the level to which they agree or disagree using the Likert sequence provided in the questionnaire (i.e., very strongly disagree 0 = 0% to very strongly agree 5 = 5%.

The analysis of each of the five question is further presented and discussed below:

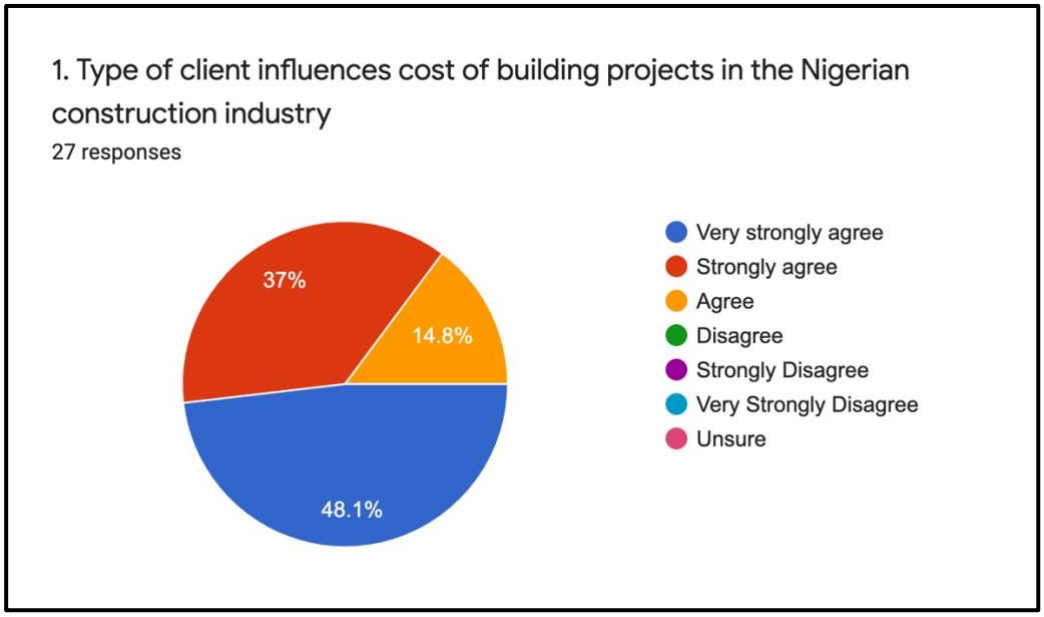

Figure 8.7: Percentage Response Rate for Question 1

Some key responses from study participants are illustrated in Figure 7.7 which indicates that 48% of respondents very strongly agree that type of client influences the cost of projects in Nigeria, 37% of respondents strongly agree and 14% agree that

type of client influences the cost of building projects in Nigeria. This is therefore evident that a larger percentage of respondents agree that type of client plays a significant role in determining the overall cost of building projects in Nigeria.

Arguably, this supports the opinions of respondents from the interview that government building projects are typically characterized by inflated final cost compared to private building projects in Nigeria.

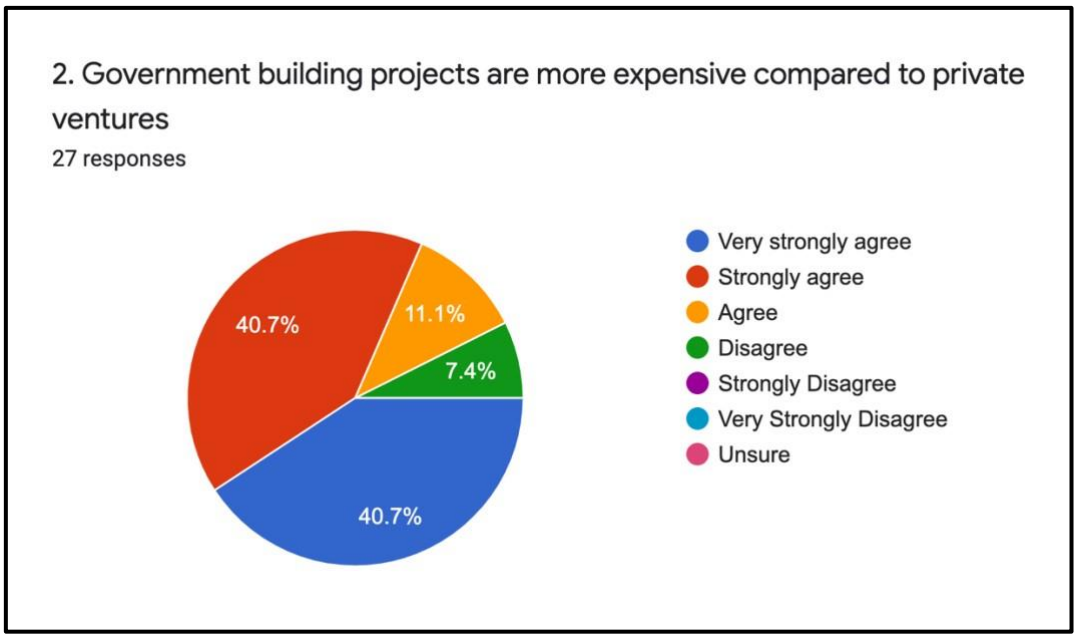

Figure 7.8: Percentage Response Rate for Question 2

Figure 8.8 demonstrates key response from the reversed question 1. The question was simply rephrased to gauge participants consistency and honesty in answering the questions using the same agreement scale. Interestingly, the responses from question 2 was somewhat like responses from question indicating a good level of participants consistency in addressing these questions. Thus, Table 8.8 illustrates the internal consistency test of reversed question with a correlation value of 0.88 which indicates a strong level of consistency. Also, Figure 8.9 illustrates the linear regression analysis of reversed question with an r value of 0.77 which indicates a positive relationship between the reversed questions.

Further assessment of Figure7.8 revealed that 40.7% of participants very strongly agree that government building projects are more expensive than private building projects in Nigeria, while 40.7% strongly agree, 14.8% agree and 11.1 disagree.

Table 7.8a: Internal consistency test of Reversed Questions (Q1-Q2)

Correlation

	Q.1	*Q.2*
Q.1	1	
Q.2	0.87854062	1

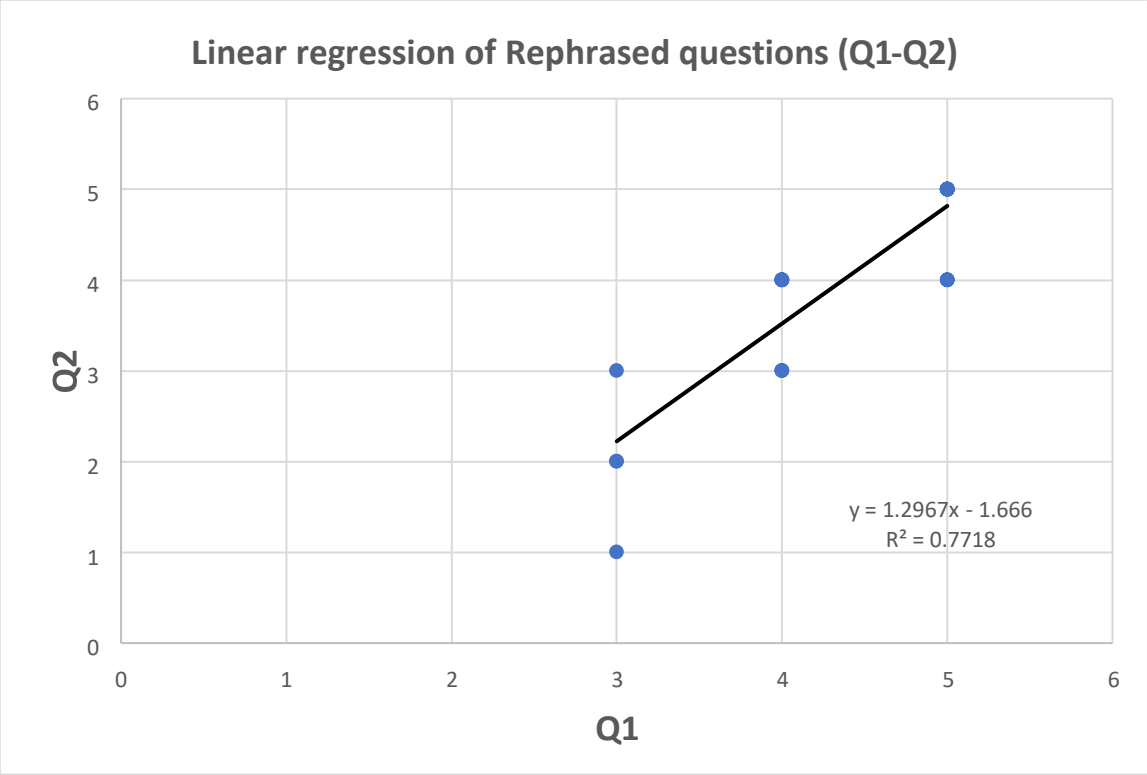

Figure 7.9: Linear Regression Analysis of Reversed Questions

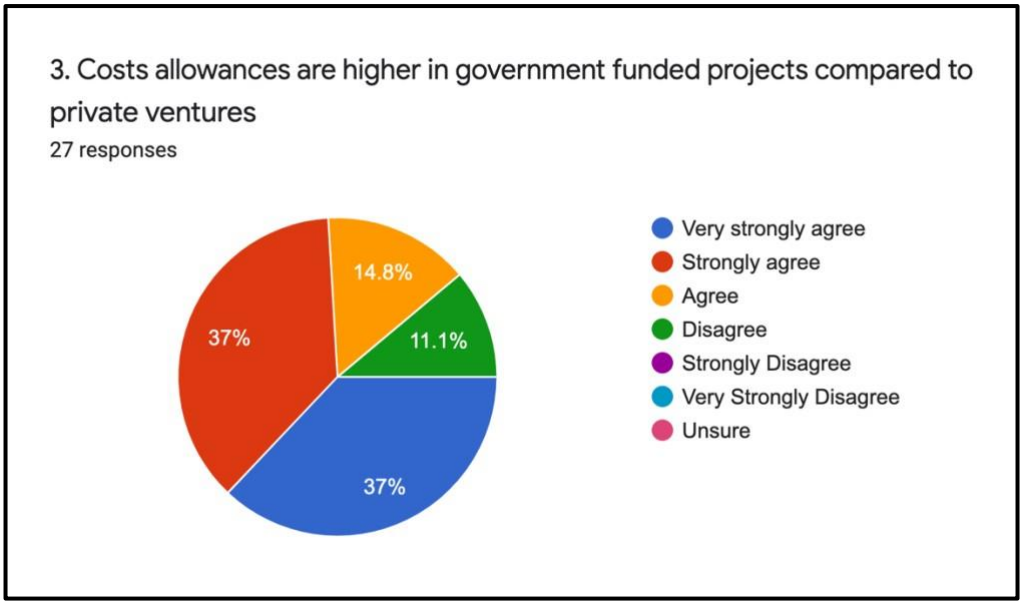

Figure 7.9a: Percentage Response Rate for Question 3

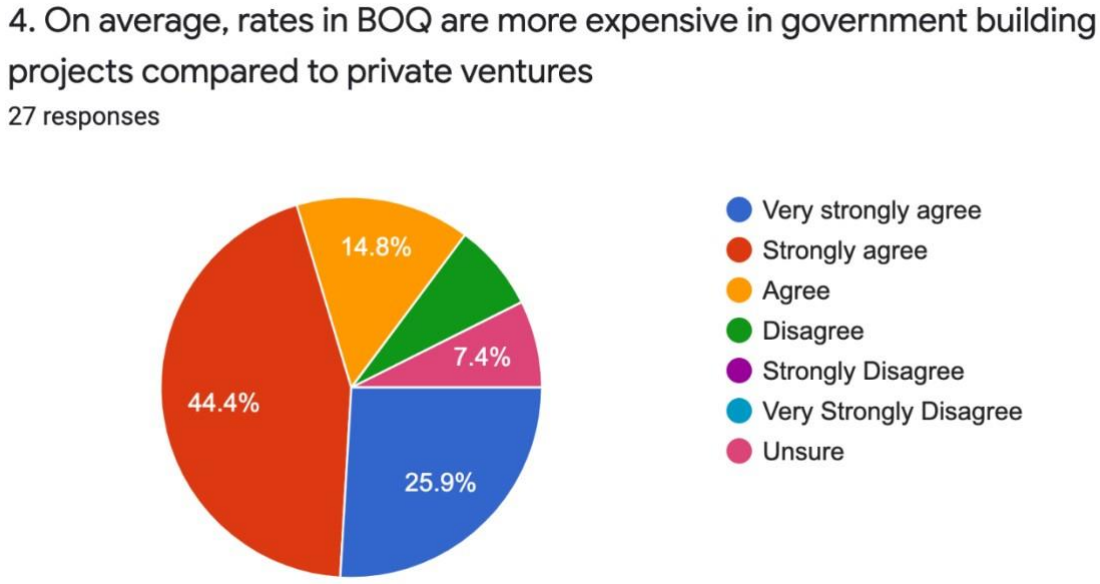

Figure 7.9b: Impact of Client Type on Building Costs

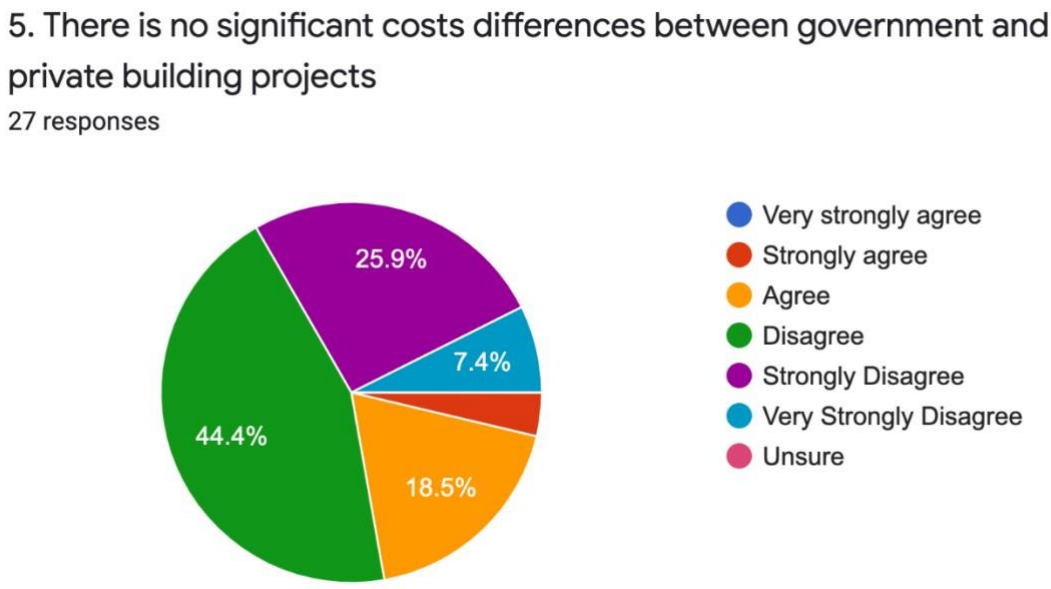

Figure 7.9c: Impact of Client Type on Building Costs

Chapter Nine

A Framework for Building Cost Information Management

9.0 Summary

This chapter describes an overview of the establishment of a comprehensive framework for building cost information management in Nigeria through extensive literature survey and investigation. It utilizes the potential information technologies and highlights the practical building cost management patterns in construction project. The chapter also evaluates the design of information management for building construction projects with the aim of establishing the applicability of the framework to a wide variety of building construction projects in Nigeria.

9.1 Introduction

Given the rapid advancement in technology, Information technology has experienced an increasing application in Architecture, Engineering and Construction (AEC) Zhiliang and Liang (2020). Some information management system such as BIM and BCIS in have used specifically in building construction for cost estimation and management. However, given diverse and complex nature of the Nigerian construction industry, the applicability of information technology to various aspects of construction. Hence to improve the applicability of cost information management framework for building construction projects in Nigeria. Also, the exorbitant cost of construction in Nigeria calls for an effective building cost database which professionals can benchmark their cost management practices or activities (Ojo, Ogunsina and Ogunsemi 2021). The building cost information management framework so developed will not only be a useful source of cost information but it will also serve as a guide for cost management in delivering value for money to the client. It is therefore essential to investigate the project cost performance to develop a comprehensive and robust building cost information management framework for the Nigerian construction industry.

Previous research in built environment and information management had developed various conceptual framework for cost management in construction and engineering

projects. For instance, Ojo, Ogunsemi and Ogunsina, 2020 established a comprehensive conceptual framework for cost management of construction/engineering projects in Nigeria. The framework was developed to integrate stakeholders and relevant indicators for measuring the performance of key areas of construction projects (i.e., project cost, time, and quality) The study posited that an overall approach in the management of information for construction project involve the development of generic information database for bench marking cost and time management of construction projects. Similarly, Ojo et al 2021, also developed a framework for value management and cost performance of construction projects in Nigeria. The study identified the leading the leading and lagging indicators of project cost performance, the leading cost performance indicators to timelines and cost management process performance while the lagging indicators constitute the outcome performance of project cost. The frameworks discussed above were all developed within the context of construction cost management. A significant characteristic of these studies is that they established the frameworks by concentrating on the cost management activities and not necessarily cost information. Therefore, this demonstrates the uniqueness of the work carried in this thesis as discussed in the paragraph below.

Based on the extensive review of literature and investigation of some completed building project across the geopolitical regions in Nigeria, this study focuses on evaluating the existing building cost information management practices in Nigeria and further develops a robust framework of building cost information management to be used by constriction professionals and stakeholders in the Nigerian construction industry. The framework is intended for the estimation of building cost as well as a benchmark for forecasting cost of future building construction projects.

9.2 General overview of the framework

The specified purpose of establishing the framework will be in three-folds. First is to understand the range and aspect of information management in building construction. Second is to understand and establish evaluation criteria for quantity surveyors and project managers on use when introducing such system for building cost management.

Hence, the framework should generally cover the following aspects, i.e., the sourcing of building cost information (e.g., from cost of previous projects, suppliers quote etc.), the integration of sourced cost information with potential information technologies, the utilization of cost indices and evaluation criteria for cost information management and lastly the maintenance of the cost information management platform, as seen in Fig 9.1. These four areas of the framework listed above will be presented diagrammatically using the EXPRESS-G presentation tool which according to Zhiliang and Liang (2020) is a widely used presentation tools for information management and modelling.

Figure 9.1 below shows a conceptual integration of the four major aspects of the building cost information management framework.

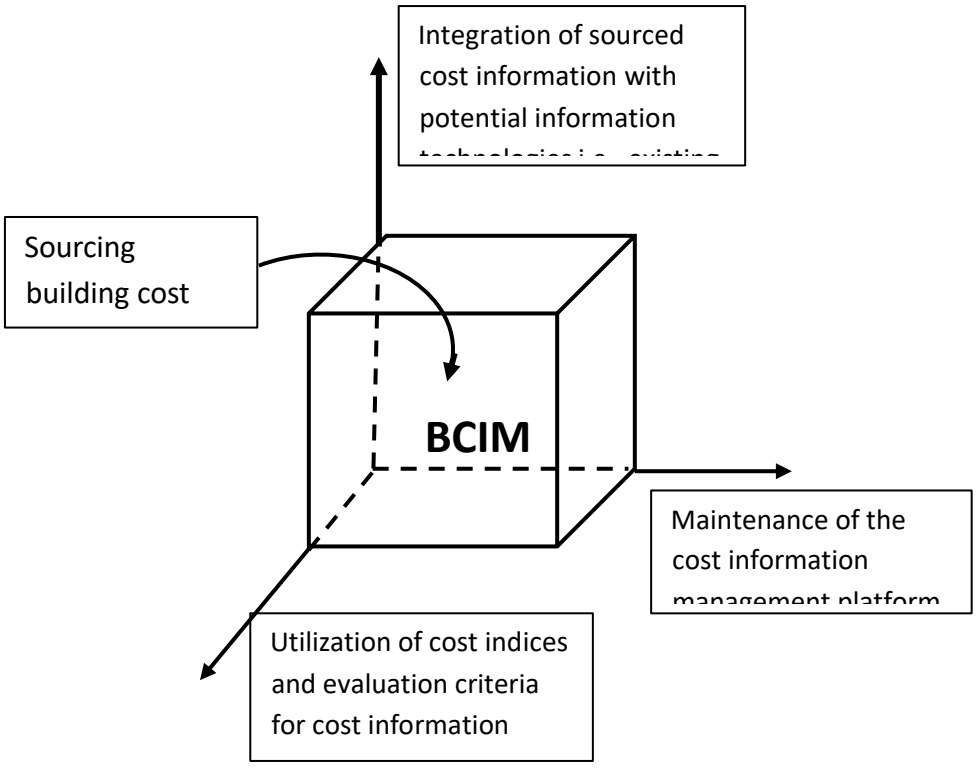

Fig 9.1 The General overview of BCIM framework process

9. 3 Building Cost information management Pattern

9.3.1 Sourcing Historical Cost Data

As a requirement, the cost information used to manage building should be reliable enough to aid accurate estimation. The framework management pattern shows how building cost is being sourced and managed based on characteristics of building projects. The first step in the frame is to source historical cost data of previous completed project of certain range for analysis. The sourced cost data is further vetted and analysed in relation to various cost indices such as inflation, location complexity of project etc., to bring the cost data to an updated version for use in building cost estimation. The essence of this step is to associate cost information with specific cost indices as required. This is further discussed in the next section.

9.3.2 Utilization of Cost Indices and evaluation criteria for cost information management

Many indices such as inflation, location, type of project etc. can be used for the evaluation and analysis of sourced cost information. This is to ensure that the information is reliable and suitable for use. Also, it is important to have specific criteria for the evaluation of cost management for building projects.

From the foregoing, the concept of “functional measurement of cost” is explored in this study and the following functional measurement listed below is summarized to represent the functional indices and factors of cost information management of building projects. Apparently, the applicability of the framework will be dependent on how much it these functional measurement and indices.

1. **Applicability**: the is to ensure that the framework can adapt to different organisational project cost information management and cope with current practice.
2. **Project Type**: this is to ensure that the framework can be adopted to manage variety of projects and project cost management pattern due to due to difference in enterprise culture.
3. **Integration of potential information technologies:** As mentioned above, this is to ensure that the potential information technologies can be fully utilized in the

framework as well as for easy integration of existing software products such as Microsoft office etc.

4. **Aid the reusability of cost information:** This is to ensure the sourced cost information is stored in a format that can be retrieved properly for information reuse.
5. **Interface for managing variety of cost management situations:** This is to ensure the framework creates an interface for managing cost information at various key stages of building project.

9.3.3 Integration of sources cost data with potential information technologies

Integrating potential information technologies with the proposed framework will enhance the successful management of building cost information. The framework is intended to support users with defining and estimating building cost based on practical situation. An information database must exchange information with other system for it to be applicable Ma *et al. (*2002) Hence, the framework will greatly enhance cost information management, so it is appropriate to be used for representing information exchange standard.

9.4 Conclusion

The chapter discus an overview of the proposed Cost Information Management Framework and the various evaluation criteria for its applicability in building projects. The framework is developed to reflect the utilization of potential information technologies and existing software and can cover the building cost information management pattern as well as key aspects of building cost information management. If well implement, the framework could be used by quantity surveyors to understand the range and cost information management aspects of building projects.

9.5 Development of Building Cost Information Framework

This section focuses on the development of building cost information framework (BCIF) and its application. It begins with the analysis of the implementation of the framework, analysis of the benefits and the outcomes of the framework application and how it enhances cost performance, improve the building cost estimation, and reduce building cost uncertainties in the Nigerian construction industry. The framework is developed through the combination of the research stages and findings from the study. It also presents a cross discussion and synthesis of all the study analysis together with the literature review to develop the framework. The following is discussed in this chapter: the overview of framework development and validation, the scope, accessibility, implementation, regulation, and the accessibility of the framework. The chapter concludes with the contribution of the framework to building cost management and the key findings are described.

This section presents an overview of cross-discussion and analysis of the developed framework. It focuses on the empirical themes from study analysis and findings and the identification of their differences and similarities. The evaluation and validation of the framework covers a total of 7 participants, which mainly included quantity surveyors and some academics in Nigeria with area interest in study. The primary task of the participants was to provide feedback on the developed BCI framework for necessary improvement and their recommendation was high supporting. However, some participant gave very strategic recommendation which are discussed and implemented in this study.

9.5.1 Theoretical Assumptions

The theoretical assumption underpinning the development of the framework is a combination of both information management and scientific management. In other words, the BCI framework appreciates the combination of both information technology and social perspectives in construction. It is therefore wholistic and innovative representation of cost management requirement in the Nigerian construction industry. The proposed framework ensures the collection, collation, analysis of building projects of specific threshold (discussed later in this chapter) and retrieval of building cost information of completed projects to aid pre-construction cost decisions.

The framework considered related building cost factors such as project type, location of project, labor rate and client type. Also, the framework is intended to integrate building cost components and applying cost variance factors to ensure an updated building cost information.

9.5.2 Development of the BCI Framework

This section discusses development of the BCI framework, the main sections of the framework and the flow of activities in the framework. Following the analysis and findings from the study, the identified factors were critically evaluated in greater depth to understand the impact of these factors on building cost performance. The use of semi structured interview provided a rich source of information on the experiences of practitioners in relation to these factors. The BCI framework is designed to aid construction practitioners estimate building cost and make effective cost decisions for building projects (e.g., inflation index, location index etc.). This is to ensure the retrieval of valid and updated building cost information.

The framework variables cut-across pre-requisites for obtaining building cost information from available sources, analyzing, and updating the information using based on specific cost parameters. The input includes cost data of fully completed projects in various geographical region collected by the regulatory authority (i.e., NIQS) overseen by the government regulatory authority (i.e., BPP). The process involves the collating the collected cost data, vetting and analyzing using specific parameters (such as location, tender price indices, resource cost indices project type, inflation indices etc.) to bring the data up to date and ensure the validity of data. The output is then achieved in form of building cost information for project cost benchmarking, estimation etc. this information is intended to be made available to construction stakeholders and the likes through a subscription process, where proceeds from the subscription is used from the maintenance and running of the framework. Figure 9.2 below illustrates the framework development process.

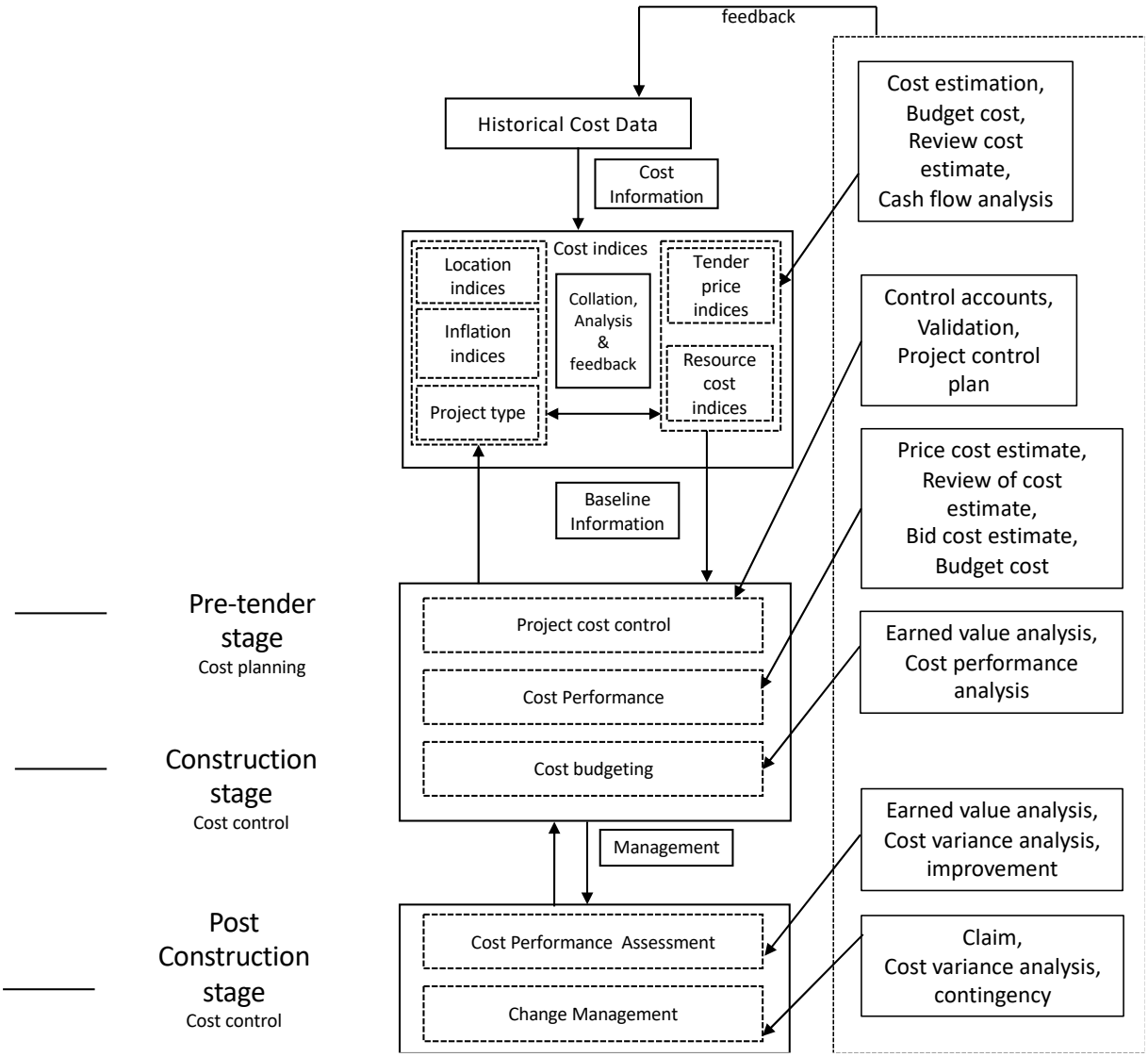

Figure 9.2: Framework for Building Cost Information Management

9.5.3 Validation of BCI Framework

Developed frameworks in research are usually validated to test against established performance and ensure practicability of the framework.

To validate the framework, an evaluation question was designed and distributed via an online google survey to construction expertise which included quantity surveyors, civil engineers and other construction expertise and stakeholders. The validation survey involved a total of 7 participants who provided very commendable recommendations and areas of the framework to be improved This primary aim of this survey was to obtain feed from construction professionals on the developed framework

for possible improvement. These professionals were carefully selected for the framework validation given their years of experience in building cost estimation and project management; hence their feedback and recommendations could arguably be a representative sample and deemed valid form this study. The participants were required to complete a list of questions about the framework layout and its implementation by ranking their degree of agreement or disagreement ranging from (strongly agree as highest form of agreement to strongly disagree as the lowest form of disagreement). Typically, the participants suggested that the framework is a good a welcomed innovation. However, a large percentage of the participants suggested given the dynamic nature of the Nigerian construction industry, the framework implementation will require more than just legislations. They argue that it will require the collaborative effort of the judiciary and the executive (Presidential) willpower to curb systematic building cost escalation and corruption in the Nigerian construction industry. Another commendable aspect of the framework pointed by the participants is the simplicity of the framework layout which the participants claimed was easily understood.

Aside the positive feedback, participants gave comments as follows:

> *"…Also, the Engineering/Building/Professional /Consulting bodies should be given more roles/responsibilities in making the effective especially during the planning & implementation stages."*

The participants further assert that introducing a building cost information framework like the BCIS used in the UK to the Nigerian construction industry will requires trust, honesty, and commitment from both the Nigerian construction professionals and the Nigerian government. In other terms it involves a collective effort of the law makers in Nigeria and the Nigerian construction stakeholders. These constructive responses have been incorporated into the framework and further studies is required for its development as a software for easy usage.

9.5.4 Survey Evaluation

The framework validation involved 7 participants who were required to evaluating the framework and provide strategic recommendation with regards to the framework layout and possible implementation. The validation survey comprised 12 structured question and 1 open ended question requesting participants to provide their general opinion about the framework see appendix C for copy of validation survey responses. The survey questions were categorized into three sections with each section comprising 4 questions.

The first section includes questions addressing the benefits of the framework. These questions were based on the study findings and experts' recommendations from data collection on the benefits of having a building cost information management framework in the Nigerian construction industry. In response to the questions, participants stressed the need and urgency in in having a robust cost information system to aid the much-needed cost transparency in the Nigerian construction industry.

The second category comprise questions addressing the implementation and workability of the framework. Majority of the participants strongly agree that the framework will go a long way in enhancing building cost estimation and cost appraisal if implemented properly and regulated effectively.

The last section comprises question addressing the framework layout whether it understandable and recommended by construction professionals. Many of the participants strongly agree to the simplicity of the layout and agree that it is easy to understand. However, some of the participants recommended that the flow should make room for comments/ changes as stated below:

> *"…The flow chart should provide for comments/additions/changes so that this can be accommodated"*

The survey concluded with an open-ended question requiring participants to provide their view(s) on the developed framework as well as their recommendations. The recommendations and feedback from participant were highly constructive and commendable. These recommendations were considered in the study to validate the framework.

Figure 9.2 illustrates the analysis of framework validation survey responses.

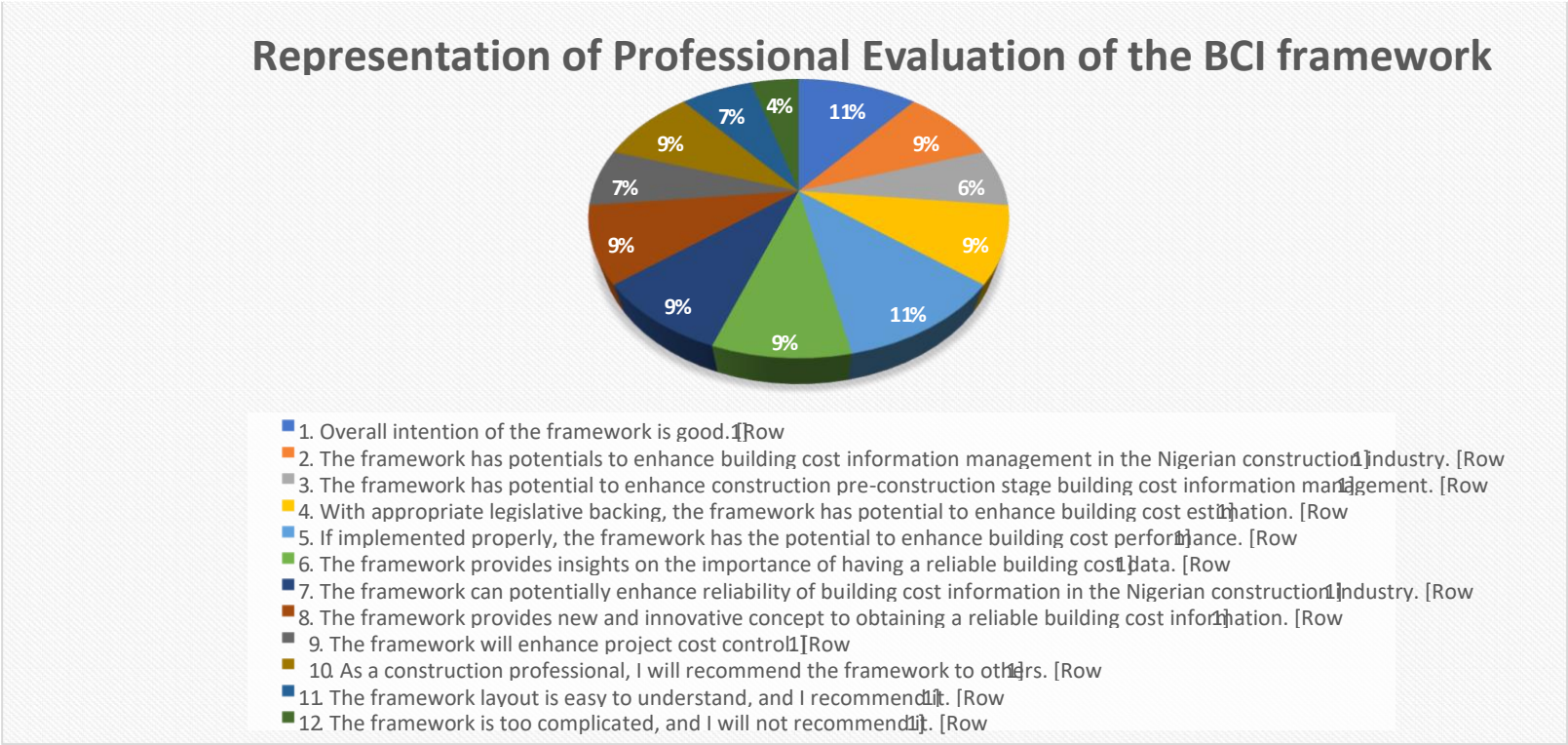

Figure 9.3: Representation of Professional Evaluation of the BCI framework.

9.6 Scope and Limitation

The Building Cost Information Framework (BCIF) design is based on the synchronization of findings from extensive literature search, data analysis and knowledge elicited from experts in the construction industry. Its scope of application is delimited to building construction projects.

The BCIF is designed to be used by construction professionals and stakeholders (e.g., consultants, commercial managers, contractors, clients etc.) in the Nigerian construction for specific cost estimates, cost appraisals, cost planning etc. mainly involved in building construction projects. The use of the framework must be within the bounds of the prevailing regulatory bodies and government policies. It provides the relevant cost information to be used by building cost estimators for estimation and cost decision making at pre-contract stage of building contract.

It is important to note that overall data retrieved from the framework for building cost estimation is depended on the response provided to each project variable, hence a guide to construction professionals to enable them to make appropriate cost decisions.

9.7 Implementation

The implementation of the above framework will be based on the collaboration of the NIQS, BPP and the Nigerian government, whose responsibility will be to nominate an Independent Special-purpose Building Cost Verification Board (ISPBCVB) and regulate it.

- The ISPBCVB will be the body set up to oversee the collation, classification, verification, analysis, storage, and retrieval of building cost information in the Nigerian construction industry.
- The framework recommends that all as -built building projects cost should be prepared in an elemental format and submitted to the regulatory body within 6 months of practical completion.
- Projects considered are to be classified according to their types i.e. residential, commercial, educational etc.

9.7.1 Benefits of Framework

The BCI information is designed based on the needs of construction professionals to acquire valid building cost information for effective cost management of building costs. The designed BCI framework proposed in this research is to aid building cost estimation will serve as a valid guide for cost decision and management to quantity surveys, commercial managers, and other stakeholders within the construction industry. The system will serve as a powerful for managing building cost efficiently. If implemented properly, the following categories of stakeholders will benefit from the proposed framework.

- Fully able to integrate all cost information generated from building construction project for future project benchmark and cost appraisal.
- Government at all tiers (i.e., local, state and federal) being major clients to large building construction projects will benefit maximally from this framework by expediting pre-building cost information.
- The framework will help construction professionals such as commercial managers, contract managers, estimators, quantity surveyors to have a point of reference (benchmark) to building cost information.
- The framework will act as point of reference for building cost information management, with potential to minimize price manipulation

9.7.2 Possible Limitations of Framework

- The proposal does not cover building project less than N5,000,000m (naira). It considers project from 5,000,000 and above.
- It compels construction contractors and clients to submit building cost data regularly within a stipulated time frame.
- The framework is limited to building projects and does not cover other aspect of construction such as civil engineering works etc.

9.8 Summary

This chapter presented the discussion and the developed Building Cost Information Framework (BCIF). After a critical review of literature and data collection/analysis, it was discovered that the Nigerian construction industry has no national building cost information database for cost benchmark and cost estimation due to several factors discussed in chapter two of this study. As a result, construction professionals are faced with the issues of inaccurate building cost estimation because the information available for benchmarking and estimation are not reliable in many cases. Hence the need to develop a robust building costing information framework to aid accurate estimation of building cost and for availability of reliable building cost information. The developed BCI framework was developed based on the study findings and analysis. Its development also factored the specific factors established to be responsible for cost information variances across the different regions in Nigeria. Also, the framework was validated using professional evaluation feedback. BCI framework is therefore considered to be robust enough to account for the building cost information management and cost performance within the Nigerian construction industry.

It is important to note that the framework accessibility is proposed to be based on periodic subscription payment of registered construction stakeholders at a cost to maintain the framework.

9.8 Facilitation of engagement with the framework through subscription

The study output is the framework for building cost information management for the Nigerian construction industry. However, given the scope and limitation of the study only the development of the above-named framework is covered, hence the suggested subscription of this framework will only be applicable if the framework is further developed into a system which is not covered in this study. Consequently, this study has recommended future research on the further development the BCIM framework into a system where the following subscription recommendation can be applicable to facilitate engagement.

- An online paid subscription (preferably 12 month) should be launched. This will be subject to specified terms and condition by the regulating authority.
- Also, charges should be specified to cater for different subscription type which will also determine the level of access of the subscriber.
- Educational subscriptions should also be made available for educational institutions to use within the capacity indicated their subscription
- Finally, cost data should be made accessible through a database or other applications including electronic means to subscribers for better understanding and easy engagement.

Chapter Ten
Conclusion and Recommendations

10.0 Introduction

This chapter presents the conclusion and the summary to this study which highlights the findings of the research as well as significance of the study. Also, the research recommendations for academia, industry and future works are presented in this chapter. The management of building cost data is recognized to be a crucial part of project management, yet a reliable national building cost information database is lacking in the Nigerian construction industry. In addition, cost database used by many construction organisations in Nigeria are mainly bespoke designed by such organisations to cater for their building projects. Hence, professionals rely on cost information sources such as market survey, suppliers, historical cost data etc. to prepare and estimate building costs. In response, this study develops a robust building cost information management framework to enhance buildings cost estimation, cost control and forecasting.

10.1 Research summary

The research aim is indicated fully in the next section; however, it is worth mentioning briefly in this section as it presents the overview of the entire study. The aim of this study emanated firstly from the fact that the study area has not been widely researched in Nigeria, and secondly from the claim in literature and preliminary survey of the lack of a national building cost information management database which was empirically demonstrated in this study. The review of literature in the study area provided an insight into the current practice of building construction cost management as well as understand the causative factors affecting building cost variation in the Nigerian construction industry. The review of literature gave rise to the identification of knowledge and the bridging process conceptualized. The nature of the type of data collection informed the adoption of pragmatism research philosophy for this study. Subsequently, a robust quantitative data collection technique(questionnaire) was designed and distributed via an online survey platform

Therefore, this research develops a building cost information management framework BCIM. The BCIM framework, which is recommended to enhance building cost estimation and management as presented in in figure 9.2

The researcher adopted a model of thesis structure which encompasses ten chapters to review, present and analyze the data to achieve the aim and specific objectives. These chapters correspond with the research process as well as the research objectives, which are clearly identified in chapter four (the methodology chapter).

10.2 Evaluation of aim and objectives of study

The aim of the study is to develop a building cost information management framework for the Nigerian construction industry. This aim was achieved by conducting rigorous mixed research which included qualitative, quantitative and the use of archival data utilizing a clear philosophical and methodological assumption, and robust research process that adequately addressed the specific objectives. To achieve study, aim the following specific objectives are set:

1. *To examine the impact of types of clients on building cost information.*

This objective is addressed through a quantitative research strategy using archival data of previously completed building project of public and private clients. In total, eleven projects were analysed four of which were public projects and seven private projects. The analysis of the data was conducted using a T-test. The result established a clear difference in the percentage of cost variances in the public project compared to private project. It was established that cost of government projects was more likely to be inflated compared to private projects due to corruption and bureaucracies thereby leading to higher percentage of cost variations compared to private projects.

2. *To investigate the underlying cause(s) of building cost variance around different geographical region in Nigeria.*

This objective was achieved through the review of literature and a quantitative research strategy. Findings from literature review established that cost of building projects varies from region to region within Nigeria. These variations were claimed to

be due to several factors some of which include availability of building materials, site conditions and topography, unreliable sources of building cost data, exchange rate, inflation etc. Both findings from literature review and quantitative research combined problems associated with building cost variances were achieved.

3. *To critically examine factors that affect building cost information in the Nigerian construction industry.*

This objective was achieved through literature review quantitative and qualitative research strategies. An extensive literature review revealed some major factors responsible for the management of building cost information in the Nigerian construction industry. Some of the factors include corruption, lack of building cost information database, poor computer literacy, poor record keeping culture etc. findings from the quantitative and qualitative data analysis also revealed that the lack of building cost information database ranked highest among all other factors in.

4. *To investigate reliability of building cost data in the Nigeria construction industry.*

This main objective is achieved through strategic qualitative research using a semi-structured interview. In total 12 interviews were conducted with practitioners associated with building costing in the Nigerian construction industry. The analysis of the empirical data was conducted using content and descriptive analysis. The result established that many of the available sources of cost building cost data were not reliable because they are not regularly updated to current prices. The study also revealed that cost sources such as suppliers' quotes are often time inflated cost and does not give true reflection of actual costs.

5. *To comparatively analyze building costs in the UK and Nigerian construction industry.*

The fifth objective was achieved through a strategic analysis of archival cost data of selected similar building projects from the UK (from BCIS) and the Nigerian construction industry (Projects samples across all 5 geo-political regions in Nigeria). the cost data was analysed using T-test. Results revealed a significance difference in the disparity between budgeted cost and final cost of projects in the UK compared to

disparity in budgeted and final cost of projects in Nigeria. The percentage of disparity in budgeted/final cost of projects in UK was established to be lower compared to percentage of disparity in Nigerian project. This was due to some factors such availability of materials in the UK compared to Nigeria, inflation rate, unavailability of certain equipment and machineries, availability of national building cost database (BCIS) in the UK construction industry etc.

6. *To develop a strategic framework for building cost information management for the Nigerian construction industry.*

Finally, this objective was accomplished through findings from major study and analysis and literature review. This involved the development of building cost information management framework which is fully explained in chapter nine of this study. The validation was achieved through and evaluation group of selected professionals in the Nigerian construction with experience in cost management. The results were collected in tick box questions and participants recommended the need for the BCIM framework as a welcomed development in the Nigerian construction industry.

10.3 Summary of findings based on empirical research analysis

This section presents findings from empirical research in relation to research objectives, questions, and hypothesis. To achieve the research aim, rigorous qualitative research was conducted utilizing a clear methodological and philosophical assumption and robust research process to sufficiently address the specific objectives. All findings from the research were gathered to develop a robust and innovative building cost information framework. There were five specific objectives to this study.

10.3.1 Objective 1

Examination of the impact of types of clients on building cost information This objective was addressed through a qualitative research process and quantitative archival data analysis presented in chapter five of this study. There was a total of twelve semi-structured interview conducted with construction professionals. The empirical data was conducted using content analysis. The result revealed a clear difference in the rate of cost variances in public projects compared to private projects.

The result also established that high a percentage of variability between initial contract sum of public projects and final building cost. One of the major reasons for high cost of public building projects has been corrupt practices which is line with Nnadi (2013) view on the causes of high construction cost in Nigeria. He argues that Most contractors especially for public projects hike their tender bid to cover for any loss in case of change of government which may result to abandonment of the project. Nigeria leadership is notorious for discontinuity of projects initiated by their predecessors resulting to building deficits.

10.3.2 Objective 2

Investigate the underlying cause(s) of building cost variance in different geographical region in Nigeria

This objective is accomplished through the analysis of archival building cost data of completed projects from different geographical location in Nigeria. The analysis is presented and discussed in chapter five to establish the main cause of building cost variance of similar projects in different geographical location Nigeria. It was established that the location of a project inadvertently contributes to the high/low cost of building projects due to various factors some of which include availability of labor, material scarcity, different labor rate for different region, insecurity issues etc. Since a building project's location affects the final cost, an estimator must therefore understand what specific location factors will be encountered and what to be mindful of estimating the cost of a building project.

10.3.3 Objective 3

Critically examine factors that affect building cost information management in Nigeria

This objective was realized through critical literature review and through quantitative data collection. The review of literature and data analysis identified 9 major factors that affect building cost information management in the Nigerian construction industry. These factors were ranked in order of their impact on building cost information. Among the factors identified; corruption was ranked the most significant factor. According to study participants corruption gives birth to many other factors negatively impacting

building cost management in Nigeria. They suggested that curbing corruption will go a long way in ensuring transparency in the construction industry in Nigeria.

10.3.4 Objective 4

Investigate the reliability of building cost data in the Nigeria construction industry

This objective was achieved using a qualitative data technique which included semi-structured interview. The analysis is presented in chapter seven. Findings revealed that majority of the building cost information sources in Nigeria are not reliable thereby leading to inaccuracies in building cost estimation.

The findings set the basis for the development of BCIM framework.

10.3.5 Objective 5

To comparatively analyze building costs in the UK and Nigerian construction industry

This objective was achieved through the comparative analysis of building cost management the UK and Nigerian construction industry. The result revealed a significant difference in building cost management procedure in the UK construction industry compared to the Nigerian construction industry. Findings also revealed a significant difference in the level cost data management and storage in UK compared to Nigeria. for instance, the UK has a cost database system available to construction practitioners Known as the Building Cost Information Services (BCIS) whereas Nigeria has no existing national building cost information database. This also informed the basis for the development of BCIM framework.

10.3.6 Objective 6

Develop a strategic framework for building cost information management for the Nigerian construction industry

Finally, this objective was accomplished through the literature and the cumulative data collected for this study. From the overall research findings, a robust Building Cost Information framework was developed. The feedback from construction professional

collected using an online survey platform (Google Form). the scope of this study was delimited to building construction projects; hence the frame is adaptive to building construction projects only. The assessment of the research aim, and objectives implies that the research has satisfactorily achieved its aim and objectives with useful commendations from research participants.

10.4 Summary of gaps in literature

The knowledge gained from the literature review of this study are summarized as follows:

10.4.1 Poor cost performance of building projects due to limited cost information

Building construction projects inevitably generate immense and complex sets of information. Managing this bulk of information effectively is highly important to ensure that projects meet their specific baseline (Liu and Zhao 2013). However, poor or lack of information can easily lead to project delays, uneconomical project decisions, or even the complete failure of the desired outcome. In the same vein, cost information management plays a crucial role in building construction contracts management, because information is associated with the cost positions of construction contracts, and the construction industry can efficiently fulfil its cost management by using a reliable cost information. Especially in the modern construction, the collecting, transferring, storage and application of information are associated with the quality and efficiency of construction project delivery. So, we must strengthen the information management in construction engineering to guarantee the engineering construction

Unfortunately, the Nigerian construction industry is not quite there yet, Olalusi and Jesuoluwa (2013) opined that the poor cost performance of building projects especially for public projects is a common issue in Nigeria due to lack of cost information system to appropriately benchmark project costs. They argue that the present information system used in the Nigerian construction is characterized by several inefficiencies. The Nigerian construction industry currently does not have and industry-based cost information system and sometimes the adoption of foreign based system does not accurately the actual circumstances of the Nigerian construction environment, due to

variations in technological advancement, personnel inexperience, fluctuation and unstable exchange rates, project sites and location etc.

As discussed earlier in the first chapter of this study, there is limited on building cost management. Also, there is limited literature on building cost information management. This is because building cost information includes cost information of aspect of building projects. Currently individual construction organisation in Nigeria design and/or adopt their various in-house cost information system to manage and control building project costs. However, some of many of these in-house cost system or databases sometimes do not capture the cost indices of some other regions in the country, hence the reliability of these systems is not guaranteed. There is currently no national building cost database accessible to construction professionals and estimators to benchmark to estimate and benchmark building cost. For example, building construction cost are sometimes over-estimated and escalated especially in public projects by clients as a way of syphoning. This act according to Osisioma, (2013) breeds market inefficiencies and leads to decline in the quality of public building projects, as well as project abandonment.

Many building cost factors are directly related to the main contractors whose key responsibility is to ensure that project meet their cost objectives, hence the contractor is considered one of the stakeholders responsible to answer key question regarding building cost performance. However, the findings of this study also reveal that the type of client (i.e., public, or private) can influence the cost of building project hence the responsibility of managing building cost also rest on clients who most times initiates the types of project and project policies.

Some factors have significant influence on building delivery target. Nine influence factors have been identified by this study. Analysis from literature reveal that corrupt practices, sources of cost information and location significantly impact cost of project delivery in Nigeria. Also deducing from literature in the subject area, other factors such as estimators bias, inappropriate construction technique have also been identified as some of the causative factors responsible for building cost variances or excess of final completion cost over contract sum of building projects in Nigeria (Uchenna, 2017). As such many building projects in Nigeria experience cost overrun, which put the competency and integrity of construction professionals to effectively manage project cost in doubt.

Also, there is paucity of study in some area of building cost performance especially the cost information and the sources in Nigeria. These aspects of building are mostly summarized in the theory of cost overrun. Current volumes of building cost research attempts tend towards causes of cost overrun and not necessarily cost information. Hence the need for this study.

10.5 Practical implication of the research findings

The study bears practical implication on the management of building construction projects in the following dimensions.

10.5.1 Building Cost Information Framework as building cost information Management tool

- Effective implementation of the BCI framework hopefully will reduce the persistent cost overrun challenges arising from lack of information in the Nigerian construction industry. The developed Framework promises to be useful tool for government agencies like the Bureau for Public Procurement (BPP) and professional institutions like the Nigerian Institute for Quantity Surveyors (NIQS) etc. Such framework could be developed by other countries within the continent, using generated cost data from previously completed building projects.

10.5.2 Information Provision for Construction Investors

- Some of the results from this study provides useful information to construction business who may be interested in establishing a construction company and require such information for strategic cost planning.

10.6 Academic implications

This research evidently aimed to improve building cost management. The study bears the academic implications on the enhancement of construction cost management, enhancing performance and understanding in the subject area. The BCIM framework

will also enhance project cost management as well as improving performance and overcome the following:

- Limitations of cost planning and cost management of building projects
- Cost related communication barrier
- Lack of understanding of project cost control
- Unrealistic cost estimations
- Limitations of digital cost information management

10.7 Research originality and contribution to knowledge

This study primarily contributes to the construction cost management existing body of knowledge by qualitatively and quantitatively exploring the current issues of building cost information management in the Nigerian construction industry by innovation from the UK (i.e., the BCIS) construction industry to develop an innovative building cost information framework to enhance cost estimation and appraisal.

The study contribution to knowledge is grouped in three major ways which will be adequately discussed in this section.

10.7.1 Methodological contribution

- This research adopts a pragmatism to understand and develop a practicable building cost information framework. Thus, contributing to the construction cost management knowledge that pragmatism provides flexibility and the ability to adopt the most appropriate method for construction cost management research. The research also contributes by emphasizing the significance probing questions in a qualitative research data collection.

10.7.2 Theoretical contribution

- This research contributes to limited literature on construction cost information management area and its managerial process. It develops a concept for

sourcing, analyzing storing and retrieving a reliable building cost information to aid accurate estimation of building costs.

- It contributes to knowledge by highlighting the influence of client type on final cost of building projects in Nigeria.
- The study also provides a platform form more extensive research to be conducted in information management in building construction.

10.7.3 Development of the BCI framework

- The research develops a robust Building Cost Information Framework. The technique is based on the industrial requirement of a reliable building cost information management source to enhance building. Cost estimation in Nigeria.
- The study develops the methodology for implementing the framework. This includes the sourcing, collating, analyzing, and vetting the building cost information from construction practitioners as well as the guidelines for accessing the framework.
- The practicability of the BCI framework was explored by validating the system through construction professional's evaluation of the framework. The appropriate implementation of the framework promises significant benefits for building cost management, improvement, and management in Nigeria.

10.7.4 Industrial contribution

- The research contributes to knowledge by establishing the industrial challenges of lack of national building cost information database and the use of unreliable building cost data in the Nigerian construction industry established by from practitioners' perspective.
- It contributes to a better understanding of building cost information management and the factors influencing the management of building cost information management in Nigeria which was last explored in 2008 by (Akintoye and Olomolaiye 2008).
- The research also explored the use of mixed method approach rather than the conventional quantitative method used for research of this nature.

10.8 Research limitations

Although the study has contributed enormously to the body of knowledge, research and practice, there are considerable number of limitations encountered in the cause of this study design, the collection of study data and analysis.

The researcher encountered difficulties in receiving responses from research participants in timely manner due to the confidential nature of the data required for this study. Hence this resulted in a lot of delay in data analysis extending the thesis completion beyond the planned date.

Also, scrutinizing the archival data obtained for the study, it was discovered that some of the data was repeated and as such repeated data was discarded and not used for this study. This has reduced the expected data sample size for this study.

10.9 Suggestion for further research

Findings and results from this research established the following possible areas which were outside of the research scope but can be considered for future research.

- Evaluating the impact of client type on building cost information management in Nigeria.

Results from study analysis revealed that client type significantly influences the final cost of building projects as well as affects the effective management of building cost information in the Nigerian construction industry; For instance, most of the study participants established that a large percentage of building projects in Nigeria especially public projects are often completed at a much higher cost than the budgeted cost. Hence extensive research in this area is highly recommended.

- Future investigation on the impact of location on building cost management in Nigeria can be conducted as a follow up to this study. Outcome from such study(s) shall contribute to the documentation of building cost management in the Nigerian construction industry.

- This study highlighted and briefly discussed variety of factors influencing the reliability of building cost information in Nigeria. These could serve as motivation for further research.

10.10 Summary and conclusion

The main aim of the study was to develop a building cost information framework that will enhance cost reliability and aid accurate estimation of building cost in the Nigerian construction industry. The study contributes to the emerging studies of introducing information technology in the construction industry, and primarily seek to understand various factors influencing building cost information management in the Nigerian construction industry.

The study developed a robust building cost information management framework for the Nigerian construction. Key terms used in the clearly defined and explained in the literature review chapter for better understanding of the research problems and the current trend in the research area. The research questions were formulated from the current knowledge gap identified in the study area. The research question was clearly outlined chapter one. Again, addressing the research questions form the basis for the research techniques, data collection techniques, and methods of analysis. These spans through spans through chapter four, five, six and seven. Thus, the study conclusions are based on results drawn from the empirical research and extensive literature review. This research also provides further findings to the study that identifies the limitations of building cost information sources in Nigeria and the various factors responsible for building cost variances.

One of the objectives of the study was to examine the impact of types of clients on building cost information. Following the analysis on the archival cost data obtained, the results showed that 95% of these projects were completed at costs over the budgeted cost. However, the public projects were found to have the highest percentage of cost variances. These results further buttress the assertion by Nnadi (2016) who stated Most contractors for public projects hike their tender bid to cover for any loss in the event of change of government which may result to abandonment of the project. To investigate the underlying cause(s) of building cost variance around different geographical region in Nigeria.

Also deducing from the study analysis 9 key factors were identified as those influencing building cost information management in Nigeria. However, ranking the factors according to the participants' rating, three major factors were identified as the most significant factors influencing building cost variance with corruption having ranked highest. They include.

- Corruption
- Location factor
- Client type

The findings from qualitative, quantitative, and archival data analysis supported the justification for the development of the BCI framework.

Furthermore, the validation and implementation strategy were benchmarked using guideline from the Building Cost Information Services (BCIS) used in the UK construction industry considering the cost elements of the Nigerian construction industry.

It is therefore concluded that the research objectives for this research work have been achieved, on this account, the study has endeavored at examining the factors responsible for the variances in budgeted and final cost of building projects in in different geographical location within Nigeria. Also, areas of discrepancies in sourcing reliable building cost information have been identified while ways of promoting them have been articulated, with a view to reduce building cost overrun and enhance accurate building cost estimation.

10.11 Recommendations

The examined the building cost information management practice in Nigeria with a view of identifying critical attributes contributing to building cost variances. It was argued that a realistic and accurate cost estimate can help serve as an effective plan for project cost control (Olawale and Sun 2014).

Based on the study findings, the strategic recommendations remedy to solving the specific building cost information management issues in the Nigerian construction industry are as follows.

- With reliable cost information, cost problems could be identified early in building projects and as such provision are made early enough to solve such

problem(s). hence the study recommends the collaborative effort of the Nigerian government and construction professional bodies to ensure the proper implementation the proposed BCI framework and similar systems proposed by other researchers to enhance building cost management in the Nigerian construction industry.

- Construction practitioners in Nigeria should ensure due diligence in carrying out their duties as professionals and should restrain from corrupt practices and professional indiscipline of any kind
- The use of information technology should be encouraged in the Nigerian construction industry proper record keeping and best practice.
- With regards to building cost management in Nigeria, Nnadi (2016) suggest that with reliable cost data for benchmarking and prudence in management of public funds many layers of government influence on systematic escalation of building costs will be eliminated and this also extends to private building projects. Hence research that implements the findings of this study to further develop a BCI system for the Nigerian construction industry is highly recommended.
- Furthermore, a collaborative study between the academia and the industry to assess the efficiency and implementation strategy of the BCI framework is recommended.
- Akintoye and Olomolaiye (2006) opine that construction cost management can be improved in Nigeria with the introduction of a national cost database thereby ensuring accurate cost estimation. Hence more research could be conducted to assess other influencing factors of high cost of construction projects in Nigeria.
- Given that government policies and programs have significant impact on building construction cost due to the high level of government involvement in the construction industry, it is recommended that Nigerian government alongside the BPP should set up an internal control mechanism for budgetary control, and rigorous vetting of building contractors, consultants, and suppliers to ensure transparency in contract execution.
- It is recommended that government should deal with cost inflation to reduce the high prices of building materials which is responsible for constant increase in building cost.

- Finally, as new, and innovative technology are constantly being introduced in construction for strategic decisions, it is highly recommended that construction professionals in Nigeria engage in learning and training exercise to gain greater understanding of these new technological advancements and expand their opportunity to work more efficiently.

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APPENDIX 1: Pilot Survey Structure

PRELIMENARY SURVEY

DEVELOPMENT OF A FRAMEWORK FOR BUILDING COST INFORMATION MANAGEMENT IN NIGERIAN

BY

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Instruction: Please select as appropriate.

SECTION A (Personal Questions)

1. Which of the following best describes your profession?

Architect ☐ Engineer ☐
Quantity Surveyor ☐ Builder ☐
Others, please specify _____

2. Which of the following best describes your organization type?

Client ☐
Contractors ☐
Sub-Contractors/Suppliers ☐
Consultants ☐

3. What Part of Nigeria is your organization located?

Middle Belt (North Central) ☐ North-East ☐ North-West ☐
South-East ☐ South-South ☐ South-West ☐

4. What is the highest level of formal education you have received?

O.N.D ☐ B.Sc./B.Tech. ☐
H.N.D ☐ M.Sc./MBA/M.Phil ☐
PhD ☐

5. How many years of experience do you have in the Nigerian construction industry?

1 – 5 years ☐ 6 – 10 years ☐

APPENDIX 2: Questionnaire

Academic survey (Coventry University, UK)

Please read each question and place a tick in the column that best describes your judgment of building cost information system in the Nigerian construction industry. Please try to answer every question honestly and do not answer unduly to show your company or the construction industry off in a good light. Your confidentiality and anonymity is assured.

In the context of building cost information, please indicate the extent to which you agree or disagree with the following statements:

1. 1. Type of client influences cost of building projects in the Nigerian construction industry

   Mark only one oval.

   - ◯ Very strongly agree
   - ◯ Strongly agree
   - ◯ Agree
   - ◯ Disagree
   - ◯ Strongly Disagree
   - ◯ Very Strongly Disagree
   - ◯ Unsure

2. 2. Government building projects are more expensive compared to private ventures

   Mark only one oval.

   - ◯ Very strongly agree
   - ◯ Strongly agree
   - ◯ Agree
   - ◯ Disagree
   - ◯ Strongly Disagree
   - ◯ Very Strongly Disagree
   - ◯ Unsure

APPENDIX 3: Archival Projects

Historical Building Cost Information for Nigeria

APPENDIX 4:

Certificate of Ethical Approval

Applicant:

Ozavize Banwo

Project Title:

DEVELOPMENT OF A FRAMEWORK FOR BUILDING COSTS INFORMATION MANAGEMENT IN NIGERIA

This is to certify that the above-named applicant has completed the Coventry University Ethical Approval process and their project has been confirmed and approved as Medium Risk

Date of approval:

03 April 2019

Project Reference Number:

P89781

APPENDIX 5: Participant Information Sheet

PARTICIPANT INFORMATION SHEET

Research Tittle:	Development of a Cost Information Management System in Public Procurement in Developing Countries
Research Case Study:	Nigeria
Research Aim:	The main aim of the research is to develop a cost information management system in public procurement in Nigeria to enhance performance and efficiency in the public-sector procurement in the construction industry.
Participation:	I understand that my participation is entirely voluntary that I can change my about taking part in the project at any point with no consequences to deciding not to participate in the project
Data Protection:	I understand that all details of the material discussed are confidential and agree not to disclose any of the information given to any other party. All consent forms will be stored in a separate secure (locked) location from the raw data itself I will only retain the raw data from the project until my final mark for my thesis has been awarded. The data will thereafter be destroyed I agree to the use of anonymized quotes for participants in these project and other academic publications
Targeted Participants:	Participants chosen to participate in this research are key players in the Nigerian Construction Industry with a wealth of experience and specialist industry knowledge which is highly coveted. Participants views on public procurement and cost information management will help in providing a grounded picture on the current issues and future trends of this subject in the Nigerian public procurement practices and the Construction Industry at large. In other words, their participation will aid the achievement of the stated aim and objectives of this research.
Participant Experience	Targeted Participants will be practitioners in the procurement and construction industry with work experience from 5years to 15years and beyond

Participation Details An individual interview will be conducted with you, which would last for about 45 minutes to 1hour.

Questions regarding your occupational background and questions bordering on the purpose of the research will be asked.

These questions will be asked with the view of eliciting from your wealth of knowledge and specialist industry experience.