IMPACT OF PROJECT QUALITY MANAGEMENT ON THE PERFORMANCE OF RESIDENTIAL ESTATES IN NORTH-CENTRAL NIGERIA

BY

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AUGUST, 2021

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THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF TECHNOLOGY IN PROJECT MANAGEMENT

AUGUST, 2021

ABSTRACT

Great expense of time, money and resources, both human and material, are wasted each year because of inefficient quality management procedures. This has led to poor quality output which is evidenced most times by late delivery of projects to clients, cost overrun of project, poor workmanship. This study examines the role of project quality management on the performance of residential buildings in North-Central Nigeria. It examines factors that influences resident's satisfaction of selected residential estates; determine quality cost that contributes to performance of residential estates; examine quality management practices of selected residential estate and develop a quality management model for sustainable performance of residential estates in North-Central Nigeria. Quantitative data was collected from building professionals from Real Estate Development Association of Nigeria and occupants of selected estates at selected study areas in North-Central Nigeria. Data collected were subjected to statistical analysis using SPSS 23.0. Structural Equation Modeling (SEM) was used to test the hypotheses in this study. The results show coefficient of determination (R Square) of 0.944, 0.93, 0.982 and 0.846 for sustainable performance, quality cost, quality management practice and sustainable quality management model latent variables respectively for residential estates in North-Central Nigeria, viz: This means that sustainable performance of residential estates in North-Central Nigeria moderately explain 94.4% effect on all variables. Quality cost together explains 93.12% effect of all variables. Quality management practices explains 93.1% variance effect, while Sustainable quality management model factor explains 84.6% variance effect. The study recommends proper quality conformity analysis should be periodically carried out for sustainable performance of residential estates.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Buildings are required to provide shelter, comfort, and safety for its occupants. Hence, to attain these purposes buildings are designed, planned, constructed and managed according to certain codes and regulations, governed by experts and government bodies (Amasuomo, *et al*., 2017). The success of any building project could be measured in terms of performance, aesthetics, stability, cost and duration (Ogundipe *et al*., 2018a). According to the authors, the quest for project delivery can be best achieved with adequate design and quality of supervision exercised at planning and production stage. These can be linked to the quality appearance and usefulness of what has been built, the duration observed to build it and the cost of the project. However, Aoieong *et al*. (2002) maintained that quality in construction projects could be expressed as the complete nature and outcome of building production process with emphases on meeting and fulfilling the expected standard. Heravitorbati *et al*. (2011) described quality and success in construction projects as the fulfillment of expectation of project participants.

Building performance is not limited to energy conservation, life cycle costing, and the functionality of buildings. It also needs to focus on users' perspectives on buildings. Ilesanmi (2010) pointed that evaluation by the actual users of a building is important for improving design quality and studies by Ferreira and Cardoso (2014); Ackley *et al*. (2017) supported that evaluation by the actual users of a building is crucial since people spend up to 90% of their time inside buildings where they work, study or live in.

In general, satisfaction is a cognitive or subjective evaluation of the performance of products or services in meeting the needs and expectations of users or customers (Hanif *et al*., 2010). Sholanke *et al*. (2015) pointed that some problems that affect operative service delivery have to do with construction process and material procurement and also maintained that application of low quality of building materials and poor design contributed to buildings collapse experienced from time to time in developing nations. Ogunde *et al*. (2017) posited that construction projects could experience low quality of finished job, project elongation, disputes, delay payment and poor project delivery due to shortage of skilled workers. Ogundipe *et al*., (2018b) argued that lack of safety knowledge of workers during their apprenticeship could negatively impact their skills and response to safety practices on sites. Dimension tolerance is another major problem affecting the procurement and performance of building materials, because materials such as blocks, bricks, reinforcement bars, plumbing pipes and prefab concrete vary in lengths, diameters, strength and sizes (Kim, 2015; Joshua *et al*., 2018; Ajao *et al*., 2018). Wordsworth, (2001) pointed that the condition and quality of buildings in which people live, work and learn reflects a nation's well-being.

Therefore, this study examines quality management as a tool for residential building performance in North-Central Nigeria to improve the quality of building construction in the country and promote sustainability.

1.2 Statement of Research Problem

A great expense of time, money, human and material resources are wasted each year because of inefficient quality management procedures. Arditi and Gunaydin (1997) pointed that acceptable levels of quality in the construction industry has long been a problem. The last

thirty years have also observed groundbreaking studies on improving quality performance of construction projects (CII, 2015). Lee and Arditi (2006) emphasized that the management of quality is an important issue in the delivery of construction projects. Delgado-Hernandez & Aspinwall, (2008) reported that the construction industry in the UK has begun to take up the challenge of quality issues; as a result, companies have won repeat business, increased their market shares and improved their customer satisfaction levels. In the case of Nigeria construction industry, poor quality was traced to the period of oil boom which according to Wahab (1977) heralded a period when too many jobs were chasing a few competent contractors. Onwusonye (2007) noted that public procurement in Nigeria, in the recent past, lacked transparency, with inflated contract cost, use of processes that were discretionary and abuse of public power. The conceptual oil boom and reconstruction after the civil war created a construction boom where demand far exceeded supply. This led to the emergence of contractors with very limited, if any, ability to manage construction.

Aside from the boom, the climate of corruption in the country gave rise to poor-quality construction, the scarcity of materials also made most contractors employ any kind of materials just to finish the project on time. This has led to poor quality output which is evidenced most times by late delivery of projects to clients, cost overrun of project, poor workmanship. Oke and AbiolaFalemu (2009) revealed that the quality of materials and workmanship in Nigeria building industry is not satisfactory and that the problem lies in the use of inappropriate materials supplied to site and inefficient supervision of workmen. This study therefore focuses on evaluating quality management and residents' satisfaction as a tool for residential building performance in North-Central, Nigeria to provide adequate data, promote the quality of building construction in the polity.

1.3 Aim and Objectives of the Study

1.3.1 Aim

The aim of this study is to examine the effects of project quality management on the performance of residential buildings in North-Central Nigeria.

1.3.2 Objectives

The specific objectives of this study are:

i. To examine factors that influences resident's satisfaction of selected residential estates in North-central Nigeria.
ii. To determine how quality cost contributes to performance of residential estates in North-central Nigeria.
iii. To examine quality management practices of selected residential estate in North-central Nigeria.
iv. To develop a quality management model for sustainable performance of residential estates in North-central Nigeria.

1.4 Research Questions

1. What are factors that influences resident's satisfaction at selected residential estates in North-central Nigeria central Nigeria?
2. How do quality costs contribute to performance of residential estates in North-central Nigeria?
3. What are the Quality Management practices of residential estate developers in North-central Nigeria?
4. How can Quality Management practices sustain performance of residential estates in North-central Nigeria?

1.5 Statement of Hypothesis

The following hypotheses will be tested during the research.

Ho_1: The identified factors have no significance on resident's satisfaction at selected residential estates in North-central Nigeria.

Ho_2: There are no cost of quality that contribute to performance of residential estates in North-central Nigeria

Ho_3: There is no significant relationship between quality management practices used by residential estates developers and performance of residential estates in North-central Nigeria

Ho_4: sustainable quality management model has no significant on performance of residential estates in North-central Nigeria.

1.6 Justification of The Study

Most of the evaluation research in architecture and housing fall into three environmental dimensions: the physical, the social and the socio-physical environments. In all cases, the assumption is that residents judge the adequacy or habitability of their environments based on predefined standards of quality. Some studies evaluate cognitive responses to the physical environment, focusing on issues such as the perceived quality of buildings and environmental quality (Kane *et al.*, 2000; Fornara *et al.*, 2006), but this study looks into occupants' satisfaction index and building feature that best provide maximum performance.

Historically, building performance was evaluated in an informal manner, and the lessons learned were applied in subsequent building cycles of similar building types (Preiser, 2002). Although informal, subjective evaluations of the built environment have been conducted throughout history, systematic evaluations, employing explicitly stated performance criteria with which performance measures of buildings are compared, but recently a significant increase in the scope, number, complexity and magnitude of evaluation studies and

publications, with developments such as: the use of multiple buildings for data collection and comparative analysis; the use of multi-method approaches to building evaluation; the investigation of a comprehensive set of environmental factors have been captured in most the recent studies (Kane *et al.*, 2000; Fornara *et al.*, 2006), this necessitates the study as it intends to capture this gap.

Firstly, the study will provide information and feedback to the architect and the construction company responsible for the design of the building environment. This can lead to improved building design and can influence and change the roles of professionals involved in a building project so that flaws in design or construction-related mistakes are not repeated. Secondly, the study is capable of empowering end-users through post-occupancy evaluation occupants help to provide benchmarks and contribute towards research on architecture and buildings to show how the end product (the building design and its management) will meet the needs of the occupants. Finally, the study will access the performance of project management as a tool for effective building performance based on physical, technical and functional performance

Also, the study provides feedback to the project managers and the construction company responsible for the design of the residential buildings. This will aid in improving building design and influence the roles of professionals involved in a building project so that flaws in design or construction-related mistakes are not repeated. The study will also empower end-users as through post-occupancy evaluation, occupants help to provide benchmarks and contribute towards research on project management to show how the buildings will meet the needs of the occupants.

1.7 Scope of the Study

The study will be carried out in North-central Region of Nigeria. The research deal with the role of quality management on the performance of residential buildings, it will focus on four out of the six States in North-central Nigeria, the States to be cover are: Niger, Nassarawa, Kogi and FCT. In Niger State it will cover Mohammed Inuwa housing estates in Minna, In Nassarawa it will cover DallatuTafida Housing Estate in Lafia, in Kogi it will cover Adam Kolo housing estate in Lokoja while in Abuja it will cover Lugbe Housing Estate. The content of this study is limited to the specific quality management performance practices developers adopt to improve performance in the selected residential estates.

1.8 The Study Area

North-Central geopolitical zone of Nigeria consists of six States which include: Benue, Kogi, Kwara, Nasarawa, Niger, Plateau States and the Federal Capital Territory, Abuja as shown in Figure 1.1. However, four States in North-Central geopolitical zone of Nigeria were selected namely: Niger, Nassarawa, Kogi and the Federal Capital Territory, Abuja making it four selected study areas. Niger State is the largest state in Nigeria with Minna as the capital city. Other major cities in Niger state are Bida, Kontagora, and Suleja. It was formed in 1976 when the then North-Western State was bifurcated into Niger State and Sokoto State. Kogi is a state popularly called the Confluence State because of the confluence of River Niger and River Benue at its capital, Lokoja, which is the first administrative capital of modern-day Nigeria. Nasarawa is a state in north-central zone of Nigeria with Lafia been its capital. Abuja is the capital city of Nigeria located in the centre of the country within the Federal Capital

Territory (FCT). It is a planned city and was built mainly in the 1980s, replacing the country's most populous city of Lagos as the capital on 12 December 1991.The study area was selected to represent the general characteristics of the zone in line with established statistical principles.

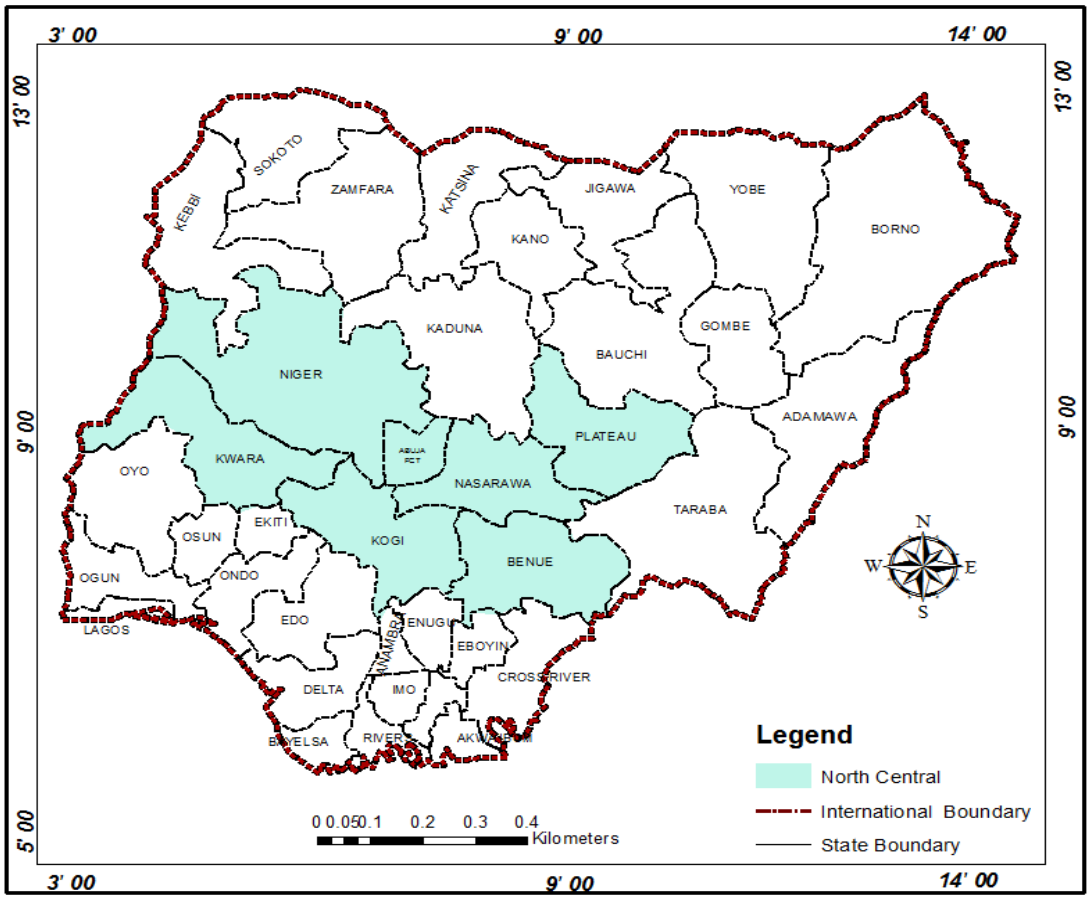

Figure 1.1: Map of Nigeria Showing Study Area

Source: Federal Ministry of Land and Housing, (2019)

1.8.1 Federal Capital Territory (FCT)

The Federal Capital Territory (FCT) is situated at the heart of the country; as such it can be easily accessed from every part of Nigeria as shown in Figure 1.2. The FCT area was created out of Niger, Kogi and the present day Nasarawa states and covers a total land mass of about

8,000 square kilometers. The FCT is divided into area councils and presently has 6 area councils which include Abuja the Federal Capital City of Nigeria which has become a popular and adopted name for the Federal Capital Territory (FCT) as a whole. Also, Abuja has over a hundred registered estate firms which represent over 10% of total registered firms in the 36 states of Nigeria (NIESV, 2013). The headquarters of the regulatory authorities of the practice of real estate valuation's headquarters are as well situated within FCT, Abuja.

Abuja, the Federal Capital Territory is on the longitude 6^0 $44^{'}$ to 7^0 $37^{'}$ E and latitude 8^0 $23^{'}$ to 9^0 $28^{'}$ N. it was created under past federal military government of Nigeria. In 1976 FCT was carved out from part Nassarawa Niger and Kogi states in the central part of the country. The city is confined by a monolith rock called Aso Rock, and the city experiences two annual climatic conditions a year; the raining and the dry seasons. The city is located at sub region of Guinea Forest-Savanna of West Africa. The landscape is the city is characterized with plain, gullies and rough terrain. The major gullies and rough terrain is found around Gwagwa plains where the pitches of rain forest occurrence are predominant. The annual range of rainfall is 127.3mm-118.5mm with average temperature ranges between 21.2^0 C to 31.9^0C.

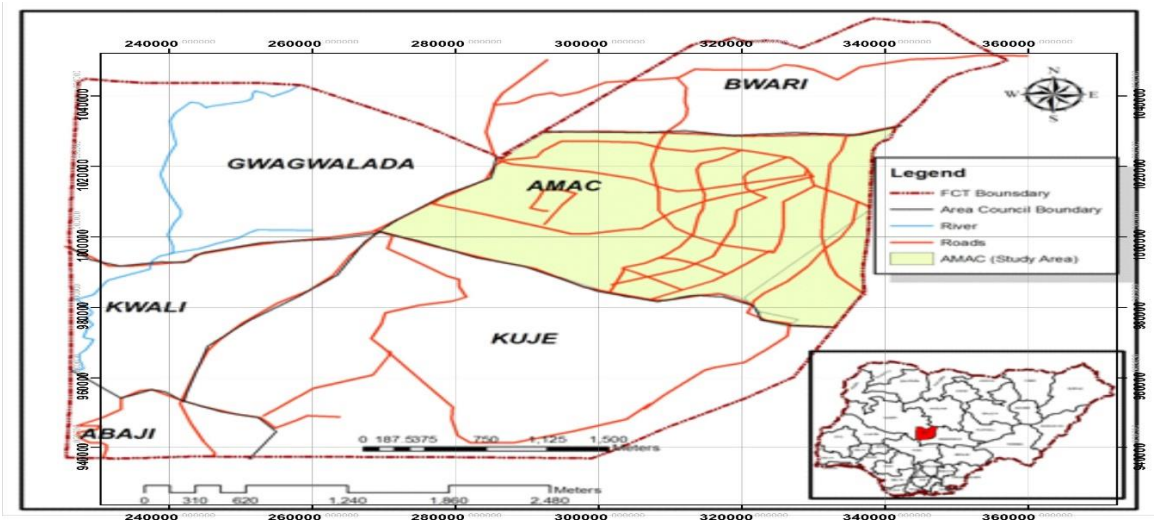

Figure 1.2: Federal Capital Territory (FCT) and its Neighborhoods

Source: FCDA (2019).

1.8.2 Nasarawa State

The location of Nasarawa State in Nigeria coordinates are: 8º 32' N 8º 18'E / 8.533ºN 8.300ºE. It has a total area of 27, 117 km^2 (10,470 sqm), a population of 2,040,097 people (2006 National Population Commission) and a density of75 km^2 (190/ sqm). General Murtala Mohammed created more states and these LGAs were put in Plateau state with Jos as the capital. General Babangida's regime created eleven more states in 1991 as defined in the 1979 constitution. General Abacha's regime set up a committee for creation of more states, which approved Nasarawa state out of Plateau state on October 1st 1996 with the capital at Lafia. Nasarawa State is one of the 36 States of Nigeria (See Figure 1.3). Created in 1996 and covers a total land area of 27,290km2 it has a population of over two million people (2006National Census). It is predominantly rural with agriculture as its main economic base.

- Its proximity to Nigeria's Capital Territory and City of Abuja has a lot of impact on its people, economy and landscape (Nasarawa State Geographic Information System, 2012).

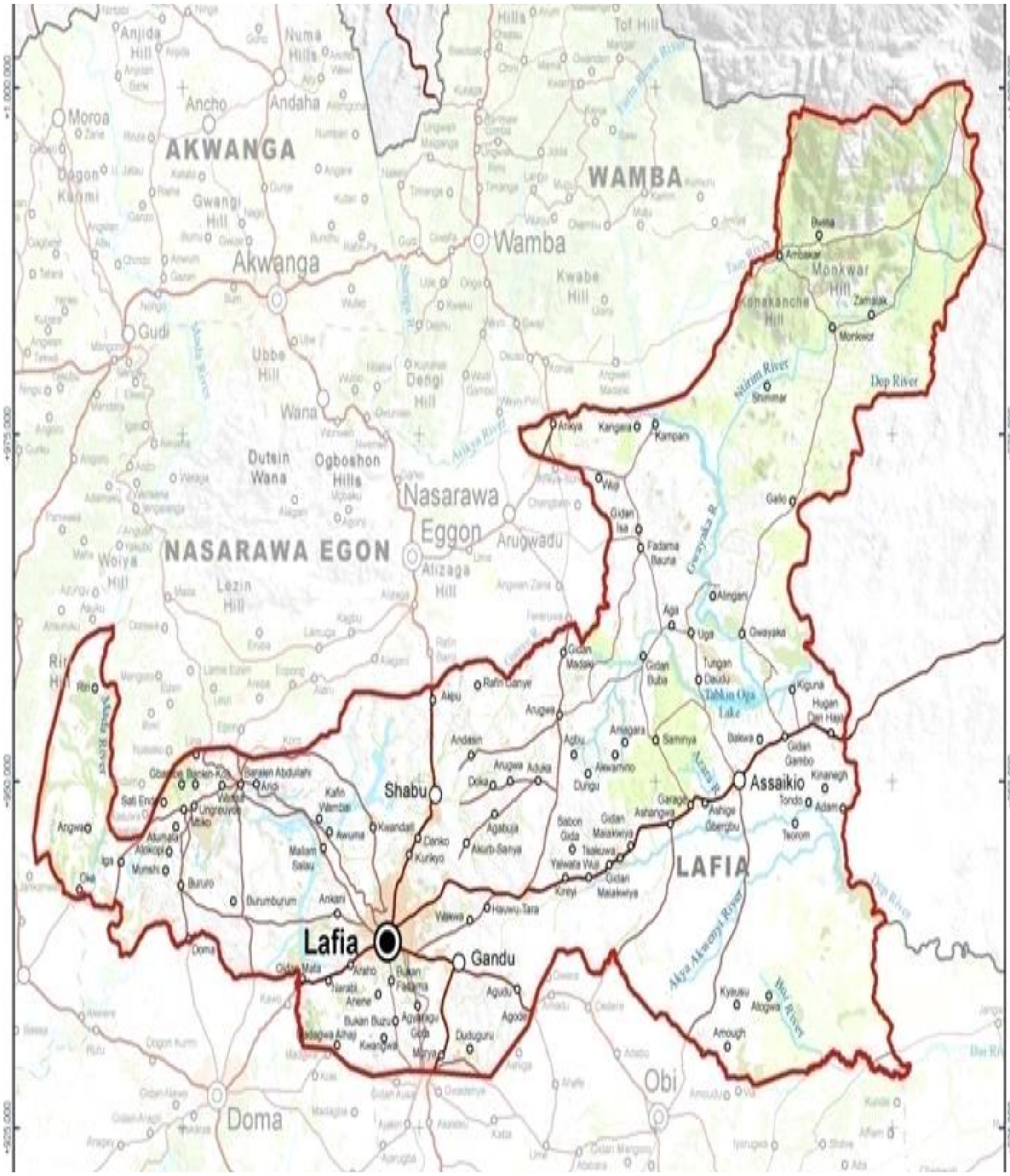

Figure1.3: Map of Lafia in Nasarawa State

Source: Nasarawa Ministry of Land and Housing (2019)

1.8.3 Niger State

Minna Township is the capital of Niger state and comprises Chanchaga and Bosso Local Government Councils. It occupies a total land area about 6,784 square kilometres. It is located on Latitude 9 37' North and 6 33' East as shown in Figure 1.4. The Mean annual rainfall is 1334mm with September recording the highest rain of 3300mm. The town enjoys a typical climate of middle belt zones of Nigeria. The rainy season lasts between 190-200 days; starting on an average from 11^{th} -20^{th} of Aprils. The mean monthly temperature is highest in March at 37 c and lowest in August at 25 c. Moreover, Niger state covers a total land area of about 76,469.903 square kilometers which representing about 8% of the Nigeria land mass, and about 85% is arable. It also records a distinct wet and dry season; the minimum temperature is within December and January while the maximum is within March and June.

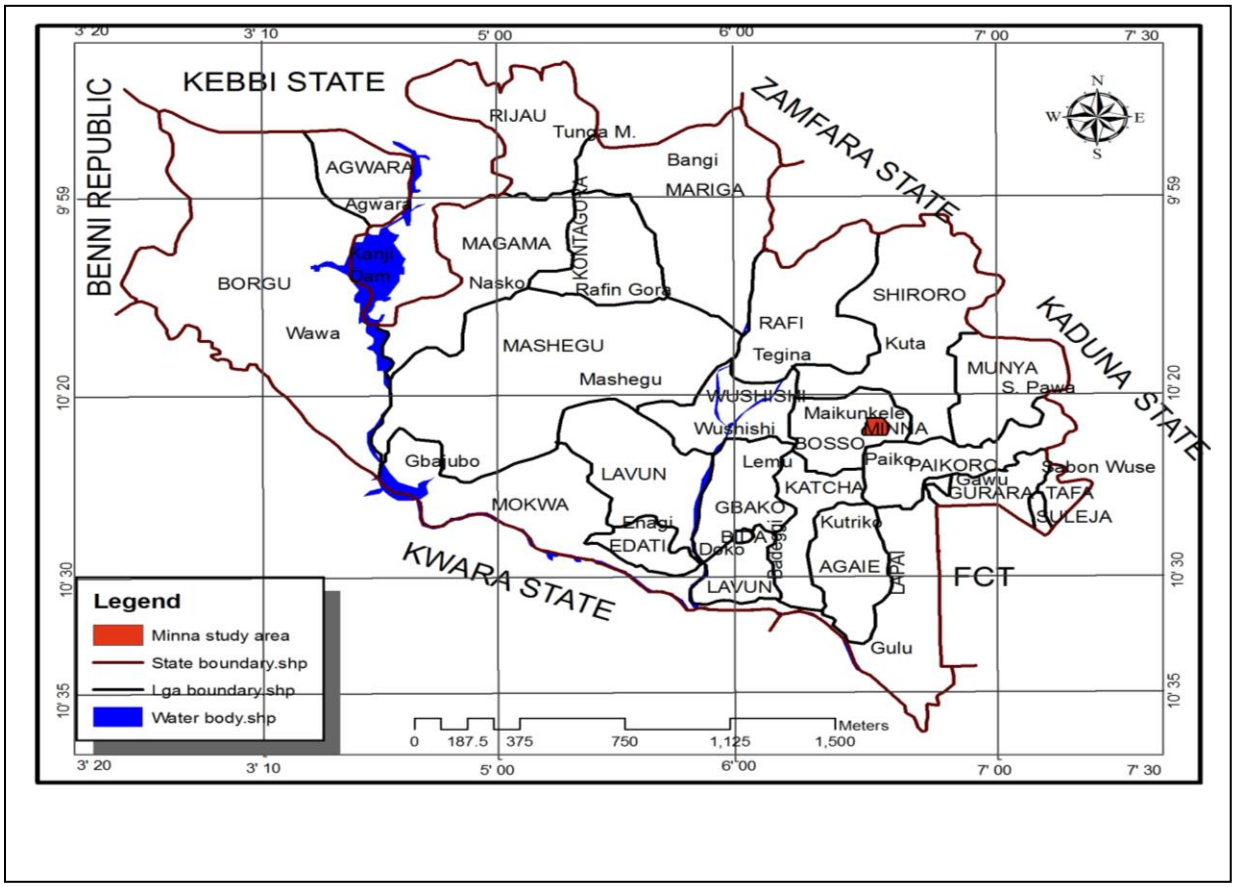

Figure 1.4: Map of Niger State

Source: NIGIS, 2019

1.8.4 Kogi state (Lokoja in particular)

Lokoja, the study area is located between latitude 7º45´27.56´N and 6º41´55.64´E longitude 7º51´04.34´´N and 6º45´36.58´´E, with a total land area of 29,833km2 (Figure 1.5). It shares political boundaries with Niger, Kwara, Nassarawa States respectively and the Federal Capital Territory to the North; Benue State to the East; Adavi and Okehi Local Government Areas by the South and Kabba Bunu (LGA) by West (Oyebanji, 2012). It is popularly called the confluence state because of the confluence of River Niger and River Benue at its capital.

Lokoja is the first administrative capital of modern-day Nigeria (Ojo, 2014). The bigger rivers have wide flood plains such as the portion of the lower Niger in Kogi state, which is more than 1,600 metres wide at Lokoja, while the small streams have narrow valleys. The general relief is undulating and characterized by high hills. The Niger-Benue trough is a Y-shaped lowland area which divides the sub-humid zone into three parts. The land rises from about 300 meters along the Niger - Benue Confluence, gradually reaching up to 600 meters above the sea level in the uplands. Lokoja is drained by Rivers Niger and Benue and their tributaries. It has been deeply dissected by erosion into tabular hills separated by river valleys. The flood plains of the Niger and Benue river valleys at Lokoja, is made up of hydromorphic soils which is a mixture of coarse alluvial and colloidal deposits. The alluvial soils along the valleys of the rivers are sandy, while the adjoining lateritic soils are deeply weathered and grey or reddish in colour. The soils are generally characterized by a sandy surface horizon overlying a weakly structured clay accumulation.

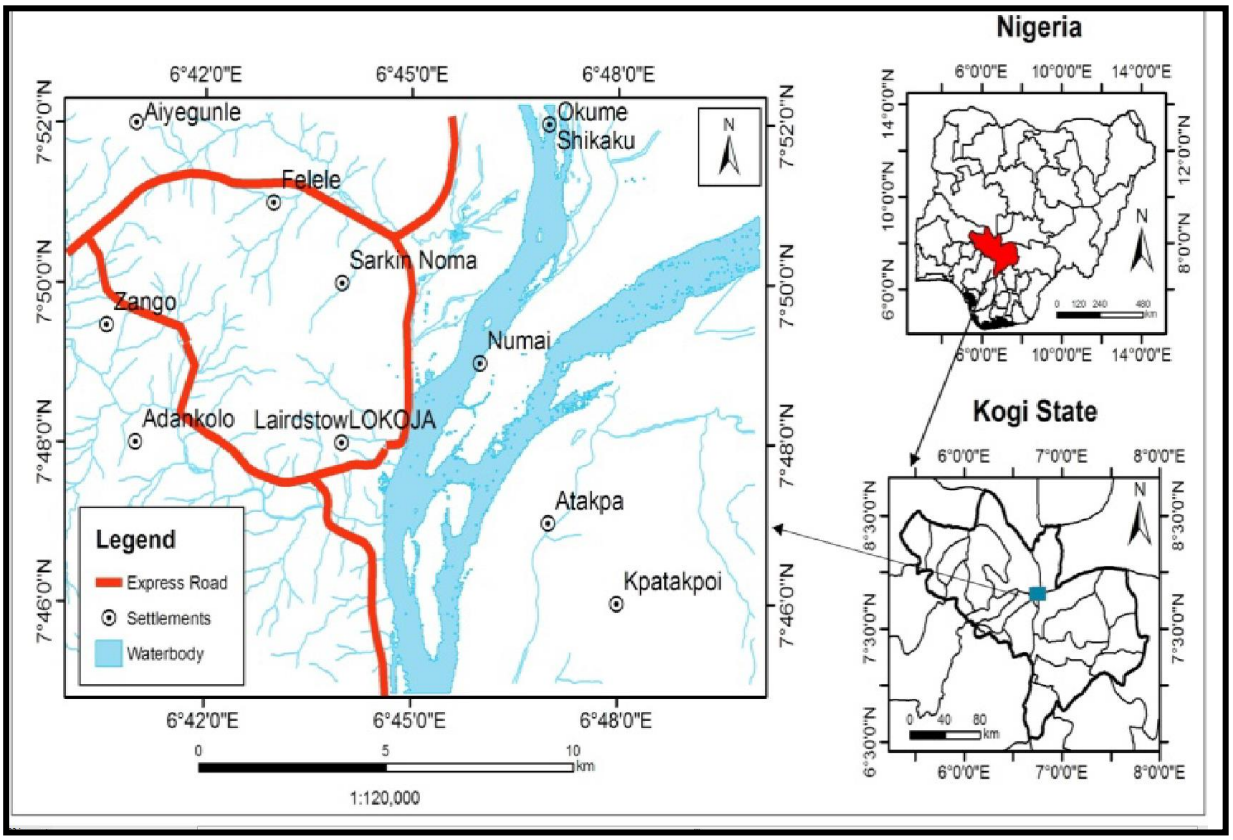

Figure 1.5. The Study Area (Lokoja city, Nigeria)

Source: Kogi State Ministry of Land and Housing with Authors Modification, 2019

Kogi state is surrounded by many other states which are; Abuja to the north, Nasarawa state at the north-east, Benue state at the south, Enugu state at the Southeast, Anambra state at the south, Edo state at the Southwest, Ondo and Ekiti at the West, Niger state at the North and Kwara at the North-west. Kogi state has 21 Local Government Areas and they are; Adavi, Ajaokuta, Ankpa, Bassa, Dekina,Ibaji, Idah, Igalamela- Odolu, Ijumu, Kabba/Bunu, Kogi, Lokoja, Mopa-Muro, Ofu, Ogori/ Mango, Okechi, Okene, Okmaboro, Omala, Yagba East , Yagba West.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Review

2.1.1 The Concept of Project Quality Management

Quality management generally is a method that ensures that an organisation is involved in producing high quality outcomes in everything they do. Willar (2012) stated that earlier researches into quality for construction did not give a clear-cut definition of the subject matter. However, according to American Society of Civil Engineering (2005) quality refers as meeting the legal, aesthetic and functional requirements of a project. These requirements may be simple or complex, or they may be stated in terms of the result required or as a detailed description of what is to be done.

This research identified sections of quality management mainly from TQM and ISO 9001 standards, including the challenges or factors affecting quality management and quality improvement practices in the global construction industry.

For construction projects, quality management means making sure things are done according to the plans, specifications, and permit requirements. The days of embarking on projects which usually involve huge funds without due diligence and proper regulation seem to be over, making it imperative that communities get the most out of their infrastructure projects (Arditi, 2004). Gunaydin (1997) opined that one of the best ways to assure good construction projects is to use an inspector. The first step an inspector should take is to become familiar with the plans, specification, and permit requirements and, equally important, to ensure quality control during all construction phases needs to be better, and the utility system needs

to know what is being installed while the work is being done. On most construction jobs, the inspection is one of the last things to be done if it gets done at all.

2.1.2 The Practice of Project Quality Management

The American Society for Quality Control characterizes quality as "the aggregate components and attributes of an item or administration made or performed to fulfill clients‟ needs at the period of buying and during utilization" Talha (2004).

Quality management on the other hand, can be defined as a managerial approach geared towards in cooperating inherent managerial tendencies of planning, control and improvement. Manufacturing-based definition positions quality management as design activities and manufacturing practices aimed at enhancing product quality. The ISO 9000 defines quality management as the set coordinated activities directing and controlling an organization's quality projections. The activities encapsulate quality planning, quality control, quality improvement and quality assurance.

Value is defined as identifying the client's wants and their fulfillment. Numerous associations have concentrated on quality and diminished their expenses to increase consumer loyalty e.g. Toyota in Japan, Samsung in South Korea. As indicated by Foster, (2001) and Maguad, (2006) accomplishing consumer loyalty relies on upon not just how well and how closely quality activities in the few areas of the association work exclusively but also on how well they cooperate. As indicated by Kusaba (1995) quality alludes to the diverse workmanship of different exercises. Thus, every business or movement has a varied meaning of value, for instance in sales the term quality is more centered around the client, while in

manufacturing, the term quality is more centered around the production procedure, and in development, quality alludes to both services provided and outputs.

Quality is dictated by the client and the marketplace and incorporates all the items characteristics. Quality incorporates everything that the customer expects and requires and is persistently evolving. The definition considered the clients who direct the quality, and alterable as indicated by client necessities. Mukherjee (2006) shows that quality fulfills three F's-Fit, Form and Function. This is a customary meaning of value is essentially bound to an item fulfilling the requirement for the required measurements, fitment, required frame and feel. The item ought to likewise have the capacity to satisfy the capacities fancied to be performed by the item. Quality is more than an instrument or issue used to increase upper hand for organizations since it involves survival. In this way, the greater part of the quality ideas specified above concentrate on giving an item that fulfills and address the client's issues. Quality is subsequently to a great degree essential for the associations to guarantee that they have conveyed their items or administrations as indicated by the client desires and necessities (Muchemu, 2008).

In addition, every individual has his or her own idea of value and it is extremely hard to give particular definition for quality, yet there is most likely and everybody can concur that, quality is flawlessness through control, precision, and fulfillment in work.

The philosophy of quality management has identified its key drivers as the vehicle to achieving manufacturing excellence within an organization. Quality management is aimed at elimination of error and waste in the manufacturing environment by get things right the first time through mechanisms such as continuous improvement, statistical measurement and having a mentality of zero defect (Lindsay and Evans, 2007). In the manufacturing scene, the definition of quality differs from that of the service industry. Manufacturing

organizations produce tangible products that can be seen, touched as well as directly measured. This means that quality in the manufacturing firms has a focus most of the time on tangible product features. According to Moore (2012) the most common definition of quality in manufacturing is on conformance. Conformance is defined as the degree to which the characteristics of a product meet standards that have been preset. Quality in the manufacturing scene is also defined in terms of performance, reliability, the features, durability and serviceability.

Altiok (2012) argues that one cannot inspect quality into a product. A product will remain in the same quality it was produced during inspection no matter how many inspections are done; it will remain unchanged. The delivering of quality for optimal performance in an organization is integral and involves also practices that prevent failure from occurring and hazardous that would jeopardize performance. Muchemu (2008) posited that the benefits of quality in a manufacturing organization can only be underscored by the pattern of spread and through quality initiatives. Through quality management, there are two purposes that are achieved in a manufacturing setting. Firstly, the present situation is well known preferably through a recent study that was done based on past development. Secondly, the focus is additionally on future areas of concentration.

Quality concepts have been identified empirically to spread unevenly in the functional areas of an organization states (Crosby, 1979). The questions that are considered include: which are the functional areas that have the highest spread and why? What implications are created by the uneven spread of quality concepts in an organization? When answers are gotten to such questions, the management of an organization is able to frame and come up with quality management strategies. In a manufacturing setting, at its early stages of development, the

concentration on quality is in functional areas that will bring about the highest benefits and profits (Zabel and Avery, 2002).

This area is mostly in operations/manufacturing and product design. As an organization grows in time, quality initiatives spread to other functional areas such as services, sales, marketing and administration. In sum, the incremental benefits of quality initiatives should be planned for implemented at all the stages of growth for an organization to achieve optimal performance.

2.1.3 Application of Quality Management Systems in the Construction Industry

Some of the recognized quality management standards include; The ISO9000 series, Total Quality Management, Quality Control, Quality Assurance, Malcolm Baldridge (MB) standard and BS 5750 of the British Standard Institute (BSI), European Construction Institute (ECI) which produced the (ECI) Matrix in 1993 (Kado, 2011).

According to the ASCE manual (2012) the primary purpose of codes and standards is to protect the public's health and safety, compliance with codes and standards should be an issue addressed early in the design phase. Without early identification of the appropriate codes and standards, reworking plans and specifications can result in considerable cost and delay. The design professional must be knowledgeable about the provisions of codes and standards before starting the design process because the building codes directly control the minimum standards of many components of a building project, and are responsible for much of the finished product quality. Kubal (1994) claims that regulations controlling the construction processes are much more restrictive than in most manufacturing and service industries. (Stasiowski and Burstein, 1994) underline that quality design begins with sound engineering

and scientific principles which must satisfy the criteria of applicable codes and standards, but also the owner's project requirements. Codes and standards refer to the minimum criteria. Owners, however, may have certain requirements.

Table: 2.1 Shows the gradual evolution and metamorphosis of quality improvement which have been catalogued by various authors and researchers over the years.

Table 2.1: Evolution of Quality Movement in Construction

Duration	Quality Systems
Pre – 1900	Quality as in integral element of craftsmanship
1900 – 1920	Quality Control by Foremen
1920 – 1940	Inspection-based Quality Control
1940 – 1960	Statistical Control
1960 – 1980	Quality Assurance and Total Quality Control
1980 – 1990	Total Quality Management (TQM)
1990 – 2000	TQM and Culture of continuous improvement
2000 – Present	Organisation-wide Quality Management

Source: Abdul-Aziz, (2002)

2.1.4 Concept of building performance

Building performance is a complex evaluation system for global building quality. The process goes through estimating of user's satisfaction for essential quality demands towards a diagnose that should be used to improve buildings quality and to draw new levels of performance for further building design. In order to improve the complex and the objective

process of user's level of satisfaction assessment for each quality need are to be used a mix between subjective methods- statistical analysis for users demands- and objective one's simulations, mathematical calculus, PC aided programs. The final scopes of this concept are to constantly improve interior environment, a major defining characteristic for building system.

Traditional aspect of performance is linked to noise control, fire-safety, thermal efficiency, interior air quality, space safety, and so on.

To estimate how well a building will behave on holistic terms and on long term the Total Building Performance seams to become more important.

This goal can be realized by applying the right building solutions even from design stage a correct using of the construction throughout life cycling by assuring optimal condition for interior comfort, by cutting-off pollutants and continuously monitoring indoor air quality, monitoring the structural elements behavior and this impact on interior and exterior space quality. Buildings are, in an incipient level of definition, systems that creates protected environment controlling temperature, humidity, light and ventilation needed to sustain human life and productivity. Multiple ways of understanding the possible ways of interpretation are developed inside the more important idea of estimating building's success. The field spread out from the basic and cynical financial ones until functional and esthetical criteria. The act of assessing inside the more general process of performance measure and comparing with estimated performance criteria leads to conclusion about the level of performance a building has achieved. Recommendations, aside with their estimations, are to be used as future directions for similar building performances (Figure 2.1).

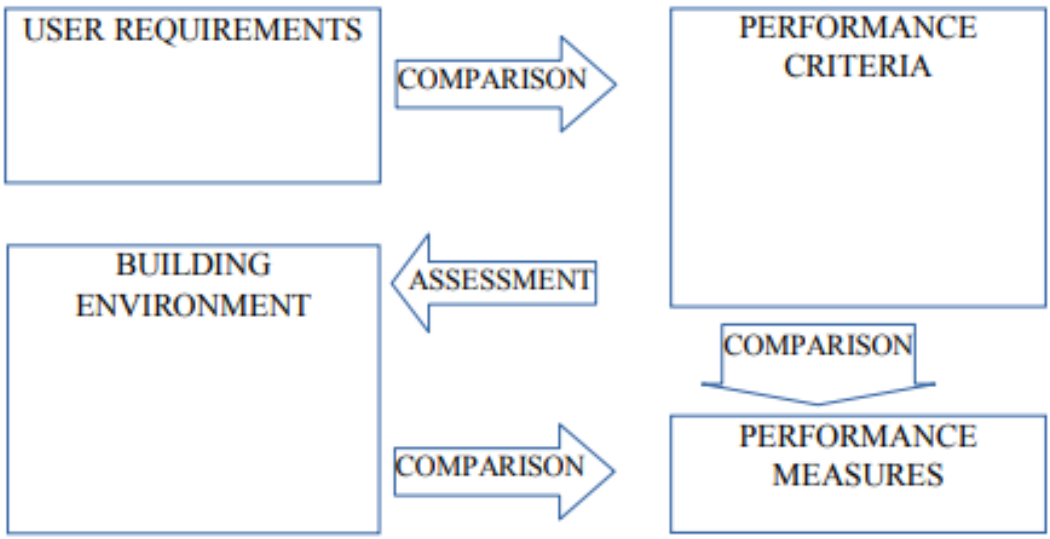

Figure 2.1: Performance Concept in Building

Source: Akingbade, (2015)

Objective goals in building performance evaluation is directly influenced by the level of precision in user's satisfaction level assessment. This process can be realized on many different ways with minor differences among them, as proved by tradition. Building systems are exponentially developing as well as users' requirements, together with technological and social evolution, proving that coordinating this system becomes complex on a daily base. The defined criteria are: a) Spatial Comfort (SC); b) Indoor Air Quality (IAQ); c) Visual Comfort (VC); d) Thermal Comfort (TC); e) Acoustical Comfort (AC); f) Structural Integrity (SI). The last process is to integrate user requirements levels of satisfaction in different modes into TBP using mathematical formulas, quality function deployment (QFD), or adding satisfaction levels multiplied by weight factors determined by specialists. The final score can be presented as percentage from the maximum level expected from an idealistic situation for need obtained from users. This can be helpful to compare two buildings, to improve future design process and to identify objectives to be increased for the same building types. The

analysis is to be done in a holistic mode, integrating any domain involved alongside the connection between them.

Through quality management (QM), an organizational strategy can be adopted that leads to improvement of product and service quality (Moore, 2012). QM over the years has been sold as a commodity and remedy that can solve a lot of organizational problems which include high performance in a firm. Through the contingency theory in contrast to this, which is all about "no one best way" asserts that high performance comes about as a result of the alignment between organization systems/processes and implicating context factors. Most studies indicate a positive relationship between QM and performance while some studies indicate a negative relationship (Mohanty, 2008). Thus, organizational performance refers to how effectively and efficiently manufacturing firms are conducting their activities so as to achieve optimal productivity (Rajab, 2014).

In the manufacturing sector, the measure of performance is in the form of different metrics such as schedule performance. Further on, performance can also be measured through the use of measurement systems that are implemented in production plants and service delivery (Hoyle, 2007). The implementation of systems gives the organization the ability to keep track of business progress. The knowledge that is gained on the manner in which the different areas of a business are performing is fundamental and additionally, the right measurement system will determine this. The measures of performance in the manufacturing scene have to be quantifiable factors that may be clearly linked to success indicators such as operational and financial performance, value creation, competitive advantage and synergy. In the manufacturing scene, performance measures go beyond the financial aspects argues (Crosby, 1979).

The first step in the measurement of performance in the manufacturing scene is through the identification of the key areas that drive business performance. The next step is the setting up of performance targets which assist in giving everyone and opportunity to know what is being aimed for (Buchholz and Appelfeller, 2011).

Preliminary evidence indicates that firms which adopt quality management practices experience better performance compared to those that do not (Zabel *et al*., 2002). The customers in the world of today have their demand on high quality products more sensitized. Organizations that cannot deliver this have the risk of running out of business thus an indication of poor performance. Based on empirical evidence, McCollum (2004) demonstrates that world class organizations such as General Electric and Motorola have attributed their performance to having one of the best quality management programs in the world. The two companies are noted to have implemented the Six-Sigma quality program. In the initiative, the level of defect is reduced to approximately 3.4 parts per million (Mohanty, 2008). This can only be achieved when every employee in the organization is trained on quality issues (McCollum, 2004). Motorola in the long run was able to win the prestigious Malcom Baldridge National Quality Award in 1988. In both companies, quality is considered as a critical factor that leads to the increased sales and market share thus good performance.

Quality management in an organization can be achieved only when the top brass such as managers and top executives play their role in driving the change (Hoyle, 2007). Besides this, there are other factors and principles that drive the implementation of QM. Hoyle (2007) highlights that over and over again that the top management of an organization as a driving force in ensuring firms achieve an orientation to quality. In the process, firms are able to

create value, establish objectives and systems that will satisfy the expectations of customers which in the long run will improve on the performance of the organization. When quality management is successfully implemented in an organization, it will lead to performance drivers such as lower costs, greater efficiency, better product quality, improved market share, increased motivation and satisfaction (Altiok, 2012).

2.1.5 Benchmarks for building performance

Early environmental design initiatives focused only on the reduction of energy demands. Different institutes and governmental initiatives developed tools and policies to address this problem. In the 1980s and the 1990s, some of the initiatives started to reflect concerns about the sustainability of the construction industry and, in 1993, the UIA/AIA Word Congress of Architects concluded that it was a bold challenge to the profession of an architect to put a broader sustainability agenda into practice (Guenther, 2008). In 2000 many of these initiatives began to incorporate sustainable design strategies as basic and fundamental in standard practice. In 2005, the American Institute of Architects (AIA) established a more aggressive position on the responsibility of design professionals, supporting the position that the architects would have to change their professional input and work together with the clients, thus changing the actual paradigm of designing and operating a building (Hamilton, 2013). In order to guide and support the development of strategic plans for residential buildings, it is fundamental that benchmarks for comparison between institutions can be established. This is important because it allows for identifying: the causes of the differences at the resources consumption, accessibility, quality, economic, and financial performance levels; the potential for improvement of each hospital at the level of each assessed performance category or sustainability parameter; the best and conventional building use

practices (e.g., best operational energy efficiency practices); and the transversal different programs (including healthcare activities themselves) to be launched for the practical implementation of the identified improvement potential. Thus, the benchmarking process in the field of healthcare buildings, aims at improving both the environmental and societal quality of hospitals, while enhancing their economic and financial performances.

Therefore, benchmarking is a continuous and systematic process for evaluating each organization's products, services, and/or work processes for the purpose of organizational improvement (Stapenhurst, 2009). It is a business tool that has blossomed in the 1980s and is now widely used in Total Quality Management (TQM) for comparing performance and identifying improvement opportunities (Hamilton, 2013). Fundamentally, a "benchmark" is a reference or measurement standard used for comparison. "Benchmarking" is the continuous activity of identifying, understanding and developing better practices and processes that will lead to higher performance.

It is the process of comparing one's business processes and performance metrics to industry's best practices. Figure 2.2 presents a typical benchmarking process

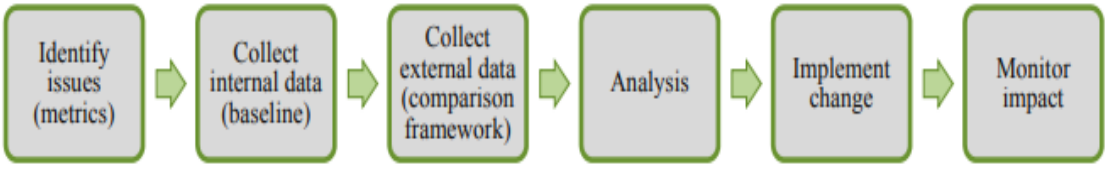

Figure 2.2 Typical benchmark process
Source: Hui, 2020

For building and facility management professionals, benchmarking is a strategic management tool which allows operating costs or other metrics to be assessed against similar properties and to evaluate how a given property or portfolio performs relative to its peers.

Through detailed comparative analysis, the benchmarking process can identify priority areas for the implementation of both more efficient operations and management practices by trimming costs or adjusting service levels. Nevertheless, the quality of a construction work, in order to be considered completely reliable, should meet two fundamental requirements, which are measurability and objectivity. Therefore, the main goal of this research is to reduce, as much as possible, the subjectivity of the assessment method of a new sustainability assessment tool by defining adequate methods to set the benchmarks for the sustainability indicators.

2.1.6 Quality Assurance and Quality Control

According to Ferguson and Clayton (1998) Quality Assurance (QA) is a program covering activities necessary to provide quality in the work to meet the project requirements. (QA) involves establishing project related policies, procedures, standards, training, guidelines, and system necessary to produce quality. The design professional and constructor are responsible for developing an appropriate program for each project. (QA) provides protection against quality problems through early warnings of trouble ahead. Such early warnings play an important role in the prevention of both internal and external problems". On the other hand, Quality Control (QC) is the specific implementation of the (QA) program and related activities. Effective (QC) reduces the possibility of changes, mistakes and omissions, which in turn result in fewer conflicts and disputes.

As mentioned earlier, quality in construction is too important to be left to chance. A look at history gives some insight into the problem. Through the first half of the 20th century, engineers and architects were in total control during the design phase. During the

construction phase they carried out a role described as 'supervision', ensuring that the owner received his money's worth in terms of quality. In the 1950s and 1960s, owners became increasingly concerned with cost, schedule and areas where design professionals were not providing good control (O'Brien, 1989). The emphasis continued to be on quality and control of exposure to liability. At about the same time, the widespread use in the public sector and, to a large degree, in the private sector, of the sealed competitive bid gave the owner the advantage of competitive pricing, but also forced the general contractor to look for every advantage during construction to control cost and maintain a profitable stance. As mechanical and electrical systems became more complex, the general contractor turned responsibility for such work over to subcontractors, including quality control of their workmanship (ASCE, 2005).

2.1.7 ISO 9000 Series

The Geneva-based International Organization for Standardization first published a series of standards in 1987. The term ISO describes the series of international standards dealing with product design, production, delivery, service and testing. The ISO 9000 series comprises two basic types of standard: those addressing quality assurance and those addressing quality management. The quality assurance standards are designed for contractual and assessment purposes and are ISO 9001, ISO 9002, and ISO 9003 (British Standards Institution, 2008). The quality management standard is ISO 9004 and is designed to provide guidance for companies developing and implementing quality systems (Doyle, 1994).

A company registered as complying with ISO standards has demonstrated to an accredited third party (an approved outside auditor) that its processes have been documented and that the company is systematically auditing and being audited that they are following the policies

and procedures necessary to produce high quality products. ISO standards are directed towards improving a firm's production processes (Arditi, 2004). A TQM system is the big picture and is concerned with customer satisfaction and all activities conducted by a firm.

A good way of viewing ISO is that the emphasis in the ISO registration is on the management of process quality. This is not meant to minimize the role of ISO in a TQM system. The ISO standards provide an excellent beginning point for a firm starting a TQM program (Arditi and Gunaydin, 1997). Recent publications on construction quality management highlight the important activities that should be performed in relation to the application of an effective QMS-ISO 9001. According to Rumane (2011) organization needs to demonstrate its ability to consistently provide products that meet or exceed customer expectations and satisfaction, while also adopting appropriate processes for the continued improvement of the QMS and related assurances of conformity to customer and applicable regulatory requirements. Watson and Howarth (2011) also emphasize that for ISO 9001 to remain a process-based system with heavy emphasis on compliance, an organization is required to rigorously conduct an assessment of organizational performance, set against a standard and leading to accreditation. Clearly, the context of an effective QMS implementation is to ensure that work is performed according to specifications, throughout the design and development phases, manufacturing and construction, and servicing, and also ensure that customers are satisfied with the resulting products and services (Beaumont, 2006).

Figure 2.3 illustrates the process model of ISO 9001, with the focus on customer requirements and satisfaction.

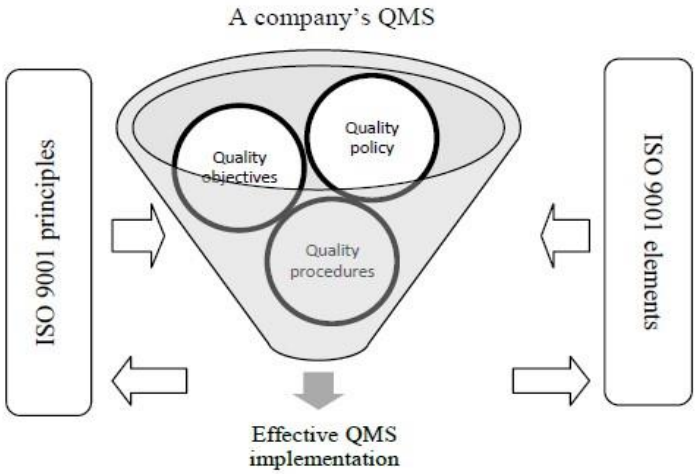

Fig 2.3: Effective ISO 9001 Quality Management System
Source: (Willar, 2012)

2.1.7 Total Quality Management Factors

Establishing the project requirements for quality begins at project inception. Artidi and Gunaydin, (1997) opined that a careful balance between the owner's requirements of the project costs and schedule, desired operating characteristics, materials of construction, etc. And the design professional's need for adequate time and budget to meet those requirements during the design process, it is essential that owners balance their requirements against economic considerations and, in some cases, against chance of failure.

The design professional is obligated to protect public health and safety in the context of the final completed project. The constructor is responsible for the means, methods, techniques, sequences, and procedures of construction, as well as safety precautions and programs during the construction process. Project requirements are the key factors that define quality in the process of construction. The process of construction can be broken down into three main phases, namely,

- The planning and design phase,
- Construction phase, and
- Operation and maintenance phase.

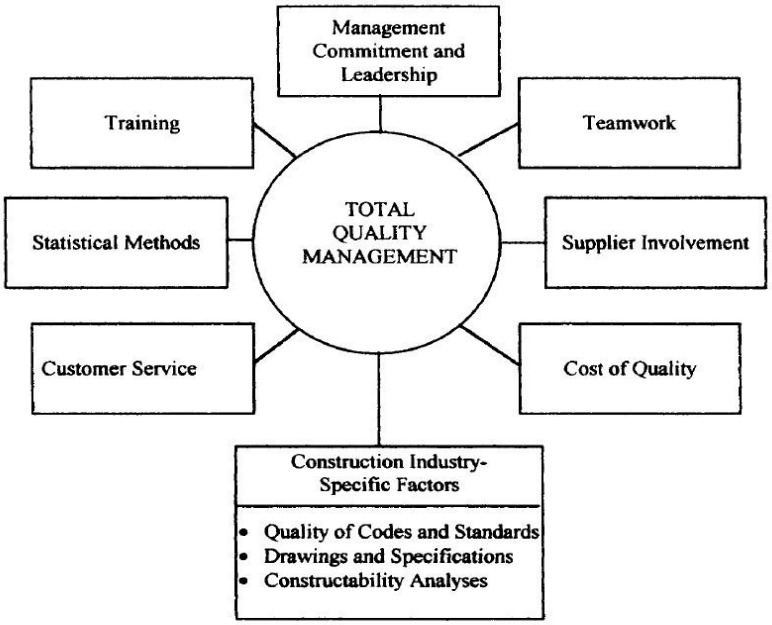

Figure 2.4: Total Quality Management in Construction Process
Source: Arditi & Gunaydin (1997)

Total Quality Management shows in Fig 2.4 generally accepted elements of TQM and construction industry-specific factors that affect quality of the process of a building project. Some of the factors that affect quality in each phase of the construction process have been identified through a literature review and are discussed in the following sections.

2.1.8 Management and Leadership

The Business Roundtable construction industry cost effectiveness study concluded that the primary causes for the decline of construction productivity directly or indirectly involved poor management practices (Burati, Michael and Satyanarayana, 1992). Since quality is part of productivity, the first step for management is to recognize that there is a problem. The

success of a TQM program first of all depends on management practices. TQM is a culture and philosophy that must permeate an organization as the method of management. It can thrive only under a senior management that establishes TQM as a top priority. This commitment must be coupled with a thorough understanding of TQM. Only if supported by this commitment and understanding, can senior management lead the company toward the realization of higher quality in its undertakings. The prominent method of management practiced in the United States today, including the construction industry, is management by control, not by participation. Forced by international competitive pressures and increasing demands for quality products and services, industries are re-evaluating the effectiveness of management by control. According to Joiner and Scholtes, (1988) in style of management, the emphasis is on the organizational chart and the key control points within the structure. All managers, beginning at the top, are given certain goals for the next year. They in turn, set goals and impose controls on each of their subordinates. In construction terms, cost, schedule, and possibly quality goals are established for each project. Project managers are rewarded on the basis of meeting these goals. This method has been somewhat successful. It is simple, logical, and consistent. But there are problems when the work gets displaced by the controls themselves (Burati *et al*., 1992). Also, competition to meet short-term goals can lead to internal conflict, adversarial relationships, reduced communication, accusations.

In Figure 2.1 Elements of total quality management in the construction process when goals are not achieved, and even fabricated reports of conformity. Management by control encourages an organization to look inward rather than outward to the customer and the customer's needs (Juran, 1988). Once it acknowledges that there is a problem, the second step for management is to develop a clear understanding of the underlying principles and

elements of TQM. Management then demonstrates its commitment to quality through action. Without this understanding, management's action will most likely contradict TQM, confirming the doubts of the labour force and dooming the effort to failure (Oberlender, 1993). The findings of a survey conducted by construction managers, designers, contractors and facility managers to investigate TQM in the design, construction, and operation phases of projects undertaken in the USA, indicated that the level of management commitment to continuous quality improvement was rated as one of the most important factors that affect the quality of the constructed facility (Gunaydin, 1995).

2.1.9 Employee Training on Quality

The importance is recognized by every quality expert. Under TQM, quality becomes everyone's responsibility and the training must be targeted for every level of the company. There should be customized training plans for management, engineers, technicians, home and field office staff, support personnel and field labour (Smith, 1988). It can be argued that the transient construction work force is quite different from the relatively stable manufacturing work force. This transient nature may make it more difficult to train workers, particularly craft labour, for the construction industry (Burati *et al*., 1992). However, there are many aspects, such as training and awareness that are similar between the safety consciousness of construction firms and the implementation of TQM concepts. Many US construction companies that had safety forced upon them with the formation of the Occupational Safety and Health Administration have proven the cost effectiveness of their safety programs and now use their safety records as a marketing tool. It is easy to envision using a good quality performance record as a strong marketing tool. If TQM concepts become widely accepted throughout the construction (Oberlender, 1993) industry, workers switching

from one company to another should require less TQM training since all workers would have received basic quality awareness in their previous employment (Burati *et al*., 1992). The training effort may include instruction in the basics of TQM, cause-and-effect analysis, team problem solving, interpersonal communication and interaction, rudimentary statistical methods and cost of quality measurement. A study of TQM in more than 200 companies found that skills in human interaction, leadership, and initiative are instrumental to the success of any quality improvement effort.

The demands on these interpersonal skills increase as the complexity and sophistication of the technical systems increase. The training effort follows a specific plan, and its implementation and effectiveness are carefully tracked. It is initiated in a limited number of pilot teams. The success stories of the pilot teams are then used to fuel the training effort. Follow-up training is essential, and is part of the overall training plan and a job requirement for each individual. The training of employees in the design phase was found not to be very important in the construction phase and in the operation phase (Gunaydin, 1997).

It follows that operation and maintenance crews working in constructed facilities should be the main recipient of training efforts, Findings are parallel to ISO 9001 which emphasizes the importance of training and underlines that activities demanding acquired skills should be identified and the necessary training provided (Doyle, 1994).

2.1.10 Teamwork among Professionals

Quality teams provide companies with the structured environment necessary for successfully implementing and continuously applying the TQM process. Quality training is conducted and the continuous improvement process executed through a well-planned team structure

(Lukman *et al*., 2011). The ultimate goal of the team approach is to get everyone, including contractors, designers, vendors, subcontractors, and owners involved with the TQM process. At the industry level, extending the TQM concept to the parties mentioned above in the form of joint teams achieves higher customer satisfaction. These joint teams are responsible for establishing joint goals, plans, and controls. The teams provide a mechanism for listening to and communicating with the owner and for measuring the level of customer satisfaction. Two obstacles to establishing joint teams are the state of legal independence between companies and their traditional methods of working individually (Juran, 1988). These obstacles can be overcome in the construction industry however, if the owner is dedicated to doing so. There are several case studies of successful partnering arrangements.

For example, on a large refinery project, TQM was applied on a project team basis; representatives of the owner and the two major contractors on the project served on the project quality steering committee. While this is a new concept, early progress is encouraging (Burati *et al*., 1992). At the company level, teams composed of department representatives are necessary to implement TQM throughout the organization. The same team approach can be used at the project level. "Extent of teamwork of parties participating in the design phase" was found to be the most important factor that affects quality in construction projects Gunaydin's study (1997). In the same study, construction managers and designers ranked this factor as the most important factor. This result shows that teamwork among parties such as structural, electrical, environmental, civil engineers, architects, and owners is essential to reach the quality goals for design. In the construction phase, "extent of teamwork of parties participating in the construction process" was found to be very important and ranked 2nd by constructors and 4th by construction managers (Gunaydin, 1997). It appears that the

importance of teamwork in the design phase was relatively more pronounced than in the construction phase.

2.1.11 Quality Management in Nigeria

The Nigerian construction industry produces nearly 70% of the nation's fixed capital formation, and its performance within the economy has been, and continues to be on the increase. But despite the increased growth of the sector the Nigerian construction industry's contribution to the country's Gross Domestic product (GDP) of 3.05% as at the close of 2012 is still below the World Bank's average of employment in the construction sector of about 3.2% in developing countries. Whereas the sector has remained consistently on the increase in terms employment to about 7.6% of the total employed citizens both directly and indirectly after rebasing of the Nigerian economy according to reports from National Bureau of Statistics (2015).

The construction sector is globally considered to be a basic industry on which the development of a country depends. Wasiu *et al*. (2012) opined that the growth of a country and its development status is generally determined by the quality of its infrastructure and construction projects.

According to Kado (2010), the acceptance of the BSI publication and standard by Nigeria, establishing SON/NSI and the development and National Building Code (2006) in 2007 are all steps towards improvement in the quality of building construction in Nigeria among many other things. In addition, there are laws, decrees, associations, authorities and regulatory bodies that are responsible for regulating building construction practices in the country. The Nigerian Society of Engineers (NSE) was established on February 6, 1958 in London, England and later inaugurated in Lagos on August 20, 1960, had its foundations laid at

Abeokuta in January 18, 1959. It was however unfortunate that Nigerian engineers had to cope with a very hostile environment occasioned by the invasion of the profession with quacks and imposters of all sorts. This has resulted in very poor standard, numerous abandoned projects everywhere, structural failures, fires and outright collapses (Yusuf, 2010). The consequences of this problem led to colossal waste of human and material resources and the terribly battered image and morale of Nigerian engineers. The devastating effect of this was slowing down the progress of this young country in hurry to develop, this attracted the attention of Government thus, the Engineers (Registration, etc.) Act (1970) was promulgated.

Unfortunately, the registration of engineers alone could not stop the continuing bastardization of engineering profession by quacks and attendant consequences. Thus, further through further hard work and representations of the Nigerian Society of Engineers the amended Act (1992) was promulgated by which the Council for the registration of Engineers in Nigeria (COREN) was now renamed the Council for the Regulation of Engineering in Nigeria with full powers to register, control, monitor and enforce compliance. It also has affiliation with the international Federation of Consulting Engineers (FIDIC). Also there is the Association of Consulting Engineers Nigeria (ACEN) which was founded and registered in 1972 and 1979 respectively. The focus of ACEN is to ensure that the highest level of technical competence and business ethics are brought to bear on the consulting engineering practice in Nigeria which will in turn result in the highest level of quality of infrastructure for Nigerians at the most cost effective prices (Kado, 2010). ACEN has strong affiliation with the National Society of Engineers (NSE) which is the umbrella association of all Engineers and individuals involved in engineering activities.

It is noteworthy that Association of Consulting Engineers Nigeria (ACEN) has partnered with the International Federation of Consulting Engineers (FIDIC) for the provision of standards in the use of construction contracts. The FIDIC Conditions of Contracts comprise of the Conditions of Contract for Construction (Red Book), Conditions of Contract for Plant and Design-Build (Yellow Book), Conditions of Contract for EPC/Turnkey Projects (Gold Book) and Short Form of Contract (Green Book). The Red Book is the most widely used of the FIDIC books. Nigerian engineering firms and indeed the various engineering associations should consider the adoption of one or more of these international construction contracts (FIDIC, ICE, NCE) with established DRB mechanisms for the standardization of the Nigerian engineering and construction industry, in line with international standards. Further development which sought to regulate professional practices in the construction industry led to the founding of The Architects Regulation Council of Nigeria (ARCON) from CAP A19 Laws of the Federation of Nigeria 2004. According to the Law, ARCON derives the power to register and control practices of Architecture in Nigeria (Yunusa, 2009). ARCON has a strong affiliation with Nigerian Institute of Architects (NIA), which is equally the umbrella body of architects and individuals involved with architecture.

Also, there is the National Institute of Builders (NIOB) which is the umbrella association of builders and individuals involved in building activities, there is also the Nigerian Institute of Quantity Surveyors (NIQS) which is also umbrella body for individuals involved in quantity surveying activities.

2.2 Theoretical Review

Quality project management theory contains many techniques, tools, and methodologies pertaining to project quality. In a sense, the quality of the project is what drives all of project management theory. The theory is based on correct and proper planning, implementation of techniques, use of tools and methodologies to produce a project that is of a sufficient and correct quality. Tools and techniques are various and are applied throughout a project to both define set criteria and also measure the set criteria against the performance of the project, the development of the project scope management is essential to the project quality.

2.2.1 Quality Improvement Theory

Quality Improvement Theory proposes that a component of quality management is that it places duty regarding fabricating associations decisively at the entryway of top administration (Deming, 1986). The hypothesis expresses that the administration is in charge of the frameworks, and that the framework produces 80 percent of the issues in firms (Hillson, 1995). Deming (1986) noticed that no quality administration framework could prevail without top administration duty; the administration puts resources into the procedures, makes corporate culture, chooses providers and grows long haul connections. Deming's Quality Improvement Theory gives business an arrangement to take-out low-quality control issues through successful administrative systems. Management's conduct shapes the corporate mentality and characterizes what is essential for the achievement and survival of the firm.

Hubert (2000) submitted the hypothetical approach of Deming (1986) in regard to the quality administration framework, and it visualizes the production of a hierarchical framework that encourages participation and figuring out how to encourage the execution of process

administration rehearses. This, thus, prompts the persistent change of the procedures, items, and administrations and imparts worker fulfillment. These are basic to advancing client center, and, eventually, helping in the survival of any association.

Deming (1986) put stock in a precise way to deal with critical thinking and advanced the generally known Plan Do Check Act cycle. The Plan Do Check Act (PDCA) cycle of ceaseless change is an all-inclusive quality change idea whose point is to always enhance execution, consequently decreasing the distinction between client prerequisites and the execution of the assembling firms (Goetsch and Davis, 2006). The hypothetical quintessence of the Quality Improvement Theory concentrated on quality worries in the making of an authoritative framework that cultivates participation and learning for encouraging the usage of process administration rehearses, which, thus, prompts execution (Anderson *et al*., 1994). Oakland (2004) focused on that the obligations of top administration ought to lead the pack in changing procedures and frameworks. Administration assumes a critical part in guaranteeing the achievement of value administration since it is the top administration's duty to make and impart the vision to move the firm toward execution change.

2.2.2 Theory of Constraints

Theory of Constraints (TOC) was initially displayed in 1984 by Eliyahu M. (Goldratt and Cox, 1984) through his progressive book, The Goal. TOC gives the strategy to characterize what to change, what ought to be changed to, and how to impact the change to persistently enhance the execution of a whole framework. TOC, as TQM, regards change as a progressing procedure. In any case, rather than concentrating on restricted enhancements in all zones, it assaults the one limitation or bottleneck that restrains the framework's execution. TOC can

be utilized as an indispensable system to help the usage of QM. It must not supplant QM, yet rather be utilized as a part of helping the organization to discover issues in its execution and center the QM endeavors toward the association's objective. TOC is an incredible approach in nonstop change, however has very little been broadly concentrated on. In the light of this, it is imperative to decide the degree of QM and TOC execution.

TOC which is an arrangement of ideas, standards and apparatuses that can be utilized to enhance administration of frameworks and expand execution by distinguishing the most prohibitive restricting component that requirements the framework's execution and overseeing it. It concentrates on enhancing execution as opposed to decreasing expenses. By and large, TOC is a mix of logic, ideas, standards, and apparatuses imagined to augment the execution of any framework by recognizing, overseeing and breaking the most prohibitive restricting variable that limitations framework execution.

Rahman (1998) outlined the idea of TOC that each framework must have no less than one requirement and the presence of limitations speaks to open doors for development. The one primary part of TOC, which contrasts from conventional change methodologies, is the way it assesses change endeavors. Numerous quality change endeavors are centered around accomplishing the most elevated cost decreases. Kazim (2008), contends that hypothesis of imperatives depends on the rule that a chain is just as solid as the weakest connection or limitation and to lift and deal with the requirement as fundamental.

2.2.3 Resource-Based View Framework

The Resource Based View framework (RBV) accentuates the association's assets as the essential determinants of competitive advantage and implementation. It embraces two

suppositions in breaking down competitive advantage (Barney, 2001). This model accepts that organizations inside an industry might be heterogeneous regarding the assets that they control. Second, it accepts that asset heterogeneity may hold on after some time on the grounds that the assets used to execute firms' schemes are not mobile across firms (i.e., a portion of the assets can't be exchanged and are hard to collect). Asset heterogeneity (or uniqueness) is viewed as an important condition for an asset package to add to competitive advantage.

The Resource-Based View Theory is to a great extent in light of behavioral and sociological worldview and considers organizational variables and their fit with the world as the significant determinants of progress. System models with this interior introduction have a solid 'inside out' approach that considers inside process factors, (for example, quality improvement, product advancement, and adaptability and cost effectiveness) as the most powerful achievement elements.

Since assets mirror a lot of the components of abilities, this study likewise centered on the performance ramifications of some internal attributes of organizations (Barney, 2001), for this situation capacities of organizations, persistent change and client centeredness. In dissimilarity, the basic contention of the Resource-Based View Theory is that uncommon, matchless, non-substitutable assets make a company's heterogeneity, and that fruitful firms are those that get and protect significant and impossible to miss assets that outcome to an organization's decent execution emerging from the maintainable upper hand that emerges thereof (DiMaggio and Powell, 1991). Organizational readiness figures out what sort of value administration frameworks to seek after, since the assets that an association has will impact what the firm does or does not do. The methodologies so attempted will then impact the

execution of the firm and help the firm pick up an upper hand in the commercial center, coming about to upgraded performance.

2.2.4 Deming's Theory of TQM

The theoretical essence of the Deming approach to TQM concerns the creation of an organizational system that fosters cooperation and learning for facilitating the implementation of process management practices, which, in turn, leads to continuous improvement of processes, products, and services as well as to employee fulfillment, both of which are critical to customer satisfaction, and ultimately, to firm survival (Anderson, 1994). Deming (1986) stressed the responsibilities of top management to take the lead in changing processes and systems. Leadership plays in ensuring the success of quality management, because it is the top management's responsibility to create and communicate a vision to move the firm toward continuous improvement. Top management is responsible for most quality problems; it should give employees clear standards for what is considered acceptable work, and provide the methods to achieve it. These methods include an appropriate working environment and climate for work-free of faultfinding, blame or fear. Deming (1986) also emphasized the importance of identification and measurement of customer requirements, creation of supplier partnership, use of functional teams to identify and solve quality problems, enhancement of employee skills, participation of employees, and pursuit of continuous improvement. Anderson, (1994) developed a theory of quality management underlying the Deming management method. They proposed that: The effectiveness of the Deming management method arises from leadership efforts toward the simultaneous creation of a cooperative and learning organization to facilitate the implementation of process-management practices, which, when implemented, support customer satisfaction and

organizational survival through sustained employee fulfillment and continuous improvement of processes, products, and services.

The means to improve quality lie in the ability to control and manage systems and processes properly, and in the role of management responsibilities in achieving this. Deming (1986) advocated methodological practices, including the use of specific tools and statistical methods in the design, management, and improvement of process, which aim to reduce the inevitable variation that occurs from "common causes" and "special causes" in production. "Common causes" of variations are systemic and are shared by many operators, machines, or products. They include poor product design, non-conforming incoming materials, and poor working conditions. These are the responsibilities of management. "Special causes" relate to the lack of knowledge or skill, or poor performance. These are the responsibilities of employees. Deming proposed 14 points as the principles of TQM (Deming, 1986), which are listed below:

(1) Create constancy of purpose toward improvement of product and service, with the aim to become competitive and to stay in business, and to provide jobs.

(2) Adopt the new philosophy. We are in a new economic age. Western management must awaken to the challenge, must learn their responsibilities, and take on leadership for change.

(3) Cease dependence on mass inspection to quality. Eliminate the need for inspection on a mass basis by building quality into the product in the first place.

(4) End the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item, on a long-term relationship of loyalty and trust.

(5) Improve constantly and forever the system of production and service, to improve quality and productivity, and thus constantly decrease costs.

(6) Institute training on the job.

(7) Institute leadership. The aim of supervision should be to help people and machines and gadgets to do a better job. Supervision of management is in need of overhaul, as well as supervision of production workers.

(8) Drive out fear, so that people may work effectively for the company.

(9) Break down barriers between departments. People in research, design, sales, and production must work as a team, to foresee problems of production and in use that may be encountered with the product or service.

(10) Eliminate slogans, exhortations, and targets for the workforce asking for zero defects and new levels of productivity. Such exhortations only create adversarial relationships, as the bulk of the causes of low quality and low productivity belong to the system and thus lie beyond the power of the workforce.

(11) (a) Eliminate work standards (quotas) on the factory floor. Substitute leadership. (b) Eliminate management by objective. Eliminate management by numbers, numerical goals. Substitute leadership.

(a) Remove barriers that rob the hourly worker of his right to pride of workmanship. The responsibility of supervisors must be changed from sheer numbers to quality.

(12) Remove barriers that rob people in management and in engineering of their right to pride of workmanship. This means, inter alia, abolishment of the annual or merit rating and of management by objective.

(13) Institute a vigorous program of education and self-improvement.

(14) Put everybody in the company to work to accomplish the transformation. The transformation is everybody's job.

2.2.5 Juran and Gryna Theory of TQM

TQM is the system of activities directed at achieving delighted customers, empowered employees, higher revenues, and lower costs (Juran and Gryna, 1993). Juran believed that main quality problems are due to management rather than workers. The attainment of quality requires activities in all functions of a firm. Firm-wide assessment of quality, supplier quality

management, using statistical methods, quality information system, and competitive benchmarking are essential to quality improvement. Juran's approach is emphasis on team (QC circles and self-managing teams) and project work, which can promote quality improvement, improve communication between management and employee's coordination, and improve coordination between employees. He also emphasized the importance of top management commitment and empowerment, participation, recognition and rewards.

According to Juran, it is very important to understand customer needs. This requirement applies to all involved in marketing, design, manufacture, and services. Identifying customer needs requires more vigorous analysis and understanding to ensure the product meets customers' needs and is fit for its intended use, not just meeting product specifications. Thus, market research is essential for identifying customers' needs. In order to ensure design quality, he proposed the use of techniques including quality function deployment, experimental design, reliability engineering and concurrent engineering.

Juran considered quality management as three basic processes (Juran Trilogy): Quality control, quality improvement, and quality planning. In his view, the approach to managing for quality consists of: The sporadic problem is detected and acted upon by the process of quality control; The chronic problem requires a different process, namely, quality improvement; Such chronic problems are traceable to an inadequate quality planning process. Juran defined a universal sequence of activities for the three quality processes, which is listed in Table 2.2.

Juran defined four broad categories of quality costs, which can be used to evaluate the firm's costs related to quality. Such information is valuable to quality improvement. The four quality costs are listed as follows:

- Internal failure costs (scrap, rework, failure analysis, etc.), associated with defects found prior to transfer of the product to the customer;
- External failure costs (warranty charges, complaint adjustment, returned material, allowances, etc.), associated with defects found after product is shipped to the customer;
- Appraisal costs (incoming, in-process, and final inspection and testing, product quality audits, maintaining accuracy of testing equipment, etc.), incurred in determining the degree of conformance to quality requirements;
- Prevention costs (quality planning, new product review, quality audits, supplier quality evaluation, training, etc.), incurred in keeping failure and appraisal costs to a minimum.

Table 2.2 Universal Processes for Managing Quality

Quality planning	**Quality control**	**Quality improvement**
Establish quality goals	Choose control subjects	Prove the need
Identify customers	Choose units of measure	Identify projects
Develop product features	Create a sensor	Organize project teams
Discover customer	Set goals	Diagnose the causes
Develop process features	Measure actual performance	Provide remedies, prove
Establish process controls	Interpret the difference	Remedies are effective
Transfer to operations	Take action on the difference	Deal with resistance to change Control to hold the gains

Source: Zhang *et al*. (2000)

2.2.6 Crosby's theory of TQM

Crosby (1979) identified a number of important principles and practices for a successful quality improvement program, which include, for example, management participation, management responsibility for quality, employee recognition, education, reduction of the cost of quality (prevention costs, appraisal costs, and failure costs), emphasis on prevention rather than after-the-event inspection, doing things right the first time, and zero defects. Crosby claimed that mistakes are caused by two reasons: Lack of knowledge and lack of attention. Education and training can eliminate the first cause and a personal commitment to excellence (zero defects) and attention to detail will cure the second. Crosby also stressed the importance of management style to successful quality improvement.

The key to quality improvement is to change the thinking of top managers-to get them not to accept mistakes and defects, as this would in turn reduce work expectations and standards in their jobs. Understanding, commitment, and communication are all essential. Crosby presented the quality management maturity grid, which can be used by firms to evaluate their quality management maturity. The five stages are: Uncertainty, awakening, enlightenment, wisdom and certainty. These stages can be used to assess progress in a number of measurement categories such as management understanding and attitude, quality organization status, problem handling, cost of quality as percentage of sales, and summation of firm quality posture.

The quality management maturity grid and cost of quality measures are the main tools for managers to evaluate their quality status. Crosby offered a 14-step program that can guide firms in pursuing quality improvement.

These steps are listed as follows:

(1) Management commitment: To make it clear where management stands on quality.

(2) Quality improvement team: To run the quality improvement program.

(3) Quality measurement: To provide a display of current and potential nonconformance problems in a manner that permits objective evaluation and corrective action.

(4) Cost of quality: To define the ingredients of the cost of quality, and explain its use as a management tool.

(5) Quality awareness: To provide a method of raising the personal concern felt by all personnel in the company toward the conformance of the product or service and the quality reputation of the company.

(6) Corrective action: To provide a systematic method of resolving forever the problems that are identical through previous action steps.

(7) Zero defects planning: To investigate the various activities that must be conducted in preparation for formally launching the Zero Defects program.

(8) Supervisor training: To define the type of training that supervisors need in order to actively carry out their part of the quality improvement program.

(9) Zero defects day: To create an event that will make all employees realize, through a personal experience, that there has been a change.

(10) Goal setting: To turn pledges and commitment into actions by encouraging individuals to establish improvement goals for themselves and their groups.

(11) Error causal removal: To give the individual employee a method of communicating to management the situation that makes it difficult for the employee to meet the pledge to improve.

(12) Recognition: To appreciate those who participate.

(13) Quality councils: To bring together the professional quality people for planned communication on a regular basis.

(14) Do it over again: To emphasize that the quality improvement program never ends.

2.2.7 Ishikawa's Theory of TQM

Ishikawa (1985) argued that quality management extends beyond the product and encompasses after-sales service, the quality of management, the quality of individuals and the firm itself. He claimed that the success of a firm is highly dependent on treating quality improvement as a never-ending quest. A commitment to continuous improvement can ensure that people will never stop learning.

He advocated employee participation as the key to the successful implementation of TQM. Quality circles, he believed, are an important vehicle to achieve this. Like all other gurus he emphasized the importance of education, stating that quality begins and ends with it. He has been associated with the development and advocacy of universal education in the seven QC tools (Ishikawa, 1985).

Ishikawa (1985) suggested that the assessment of customer requirements serves as a tool to foster cross-functional cooperation; selecting suppliers should be on the basis of quality rather than solely on price; cross-functional teams are effective ways for identifying and solving quality problems. Ishikawa's concept of TQM contains the following six fundamental principles:

- Quality first-not short-term profits first;
- Customer orientation-not producer orientation;
- The next step is your customer-breaking down the barrier of sectionalism;
- Using facts and data to make presentations-utilization of statistical methods; -Respect for humanity as a management philosophy, full participatory management; -Cross-functional management.

2.3 Conceptual Model of Quality Management on Performance of Residential estates

The concept boosts housing supply by expanding the enablers to include the public and the private sectors. The model shown in Figure 2.5 proposes the re-inclusion of the public sector to build a solid base upon which the private driven housing will thrive. The public sector housing is said to be inefficient but new procurement procedures will reduce the inefficiency and harness the best potential of the private sector through public private partnership. The conceptual framework is community based and it provides the architecture for framing to capture and evaluate community issues of importance. The framework is a composition of several components with each component being represented through a number of indicators or variables.

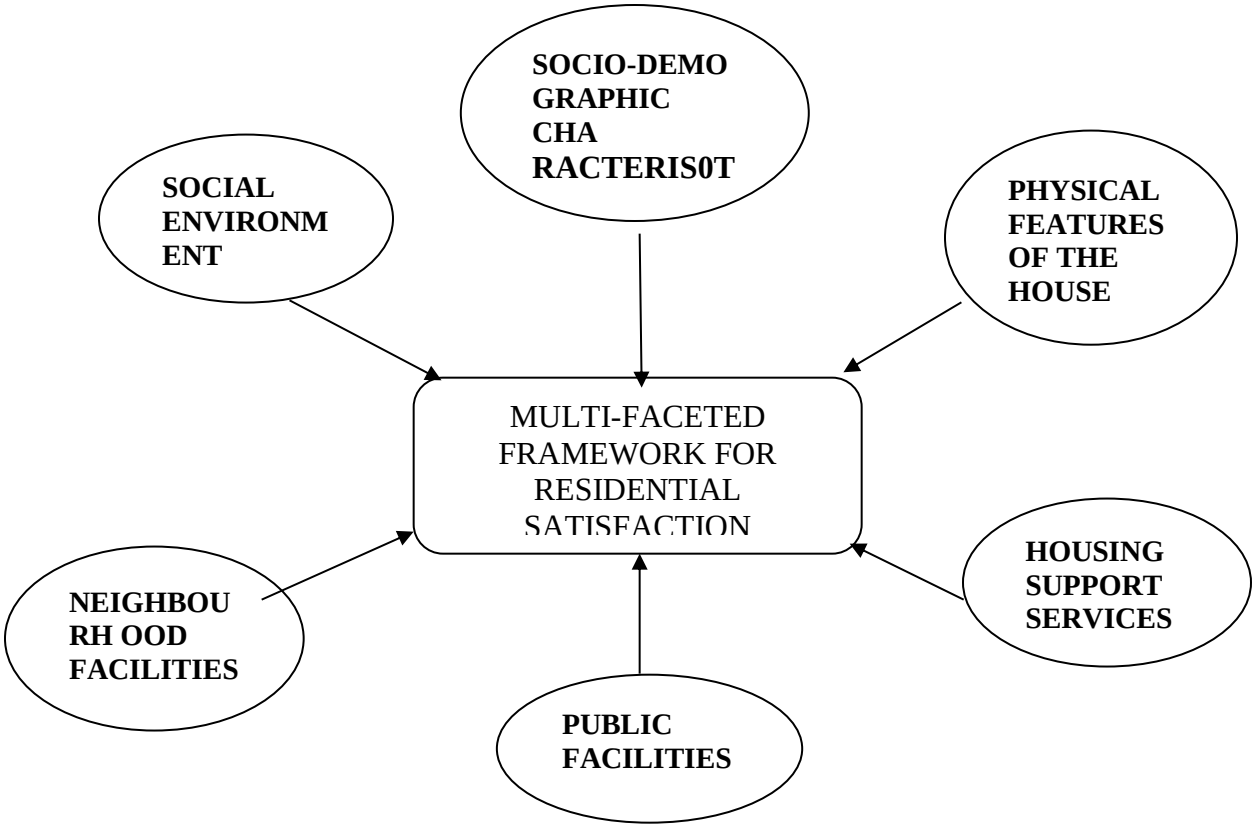

Fig 2.5 Conceptual Model

Source: Mohammad Abdul Mohit (2014)

2.4 Empirical Reviews on Impact of Project Quality Management on Organizational Performance

Quality management is an integral component essential for the excellence of any given organization, to enable their survival in the rapidly changing business environment. Recognizing quality as a key ingredient to performance is likely to propel an organization to greater heights. A summary of selected relevant literature is presented in Table 2.3.

Table 2.3 Summary of Literature Review and Knowledge Gaps

Scholar (s)	Study / Place of Study	Objectives	Key Findings	Knowledge gaps
Tata and Prasad, (2016)	Cultural and structural constraints on quality management implementation	To determine cultural and structural constraints on total quality management implementation	Organizational culture affects performance	The study did not measure the effects of the constraints on performance
Prajogo and McDermott, (2015)	The relationship between quality management practices and organizational culture	To establish the relationship between quality management practices and organizational Culture	Quality management practices affects organizational culture	The study focuses on culture while the present study will focus on performance
Lindsay and Evans, (2017)	Managing for Quality and Performance Excellence	To find out how quality management affect business performance	Quality management significantly affects performance	The study was done in a developed world while the present study will be done in
Abudi, G. (2009)	Developing a project management best practice	To determine quality management practice within an organization.	Key quality management practices were identified.	The study focused on managerial aspect of an organization and neglecting the technical aspect of project.

N A Haron1, P Devi1, S Hassim, A H Alias1, M M Tahir1, and A N Harun (2017)	Project management practice and its effects on project success in Malaysian construction industry.	The study examines the effects of management practices on project success	Customer satisfaction, competency of the project team, and performance of subcontractors/suppliers are becoming measures of success.	The study focused mostly on customers satisfaction of a project
Terziovski and power (2007)	Increasing ISO 9000 certification: a continuous improvement approach	To find out how culture, management responsibility, employee involvement affect performance	There is a positive relationship between continuous improvement and quality culture and a firm's performance	The study did not consider quality management practices and its effects on performance
Ab-Wahid and Corner (2009)	Critical success factors and problem in ISO maintenance	To find out the critical success factors in ISO maintenance	There is a positive relationship between strategic, financial, and continuous improvement and a firm's performance	The study did not find out how CSF influence performance
O. O. Ugwu, and I. C. Attah (2016)	An Appraisal of Construction Management Practice in Nigeria.	To review literatures on factors that influence quality management of project	The study identified the factors that influence management of	The study is a review. It lacks quantitative analysis.

			construction projects.	
Onifade *et al*. (2019)	Evaluation of the Effect of Project Management Techniques on Road construction projects in Nigeria	To determine the effect of quality management in project success	It revealed that majority of the respondents have the knowledge of project management techniques	The study examined few of project management tools.
Bell and Omachonu (2011)	Quality system implementation process for business success	To find out how Quality system implementation affect performance	There is significant linkage between improved documentation, firm's performance and organizational performance	The study did not consider performance of manufacturing firms
Anyango,; Wanjau, and Mageto, (2013) Kenya	Assessment of the relationship between ISO 9001 certification and performance of manufacturing firms in Kenya	To find out the relationship between ISO 9001 certification and performance of manufacturing firms in Kenya	There is positive relationship between financial HRM, firm's performance, HRM and control measures and a firm‟s performance	The study was biased towards quality managers, who may have been subjective, whereas the current study used quality assurance managers and internal auditors

Njuguna, M. (2013)	Value Chain Management Practices and Supply Chain Performance of Large Manufacturing Firms in Nairobi	To establish the relationship between value chain management and supply chain performance	Quality improvement within the value chain improved supply chain performance	The study measured supply chain performance while current study will focus on organizational performance
Mutua, J. (2014).	Quality management practices and financial performance of cement manufacturing firms in Kenya	To establish the quality management practices adopted by cement manufacturing firm in Kenya and financial performance of the same	Most cement manufacturing firms that implemented quality management practices recorded high sales turnover leading to organizational performance.	The study considered only cement manufacturing firms leaving out firms in other sectors
Rajab, A.F (2014)	Quality management practices and supply chain performance of large-scale manufacturing firms in Kenya	To determine the extent to which quality management practices are implemented by large scale manufacturing firms in Kenya	Quality management practices have been practiced to a large extent by the large manufacturing firms in Nairobi, Kenya.	The study measured supply chain performance while current study will focus on organizational performance

Source: Field survey, 2020

CHAPTER THREE

3.0 MATERIALS AND METHOD

3.1 Research Design

This research adopts a explorative approach using quantitative data. Quantitative research employs numeric data such as scores and metrics (Bhattacherjee, 2012). According to Adejimi *et al*. (2010) qualitative methods have been considered capable of studying complex situations, involving human beings and yielding rich findings. It has resulted in the increase of their popularity especially in the built environment (Adejimi *et al*., 2010).

Quantitative research is characterized by the assumption that human behavior can be explained by what may be termed as social facts which can be investigated by methodologies that use deductive logic of natural science (Amaratunga, Sarsha and Baldry, 2002). Quantitative research is primarily aimed at quantifying the variation in a phenomenon, situation, problem or issue through information gathered using predominantly quantitative variable and the analysis is carried out to ascertain the magnitude of the variation (Adejimi *et al*., 2010). Method of data collection described in orderly manner in the aspects of how the data were collected and where the data were sourced. Quantitative data was collected from occupants of the selected residential estates and the stakeholders in residential housing delivering in North-central Region of Nigeria.

3.2 Population of Study

Population is group of individuals that have common characteristics which are of interest to the researcher (Bhattacherjee, 2012). The targeted population for this research constitute occupants of the selected residential estates and stakeholders registered with Real Estate

Developers Association of Nigeria (REDAN) such as Council for Registered Engineers, Architect Registration Council of Nigeria, Estate Surveyor and Valuers Board of Nigeria, Quantity Surveyor Registration Board of Nigeria and Council of Registered Builders of Nigeria and also the estate developing companies handling the estate project should belong to Real Estate Development Agencies of Nigeria. Therefore, the members of the registered professional bodies within the North-central. The study population have been estimated to be one thousand nine hundred and twenty-five.

3.3 Sample Size

It is technically, financially and logistically impossible either to collect data from all the residential estates and stakeholders registered with Real Estate Developers Association of Nigeria in the North-central. It is therefore desirable to adopt a sampling process that will be suitable for the target population. Four sampling techniques had been identified by Doko (2013), Morenikeji (2003) and Kothari (2008), they are simple random, systematic, stratified and cluster sampling.

The sample size of this research was based on what size was considered as a representative of the population under study having known that residential estates and stakeholders registered with Real Estate Developers Association in Nigeria. Simple random sampling technique will be used to select the population from which relevant data would be extracted. It was said earlier that the population of this study is estimated to be one thousand nine hundred and twenty-five (1925) and it will be difficult, time consuming and cost ineffective to study the entire population.

The researcher carefully determined a sample size of three hundred and thirty-seven (337) having applied the Taro Yemane formula as stated below:

$$n = \frac{N}{1+Ne^2} \quad (3.1)$$

Where n = Sample Size

N = Population

E = Error Term

1 = Constant Term

N = 1925

E = 5%

$$n = \frac{1925}{1+1925(0.05)^2} = 337$$

3.5 Method of Data Collection

The data for the study will be obtained from both primary and secondary sources. These data will be used to achieve the objectives of the study.

3.5.1 Primary Data:

Primary data were obtained from the final questionnaire that was used for the analysis of the study. The data collected from questionnaire survey were distributed to stockholders that were involve in residential estates delivering. The structured questionnaire was framed based on three types of answering techniques, namely rating-based, selective based and open-ended format. Based on rating format, respondents were instructed to rate their opinion for a specific fact by choosing a 5-point scale ranging from Strongly Disagree to Strongly Agree. Secondly, selective-based questions only required respondents to tick in the appropriate box or boxes.

The structured questionnaires for this study covered two sections,

(i) Section A: The background of the respondents such as number of years of experience, qualification, position in the company. The company profile where he/she is currently employed, such as business activity and nature of the company.
(ii) Section B: The second part comprises the question that indicates the possible factors that affect the implementation of Project Quality Management in building construction work.

The respondents selected for the study are those that are involved in building construction projects running and in particular had encounter experience during construction phase. In addition to that, the organizations that were selected range from medium to large scale organization only.

3.5.2 Secondary Data:

The secondary data for the study was be obtained from the official records of the construction sites. The data were used to achieve the objectives of the study.

3.6 Data Collection Procedures

This study employed the use of personal distribution of questionnaire survey and obtained data for observation. These data presented in Table 3.1will be used to achieve the objectives of the study.

Table 3.1: Number of firms registered with REDAN in selected states of North-central Nigeria

S/No.	State	No of Member Firms
1	Niger	60
2	Nassarawa	52
3	Kogi	80
4	FCT	145
	Total	337

Source: REDAN, 2020

3.6.1 Questionnaires

Questionnaires is one of the most widely used social research techniques. The idea of formulating precise written questions, to find answer to the issues (Ololude, 2006). Questionnaire is a research instrument consisting of set of question (items) intended to capture responses from respondents in a standardized manner (Bhattacherjee, 2012). For the purpose of this research a total of 337 structured questionnaires were administered to companies handling the estate projects and that belong to Real Estate Development Agency of Nigeria and a total of 310 were returned filled.

3.7 Method of Data Presentation and Analysis

The data extracted from the questionnaire was processed and analyzed using the descriptive statistical method which includes percentages, tables and ranking method.

SPSS 23.0 and AMOS 21.0 was used to analyze the data. Partial Least Square (PLS) was used to test the hypotheses in this study, as PLS provides an appropriate analytical method for examining the relationships among variables, especially in multivariate structures. PLS

also elicits analysis results that consider the measurement error of the measurement tools. As such, PLS describes better analysis results for social phenomena compared to other analytical methods such as regression. In addition, it has an advantage in terms of examining multiple independent variables simultaneously. For these reasons, PLS was employed in the present study. According to Anderson and Gerbing (2013), a two-step approach is often preferred in PLS. To analyze the measurement model, a confirmatory factor analysis (CFA) with a maximum likelihood estimation method was conducted. After CFA, structural relationships among latent variables were analyzed using Partial Least Square.