

HOUSING PROVISION: THE ROLE OF THE QUANTITY SURVEYOR IN THE CONSTRUCTION INDUSTRY WORLDWIDE

The Vice Chancellor Sir and Chairman of the Occasion

Chairman and Members of the Governing Council of the University

Deputy Vice Chancellor

Registrar and Other Principal Officers of the University

Provost of the College of Medicine

Dean of Post Graduate School

Deans of Faculties and Directors

Distinguished Professors and Scholars

Heads of Departments

My Lords Spiritual and Temporal

His Majesties and Royal Highnesses

Distinguished Guests and friends of the University

Staff and students of Rivers State University

Gentlemen of the Press

Distinguished Ladies and Gentlemen

1.0 Introduction

1.1 Preamble

When I left the great shores of Nigeria on the Airbus Boeing 707 aircraft in 1977/78 academic year, on Federal Government of Nigeria Scholarship, through France to Bulgaria to study Civil Engineering, then I was a Mathematics teacher at the Holy Rosary Girls Secondary School, Port Harcourt in Port Harcourt Local Government Area (PHALGA) and later transferred to Akpor Grammar School, Ozuoba in Obio Akpor Local Government Area (OBALGA) of Rivers State, I never knew, I was going to discover a treasure base and a food basket in the field of the Built Environment in the Faculty of Environmental Sciences.

Upon successful completion of a rigorous pre-degree study in Mathematics, Physics, Bulgarian language and History in the Institute of Foreign Language, in Sofia the capital of Bulgaria, as a pre-condition before admission into the University system took place, I took a trip to London through Dover/France Immigration Port in 1978/79 academic year (summer holiday) in search of the Institute of Quantity Surveyors (IQS) located at 98 Gloucester place, London to compare the curriculum of Quantity Surveying as an emergent alternative choice to Civil Engineering.

The sojourn to London was to answer the question in my mind, which was who becomes a Manager in the Engineering system of Design, Production, Erection, Renovation, Procurement/Delivery, Handover and Commissioning of Building and Civil Engineering Works? I therefore discovered that I was in the right place in London for the inquiry, with the solution from the Institute of Quantity Surveyors (IQS), that a Quantity Surveyor is the Manager and the Economist in the Construction Industry, who organizes and manages Building and Constructional Works and their Resources and detailed financial matters in the Construction Industry to the exclusion of any other person, in addition to his primary functions of preparation and production of the Bill of Quantities (BOQ) and Cost Estimate of a proposed Building and Construction Project. I was satisfied with my findings — that the Quantity Surveyor is a Construction Manager, Project Manager, Construction Economist, Technical Accountant to a building, construction, civil and heavy engineering project – which I needed, and I said to myself “Eureka”, which means “I found it”.

I therefore sought and enrolled to pursue in the Department of Construction Management and Economics, the course in Quantity Surveying, and Construction Management and Finance in the University of Economics (UE), Varna City in Bulgaria, and graduated in 1983 as the Best Graduating Student, specializing in Construction Management and Finance with the degree/qualification of Master of Science (M.Sc. Construction Management and Finance) with expertise in Project Management.

Vice-Chancellor Sir, let me at this juncture recognize and state unequivocally, the immense support morally, good counseling, great care and attention given to me, while in the University of Economics (UE), Varna, by the former Vice-Chancellor (Rector) Late Professor George Dimitrov of Blessed Memory, who incidentally was a Quantity Surveyor and a Professional Colleague, who taught me Construction Management. Secondly, Late Professor Stanislav Hadjev who devoted his time to teach me Building Economics. Their erudition were uncommon.

Vice-Chancellor Sir, I returned from my studies in Bulgaria and joined the National Youth Service Corps (NYSC) programme in 1983/84 year and served at the Federal Capital Development Authority (FCDA) in Federal Capital Territory (FCT), Abuja, and in 1985, after completing a tough interview process, I was the only candidate found appointable to be a Lecturer in the Department of Quantity Surveying of this great University. On arrival as an academic staff in the Department of Quantity Surveying, Mr. Manfred Kanschat

a German Civil Engineer was the Head of Department with M.Sc. qualification in Civil Engineering. He welcomed me with great enthusiasm in the hope that, he can handover the affairs of the department to me, since he came on secondment from Germany. Other academic staff in the department, except two Nigerians, were mostly Ghanaians, with lower qualifications than I have, and Higher National Diploma (HND) Certificate Programme in Quantity Surveying was taught. The Bachelor of Technology (B. Tech.) degree Programme was immediately introduced upon my arrival and resumption of duty in 1985 in the department. As soon as the German expatriate departed, the academic leadership of the department apparently fell on me and in 1990, I was appointed the Acting Head of Department to phase out the Higher National Diploma (HND) programme and to transit and develop the B. Tech. degree programme in Quantity Surveying which I successfully achieved.

Vice-Chancellor Sir, the pioneering work was daunting, but with courage and determination the goals were roundly attained, and I rose through the ranks to the present status as Professor of Quantity Surveying.

Vice-Chancellor Sir, it is therefore an occasion of profound joy that I stand before this distinguished audience today to deliver the 60th Inaugural lecture of this prestigious University as a Professor of Quantity Surveying. My professorial promotion suffered unjustly in the hands of untidy minds in the University until the arrival of the Biblical Moses, an indefatigable Vice-Chancellor Professor Blessing Chimezie Didia in the University. With a swift action of a tidy mind, within a week upon resumption of duty, the Vice Chancellor called for my publications to be sent out to External Assessors, when he saw a masterpiece judgement by an Eminent Jurist, a Cicero and Brainbox of the Rivers State judiciary, Hon. Justice Adolphus Enebeli, directing the University to send out my publications in view of the fact that I have already been made a Professor of Construction and Project Management in Novena University Ogume, in Delta State of Nigeria.

My publications were therefore, sent to three notable Universities – University of Lagos (UNILAG); Federal University of Technology – Akure (FUTA) and Obafemi Awolowo University (OAU) Ile-Ife. The papers to the three (3) Universities all returned with positive and excellent remarks and I was pronounced a Professor of Quantity Surveying of the Rivers State University, bringing to my cap two Professorial achievements, thus the appellation **Double Professor**.

Vice-Chancellor Sir, I am the **First** Professor in the Department of Quantity Surveying, and the **Second** in the Faculty of Environmental Sciences of this University. Outside the University, I am the **First** Professor of Quantity Surveying in my Community – Uvuawhu (Ibaa) clan. The **First**, in Quantity Surveying, in my Local Government Area - Emuoha LGA, the **First**, in Quantity Surveying, in Rivers State, the **First**, in Quantity Surveying, in the South-South geopolitical zone/region of Nigeria and the **Fourth** in Quantity Surveying in the roll/register of Professors of Quantity Surveying in any Nigerian University.

Vice-Chancellor Sir, as a pioneering effort, the Chair of Quantity Surveying which I inaugurate today in this inaugural lecture titled: **“Housing Provision: The role of the Quantity Surveyor in the Construction Industry Worldwide”** is the first, and focused on the core area of Quantity Surveying and it is directed towards marketing Quantity Surveying as a discipline and profession in order to create sufficient awareness of the profession in the public domain in Nigeria and elsewhere.

2.0 Concept of Housing Provision

2.1 Background

This lecture deals with provision of living accommodation for continuous private and human life and existence in the society all over the world, be it owner occupied, rented, leased, or cooperative housing. It is different from other types of housing provision in the built environment such as working or office accommodation, storage/warehouses, recreation, spiritual needs, facilities for transport and other special constructions. These elements in varying numbers and sizes make the environment built by man for himself over the years.

2.2 Housing Definitions

Economic literature draws special attention to the concept “housing”, with different definitions. Smith (1776) defines housing (shelter) as a commodity; Ricardo (1817), as a tangible asset with potential return; Jevon (1871) – as a fixed asset regardless of whether the housing is owned or rented. Marshal (1890) – as a capital that is similar to the machine, if it is operated by a worker, but as a commodity if it is not operated. Grimes and Orville (1976) explained that in the past the concept “housing” was associated with a physical phenomenon, and the policies of countries for its provision mostly are related with construction costs that may largely vary depending on the type of construction materials, various housing standards and construction quality.



Plate 1: Urban Renewal Housing of a Block of 6 Flats, 3-Bedroom.

Within the framework of housing policy, Torgersen (1987) explained the concept “housing” as “the wobbly pillar under the welfare state” because in contrast to the health and education provision, the state does not see its role as the main service provider in this field. In the course of time the approaches for characterization of the concept “housing” have changed which depends on both the change in politics, national and regional economies and other fields. Webster’s dictionary as one of the explanation for concept of housing gave the following: Housing means dwellings provided for people. Business dictionary defines housing as building or building structures complying with requirements of Laws and regulations and where the individuals with their families may live. Similar definitions for the concept of housing is provided in Macmillan dictionary where housing is defined as building for people to live in.

The concept of “housing” has a similar concept “house” which was described by Melnikas (1998) as a specific and relatively limited physically, biologically, socially close place where people and groups of people can live their biosocial life, by receiving services, performing house chores and other biosocial activity.

Housing stock as an element of regional socio-economic development Sidelska (2014) used the concept “housing” as real estate or its part in the building, including non-residential building that is used for dwelling purposes all year round.

Donner (2000), in his works concerning the housing policy in fifteen (15) European Union States — where the theoretical and practical aspects of housing policy are unified — the concept “housing” was explained with various similar and mutually related concepts i.e. dwellings, “Low-cost dwellings”, social housing, subsidized dwellings, sub-standard dwellings.

In Europe, dwellings traditionally are defined as group of mutually related premises that is physically separated from the outer environment, and consists of walls, roof, windows and doors, engineering communications and other technical elements. Rooms must be suitable for people for independent living. The rights to use the apartment are always exclusive, because the apartment owner can decide who will be able to use the apartment besides himself or herself.

These rights to use the apartment are strengthened more or less in the tenancy agreement. In addition, each apartment in the residential building has also a joint property share existing inside the home or internal (exterior corridor of the house, basement etc.) and outside of the house or external (courtyard etc.) that belongs to the apartment owners of the residential houses and is used by all house owners and that should be jointly managed. By living in the apartment its users receives various housing utilities that respond to life of the people very differently and the importance of which during the human life cycle, changes.

Every apartment in relation to the person who lives there is characterized by such aspects as physical protection (for example, the roof protects against rain, sun, cold etc.), psychological protection (for example, can hide from danger), status (for example, use of the apartment shows social status of the household, meanwhile location and characteristics of the housing serve as a reference point for social status of persons, who live in the housing), production (this is a very important aspect today because of the fact that work from home, for example in the field of modern information technology, is highly demanded), wealth (without practical value and application of the housing) it creates the unit of invested capital, for example in the apartment rental market, and apartment purchase and sale market.

Strictly speaking therefore today, it is a topical issue that housing has to be comfortable, economical in its design and erection, reasonably maintained as well as architectonically expressive and compliant with the environment (Henrilane, 2015a).

It is an architectural unit or arrangement for living accommodation for people in order to protect the occupants from the forces of nature. In a wider meaning, housing covers all the ancillary services and community facilities which are essential to human wellbeing. In addition to physical structure, it includes water supply, sanitation, and disposal of water, recreation, exhilaration and other basic amenities of life. Thus housing can be seen as a component architectural structure within a total system consisting of various settlement varieties in the built environment.

It should be noted that there is a distinction between “house” and “home”. House and Home seem to be the same in sense and meaning but a distinction exists between the two. House being a narrower term, may represent only an architectural structure for accommodation. Home being a wider term, includes the family relationship within this architectural structure.

2.3 Significance and Need for Housing Provision

Housing need (shelter) is as old as man’s existence in the Universe. It is the second need and necessity of man after food, while clothing is the third. Civilization has positively impacted on this aspect of need of man on earth to own or have a house and is inseparable from social, economic and political development of mankind in the society (Nyenke, 2004). Housing in all its ramifications is more than mere shelter since it embraces all the social services and utilities that go to make a community or neighborhood a livable environment (National Housing Policy, 1991). It is an important life component giving safety and warmth as well as providing a place to rest. Fosters the law of existence of man, the going out and the coming in (Nyenke, 2004). In the development of any nation, it accounts for 10 – 20% of the total economic activity of a nation, as well, to be the highest asset of household (European Commission, 2005). It is also one of the basic indicator of living standard of the population. Living accommodation further became a fundamental necessity when viewed as one of the cardinal objectives/mission of man centered to conquer his environment for his survival, welfare, comfort, status symbol and class, and constitutes the deepest aspiration of man to have a roof over his head. Obviously it is a human centered necessity (Nyenke, 2004).

Its functions further are:

- To provide man, his family, relations and friends with protective envelope against the forces of nature, that have negative impacts.
- To provide a place where one can remove oneself from the remainder of the society. Provides a barrier against the ‘hubub’ of day-to-day living. Provides a base from which man can venture forth on his various activities and to which he can return at their conclusions. It is also a place of storage of his goods and chattels. Raise the quality of life, generates conditions which is congenial to the achievement of social objectives, such as health, sanitation and education, provides employment opportunities to rural and urban people, improves urban-rural equality by narrowing the differences in the standard of living. Performs multiple functions including many social needs of the household.

It is in realizing the need and importance of housing to man that several countries all over the world, supported by the world bank and the United Nations Organization (UNO) have made 2000AD as the target year by which all household should gain access to shelter (Opara et al., 2004). This has not materialized in Nigeria.

2.4 Housing from Cradle and Historical Perspective

2.4.1 The Biblical Noah’s Ark

King James version of the bible in the book of Genesis, chapters 6 verses 12 – 22 and 7, verses 9 – 12 had these to say about Housing Provision, which was Noah’s Ark and the great deluge narratives: “And God looked upon the earth, and, behold, it was corrupt; for all flesh had corrupted his way upon the earth. And God said unto Noah, The end of all flesh is come before me; for the earth is filled with violence through them; and, behold, I will destroy them with the earth. Make thee an ark of gopher wood; rooms shalt thou

make in the ark, and shalt pitch it within and without with pitch. And this is the fashion which thou shalt make it of: The length of the ark shall be three hundred cubits, the breadth of it fifty cubits, and the height of it thirty cubits. A window shalt thou make to the ark, and in a cubit shalt thou finish it above; and the door of the ark shalt thou set in the side thereof; with lower, second, and third stories shalt thou make it. And, behold, I, even I, do bring a flood of waters upon the earth, to destroy all flesh, wherein is the breath of life, from under heaven; and everything that is in the earth shall die. But with thee will I establish my covenant; and thou shalt come into the ark, thou, and thy sons, and thy wife, and thy sons' wives with thee. And of every living thing of all flesh, two of every sort shalt thou bring into the ark, to keep them alive with thee; they shall be male and female. Of fowls after their kind, and of cattle after their kind, of every creeping thing of the earth after his kind, two of every sort shall come unto thee, to keep them alive. And take thou unto thee of all food that is eaten, and thou shalt gather it to thee; and it shall be for food for thee, and for them. Thus did Noah; according to all that God commanded him, so did he.”

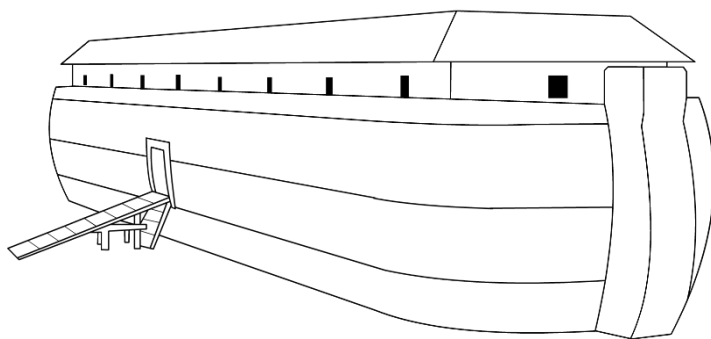


Plate 2: Noah's Ark.

And in chapter 7, verses 9 – 12: I quote, “There went in two and two unto Noah into the ark, the male and the female, as God had commanded Noah. And it came to pass after seven days that the waters of the flood were upon the earth. In the six hundredth year of Noah's life, in the second month, the seventeenth day of the month, the same day were all the fountains of the great deep broken up, and the windows of heaven were opened. And the rain was upon the earth forty days and forty nights”.

The ark as we know it today originated in the landscape of ancient Mesopotamia, and its measurement is 300 cubit by 50 cubit by 30 cubit by conversion to metric unit of measurement in metres becomes 133.2m x 22.2m x 13.3m. The etymology of the word ‘Cubit’ is associated with an ancient unit of measurement of length and the English word ‘Cubit’ came from Latin noun ‘Cubitus’(Elbow) and from the verb Cubo. It ranges between 444mm(0.444m) and 529mm(0.529m) as one cubit, and considered as the length from the wrist of the forearm to the elbow, used in the middle ages and early modern times in Ancient Greece, Rome, Egypt and Mesopotamia – Modern Iraq. The ark as we know it today, originated in the landscape of ancient Mesopotamia.

2.4.2 The Egyptian Pyramid and the Theory of Afterlife Housing Need

The theory of afterlife housing provision (need) has gone beyond providing accommodation for the comfort and safety of living human beings to provision of same to the dead. Hence, in the theory of afterlife, the ancient Egyptian in the early civilization constructed and built pyramids for the dead. The pyramids were built as burial places and monuments to the Pharaohs – Ancient Egyptian Kings. As part of their religion, the Egyptians believe that the Pharaoh needs certain things to succeed after life. Deep inside the pyramid

the Pharaoh would be buried with all sorts of items, and treasures that, he may need to survive in the afterlife. Egypt was one of the richest and most powerful civilizations in the world. The great pyramid of Giza measured 147m in height and the sides 481.4m making it the largest pyramid in the world. Built over 4,000 years ago, more precisely 2630 BC and the housing provision skill and architecture was symbolized in the ancient Egyptian Pyramids the cradle of civilization. As a house for the dead, pyramids were built with protectors against tomb robbers who often cart away expensive jewelry and valuable items that were provided for the Kings to use afterlife.



Plate 3: Great Pyramid of Giza.

Source: <https://www.sciencenews.org/article/mystery-void-discovered-great-pyramid-giza>

2.4.3 Evolution and Periods of Housing Development

The evolution and periods of housing growth relates to the English Architectural periods. 1800 BC – Prehistoric, Stone Age, Bronze Age and Iron Age.

1800BC

This period witnessed early forms of house like ‘A frame’ and cave arrangement which were covered by animal skin and thatches later the frame was formed by two forked uprights, supporting a horizontal ridge pole with closely spaced rafters having their feet bedded into the ground and their tops latched to the ridge. The covering was of interwoven branches plastered with mud and covered with straw, heather or reed. The head room was increased by digging the enclosed space to a depth of 0.5m and holes were left in the ridge to allow smoke to escape. A cave man’s early abode is a hollow place in the ground, specifically a natural space large enough for a human to enter. Cave formed naturally by the weathering of rock and often extend deep underground e.g. Sea cave or Littoral cave, deep salt cave in Mount Sodom, Isreal. They were traditional primitive dwellings.

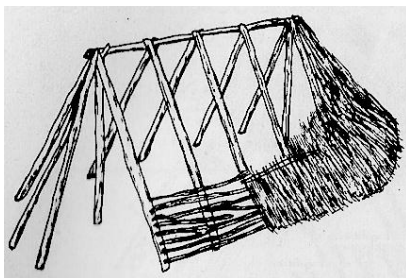


Plate 4a: Primitive dwelling/Prehistoric age

Source: Grundy (1977).



Plate 4b: Cave

Source: <https://www.hikespeak.com/trails/bronson-cave/>

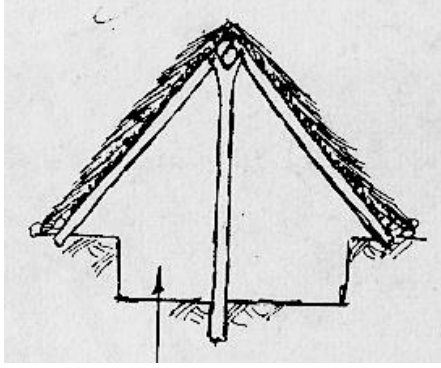


Plate 4c: Additional Space created by Excavation.

Source: Grundy (1977).

43 – 1189 AD - Romanesque

Anglo-Saxon buildings called Romanesque, required larger and better houses but the same basic framed work remained. The increased size meant increased weight of covering, which led to large sizes of timber being required and additional ground loading. As a result, the rectangular timber frame work appeared in which the joints were made by squaring off the timber members and the facility of a chimney was incorporated at one side.

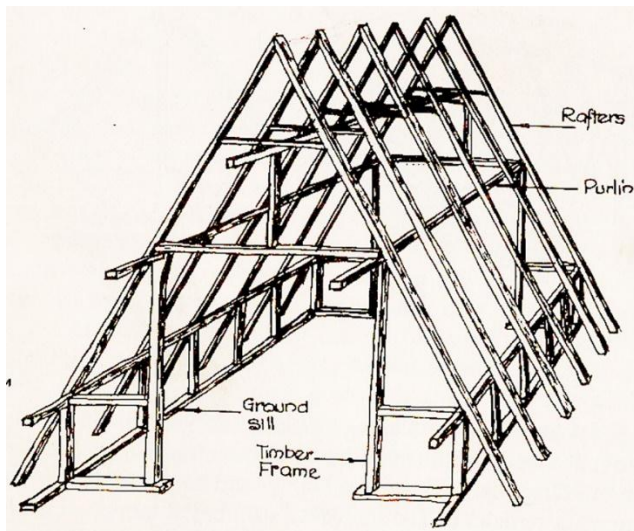


Plate 5: Framework of Family House

Source: Grundy (1977).

1189 – 1485 AD – Early English/Gothic Building

A feature of Gothic architecture was the pointed arch over doors and window openings, larger windows were split up into smaller units with transom and mullion bars. It was this time that the English squire started to have his bedroom at first floor level and the cottage also started to take the now conventional form of a rectangular plan and the roof was of thatch on light timber frame and cruck construction. This period saw more ornate stone arches with multiple curves.

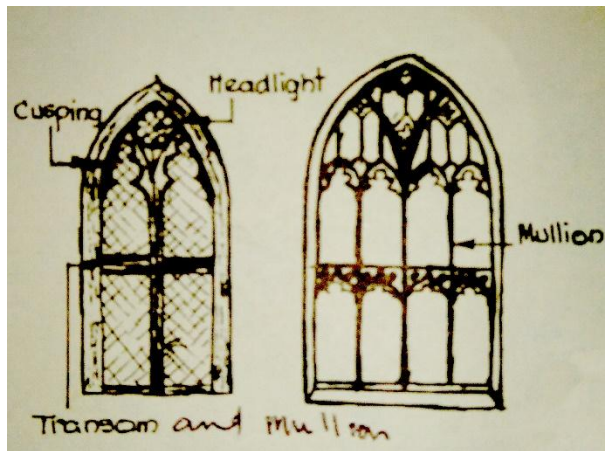


Plate 6a: Transom and Mullion Windows
Source: Grundy (1977).

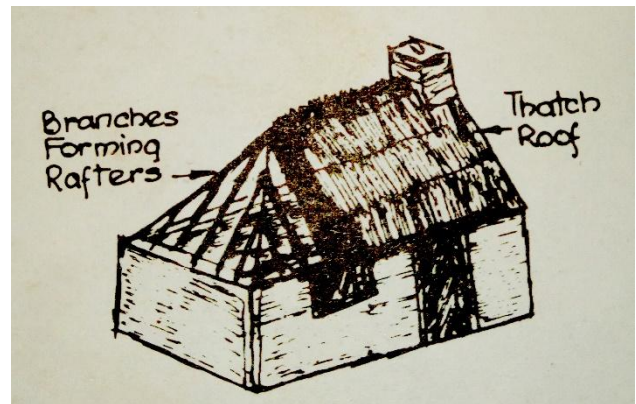


Plate 6b: Cottage
Source: Grundy (1977).

1485 – 1625 – Early Renaissance

The fifteenth century otherwise known as the early renaissance in development of housing and the peasants house remained of cruck construction, but the springing up of a new middle class with new found status, increased the development of the two-storey timber frame house construction. The arches became flatter towards the end of fifteenth century with roof pitches becoming flatter or steeper. The former being masked with parapet. The square and rectangular windows in relatively long lengths now started to appear. The focal point was still the main central hall which rose to the full height of the house and was flanked at either end by two-storey construction. Beauty also started to play a part with braces becoming more ornate.

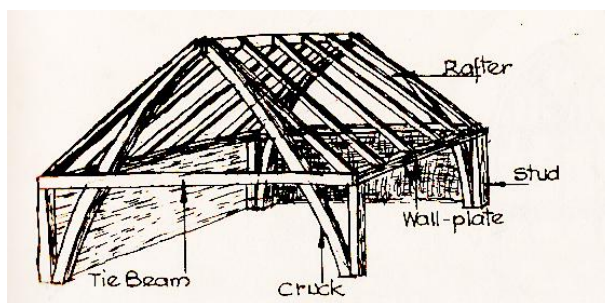


Plate 7a: Cruck Frame.
Source: Grundy (1977).



Plate 7b: 15th Century Building
Source: Grundy (1977).

1625 – 1820 AD – Late Renaissance

In the sixteenth and seventeenth century, the planning of the house became important, with emphasis on privacy and pleasant well-lit rooms. Although windows were still comparatively small, the timber mullions and transoms began to appear. This period saw bricks, previously a rare and expensive building commodity, coming into more general use for the houses of the middle and upper classes. The windows became flat-headed and domestic stair case made its appearance rather than a step-ladder access to the first floor. During the period straight lines and proportion became the elevational vogue and dormer windows began to appear in walls. Entrance door features developed. Doorways were given special treatment as a feature having stone framework and elaborate heads. Brick and stone replaced timber as the load-bearing materials of

domestic construction and as the strengths of the materials were realized, so the height of the building grew. Roof coverings of red clay pantiles and stone became more common than the thatch roof because of their durability.

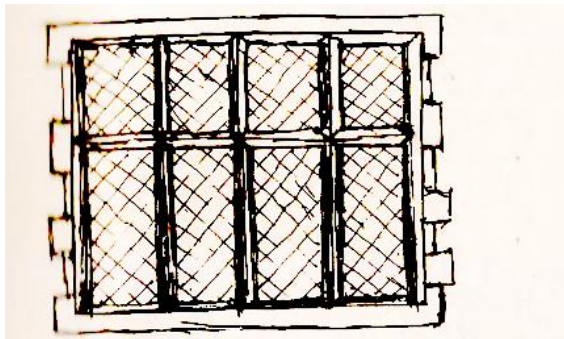


Plate 8a: Stone Mullion and Transom Window with Square Head.
Source: Grundy (1977).

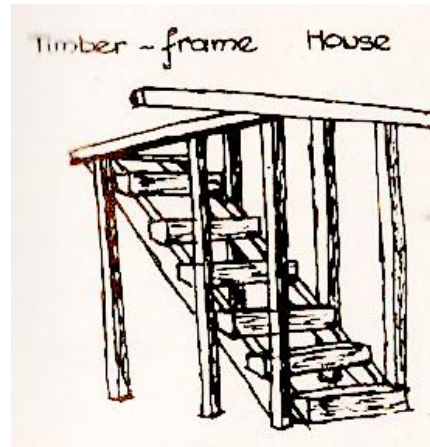


Plate 8b: Timber Staircase.
Source: Grundy (1977).

1820 – 1920 – Industrial Revolution

The industrial revolution played an important part in the development of Housing Provision by making available new materials and mechanizing the production of bricks. Slates became available as a result of the transport revolution. The slope of the roof and a pitch of 30° was found to be satisfactory with it. The houses of the workers as population increased and the demand for housing five, six and seven – storey tenement blocks were erected within city centers.

It was not until this period washing and toilet facilities were incorporated into the house and it was the Public Health Act of 1875 which first laid down minimum standards, not only for hygiene, in the form of water supply, drainage, and sewage disposal, but also for wall thickness, damp-proof courses and street widths and lengths.

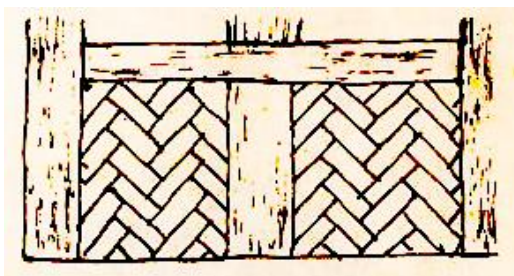


Plate 9a: Brick Infill in Timber Panel.
Source: Grundy (1977).



Plate 9b: Flats – 19th Century Building
Source: Grundy (1977).

1920 – Date – Modern Era

The twentieth century could be classified as the age of experiment, in which Housing development was experimented by combining the development of (i) Materials, (ii) Structural design concepts and (iii) Industrialized production methods in varying proportions, with space and shape. This rapid development has been facilitated by the slow painstaking development of earlier centuries and the recent rapidly changing political and economic pressure bringing about changes of emphasis in technology.

21st Century and beyond

Housing provision and development falls into the Modern Era, characterized and driven by technological innovations, discoveries, and research activities. Its feature lies on emphasis placed on straight lines and de-emphasizes on curves and excessive decorations, far less ornate, because of labor necessary and its increase in price. Best practice programme in Construction sector could be launched in Nigeria to (i) Boost productivity in Housing Provision and delivery in so much as, development and application of prefabricated methods of building and mechanization, which necessarily accompanies the rationalization of the erection process. Prefabrication technique has developed along two lines in the form of standard as compared with purpose-made components and in the form of systems of construction based on large scale purpose made components. The use of standard components has been developing steadily in other parts of the developed countries of the world over the last half century. More and more items of joinery and metal goods are purchased ready-made, plaster board and plaster panels are replacing wet plaster, electrical and plumbing systems can be obtained with units cut to size and ready for installation. These systems have been based on interlocking units which form a load bearing structure. It should be noted that prefabrication system of building reduces the slow and painstaking brick by brick method of traditional process known as “off-the-peg” process and encourages the “bespoke” system of ready-made which enhances mass production of housing units.

- Prefabrication Concept

For many years, Nigerians have adapted the traditional way of building houses using brick and mortar. This is the way known to many of us and the Government of the day after the ancient mud hut concept prevalent thousands of years ago. With the advancement in Technology, designs and the development of better and improved building materials, Nigeria can now access other home building options. One of such options, and a very good one too, is the Prefabricated Home Building Concept.

They are homes that are pre-built and assembled in factories into manageable pieces before they are transported to the building site. Due to the speed of building this type of home, the concept is witnessing a huge demand in this present age. The mode of construction can be used for homes, schools, market stalls, offices and is especially adaptable for places of high urbanization.



Plate 10: Prefabricated building – Urban Renewal Housing.

- Quick Construction

Unlike traditionally built homes where the process depends on excessive manual labour and favorable weather prefabricated homes are built in less time. The construction of prefabricated homes is simple compared to conventional constructions. The builder will visit the site to inspect where the building will be constructed and floor plans are drawn by the Architect. These kinds of buildings are being appreciated worldwide for their speed of construction and easier process. This is mainly due to minimal work required on the site and the clean process of construction, which makes it environmentally friendly.

- Design Flexibility

Designs can be customized according to individual tastes and many personalized features can be included. There are a lot of designs to choose from and homes can be built to budget preference and size.

- Better Foundations

Due to the style of erection prefabricated houses do not need costly raft foundation especially in land filled and swampy areas. Though it is as sturdy as a traditional structure, the weight of the building eliminates the risk of subsidence and sinking buildings. Prefabricated homes have now become the home of choice for many home owners in landfilled areas around the world.

- Quality Control

The entire construction of a prefabricated home is done under strict quality controlled conditions. Each section of the building is built to specification to ensure it follows building regulations. As the project is constructed in climate controlled environment, it is less affected by the effects of nature.

- Affordability

Home owners can choose specific designs and features to save their budget and extras if they like. It has been proven that prefabricated homes are cheaper to build than traditional buildings. Customers would be able to determine the cost of the project upfront in order to project effectively. This is unlike traditional construction methods where cost can easily spiral out of control. Prefabricated buildings are also not dependent on supplier of cement, bricks etc. This is because all the components of the building are pre-determined and fabricated before construction commences.

Homes made of prefabricated construction are becoming the home of choice worldwide and should engage government attention in Nigeria in their desire for provision and meeting dense housing needs of the citizenry.

2.4.4 The Built Environment

Built Environment, Housing and Public Health

The term built environment refers to the human-made surroundings that provide the setting for human activities, ranging in scale from buildings and parks or green space to neighborhoods and cities that can often include their supporting infrastructure, such as water supply, or energy networks. The built environment is a material, spatial and cultural product of human labour that combines physical element, and energy in forms for living, working and playing. It has been as “the human-made space in which people live, work, and recreate on a day-to-day basis”. All the physical things constructed by humans as aid to living.



Plate 11: The Built Environment

At the turn of the twentieth century, public health research expanded the definitions of “Built Environment” to include healthy food access, community gardens, “walkability” and “bikability”. In essence, the elements of the built environment consist broadly of accommodation for living, working, storage, recreation, spiritual needs, facilities for transport and other specialist constructions. These elements in varying numbers and sizes make up the environment built by man for himself over the years.

Considering living accommodation as the subject of this lecture, housing can be classified into three groups as follows:

- i. Low-rise buildings; varying from one to three storey(s) in height. A storey height is the distance from the floor to the ceiling.
- ii. Medium-rise buildings; varying from four to seven storeys in height.
- iii. High-rise buildings; whose height exceeds seven storeys to sky scrapers in cities of developed countries like America, United Kingdom, France etc.

A good built environment must have buildings and amenities located and designed in accordance with sound environmental principles and in such a way as to provide sustainable management of land, water and other resources.

Cities, towns, communities and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural assets must be protected and developed.

Our built environment has to meet the need of people and society, offer a good living environment and contribute to sustainable development. How we live our lives affects the environment in many ways, whether it be a matter of the way we separate and dispose our waste materials, travel to work and leisure activities, consume electricity and water supply etc.

The connection between housing, the built environment and public health became increasingly apparent from the 19th century, as hundreds of thousands of workers crowded into unsanitary, industrial cities with a resulting increase in disease and epidemics and a decrease in life expectancy. In this era, dramatic improvements in public health in industrialized nations were made possible by changes in the built environment. The installation of comprehensive sewer systems, improvement of building design to ensure that residents had light and fresh air and the movement of residential areas away from noxious industrial

facilities all brought significant improvements in health. In America, sanitary engineers were made to take lead in urban planning.

Industrialization not only highlighted the connection between the built environment and public health but also established the dominant view that population concentration and proximity between businesses and residences were unhealthy. This view was reflected in the aesthetics of the city. Beautiful movement as well as in the Social Agenda of many in the 20th century housing reform movement. It also reflected in the zoning ordinances that took hold in the 1920s. These ordinances separated neighborhoods for residential businesses, and industrial uses and specified building heights, setbacks, and the density of use. These measures improved public health, safety morals and general welfare.

By the mid-20th century, the connection between public health seemed to diminish. Infectious diseases had been brought under control, and as a result the layout and planning of cities came to be viewed as a matter of aesthetics or economics, but not health. Public health officials concentrated on human behaviors such as smoking, and to the extent they considered the built environment, the focus was on more discrete issues rather than larger-scale planning issues.

Today the primary public health problems are chronic and infectious diseases and many Nigerians live in urban and rural areas. These changes have not eliminated the connection between public health and the built environment and so, the inability of Government of the day to embark on effective control and separation of residential area from business area can lead to major health problems in the short and long run.

In contrast to the situation in the cities of the mid-19th century, today nearly all aspects of the built environment are shaped by law and government decisions. What can be built in what location is regulated by a complex set of Local, State and Federal laws. Another significant change is that unlike the situation in 19th and 20th centuries, today's public health advocates have been largely absent from discussions about major planning or land use decisions involving the built environment. Many cities and local government areas in Nigeria have large planning departments or other bureaucracies that regulate land use and buildings. These frequently include urban planners, architects, lawyers, economists, transportation engineers, environmental scientists and demographers. They rarely include public health officials. This may reflect a broader phenomenon of the increasing isolation of public health officials within government. Nonetheless, public health officials can add an important voice to the decision that shapes the built environment, and also offer guidelines to help public health professionals be effective advocates in political decision making.

The link between physical space and healthy population is that the built environment influences the public's health, particularly in relation to chronic diseases. There is ample evidence to indicate that the burden of chronic disease in the population can be reduced through an active lifestyle, proper nutrition and reduced exposure to toxic conditions. However, many cities/urban and local government areas in Nigeria are not well designed to facilitate healthy behaviors or create the conditions for health. Health officials can provide information about healthy living and if people live in poorly designed physical environments their health will suffer.

To understand therefore, the effect of poorly designed built environment on health, it is necessary to mention major health threats and diseases facing Nigerians today. The leading causes of unhealthy living in the country nowadays includes but not limited to air pollution with its detrimental effects including chronic respiratory ailments, such as Asthma, e.g. The outbreak of soot in Port Harcourt and its environs

and gas flaring in Rivers State, is deleterious to the health of people living in the area, if drastic action is not taken to stop it.

To understand therefore, the effect of poorly designed built environment on health, it is necessary to mention major health threats and diseases facing Nigerians today. The leading causes of unhealthy living in the country nowadays associated with poor built environment include but not limited to:

- Air pollution and gas flaring with its detrimental effects including chronic respiratory ailments, such as Asthma, Bronchitis, Emphysema and unintentional injuries.
- The outbreak of soot in Port Harcourt and its environs and gas flaring in Rivers State of Nigeria is deleterious to public health, if drastic measure is not taken by the government to stop it.

- **Building on water ways/siltation**

More recently the drainages do not flow freely due to poor designs, building on water ways, silt and other heavy materials, plastics/debris blocking the water channel and free flow of sewage. When this happens excess water overflows the open drainage and floods the land. Due to littering, the drainage channel with heavy materials and debris and building on water channels, the water channels become blocked and silted (Nyenke, 2013). This practice results in massive flooding in the cities and rural communities and encourage stagnant water and mosquito breeding, and deadly stench that make fresh air intake impossible. The foul air releases constitute another disaster to public health which often results in Malaria and Typhoid ailments.

- **Sewage and Waste Water**

Sewage may be defined as the used water or liquid waste of a community, which includes human and household wastes together with street-washings, industrial wastes and such ground water as may be mixed with it.

The constituents of sewage are:

- Domestic sewage, which includes human excreta as well as discharges from kitchen baths, lavatories etc. from public and private buildings.
- Industrial and trade-wastes from manufacturing processes, such as tanneries, slaughter houses, distilleries, mills, laundries, chemical plants etc.
- Ground water or subsoil water entering sewers through leaks and
- Storm water which is rain water from houses, roads, along with surface water etc.

Sewer is an underground conduit used for removal of sewage and sewerage is the general process of removing sewage. The entire system of conduit and appurtenances involved is called sewerage system or sewer system.

Lack of adequate sewerage system in Nigeria and Rivers State degrade and pollute the Built environment and encourage more communicable, but largely preventable disease like, guinea worm, measles, tuberculosis, typhoid, cholera and dysentery.

- **Waste Management**

Waste can be classified into two broad headings, that is, municipal and consumer wastes and industrial and hazardous wastes. As wastes can be seen as those materials no longer required by an individual or industry, solid waste are all the wastes from human and animal activities that are normally solid and discarded as useless or unwanted. Industrial waste of any country depends on the industrial base of that country. Even though there is no agreed definition of hazardous waste,

some countries defined hazardous waste only in terms of the danger to human health while others include damage to the environment. Hazardous wastes may thus be defined in terms of their physical or chemical characteristics. For example, flammability or toxicity or in terms of concentration of specific substances that they contain. The built environment is severely subjected to the various wastes outlined. The management of urban solid wastes constitute one of the most immediate and serious built environmental problems facing government in Africa cities (World Development Report, 1992). The conventional municipal and waste approach based on collection and disposal has failed to provide efficient and effectiveness to urban dwellers. The deplorable situation of the abundance of waste in many African cities is very common. We have in Lagos-Nigeria, Accra-Ghana, Kinshasa-Zaire etc. In all these cases, waste are dumped indiscriminately and pose environmental health hazard. The prevalence of parasites, tetanus, malaria, hookworms, cholera and diarrhea in Nigeria and African countries can be attributed to unsanitary conditions in these cities. Evidence that the most uncontrolled dumping of waste materials at sea may damage the marine environment, and concern at illegal dumping of toxic waste in countries without technical resources to deal with them has attracted international attention to control such actions. Waste dumped in storm drainage channels, creeks, lagoons and around other water impoundment points typical in Nigeria create serious built environment problems which can lead to disastrous situation of epidemic proportions.

- **Infrastructural Decay (Housing, Roads and Transportation Links and Networks)**

There is acute shortage of housing supply in Nigeria and most of the housing stocks lack basic infrastructural facilities like pipe-borne water, water closet and electricity supply etc. Rural and Urban housing in Nigeria, South-South geopolitical zone, Rivers State falls well below minimum standard in all aspects. There is a high occupancy ratio in the country with some cities like Port Harcourt, Warri etc. having an average of three to four persons per room. Niger Delta roads are death traps and accident prone e.g. East-West road that traverses Niger Delta states have been neglected and abandoned for decades without apology. The unsanitary condition, in which the solid wastes are collected, processed and disposed off, contributes greatly to urban environmental degradation. Several housing policies and programmes are never actualized and according to United Nations (UN) World Housing Survey, total housing requirement in Nigeria were 5,591,000 between 1970 and 1980 and now over 20,000,000 deficit and these needs have not been fulfilled. Most cities in Niger Delta lack open spaces for recreation. The conditions under which people live and work play crucial roles in determining their overall well-being (Nyenke, 2005). These conditions must be such that people's safety and security needs physical, mental and spiritual health, comfort and self-fulfillment are adequately taken care of. The element of the human environment in Niger Delta in Nigeria was a catalyst to my proposal at the 5th International Conference on Housing captioned "SHELTER AFRICA 2006" wherein I presented paper on "Provision of Affordable and Functional Housing in the Niger Delta of Nigeria" organized by Association of Housing Corporation of Nigeria (AHCN) between 13th – 17th March, 2006 at Le Meridien Hotel, Abuja. In the same vein in 2008 World Habitat Day organized by the Rivers State Government, Ministry of Housing under the leadership of Hon. Commissioner for Housing Dame Alice Lawrence-Nemi. I presented a storey building (Bungalow) housing model in that conference considering the national standard of four (4) children, Father and Mother as a family unit. The housing model consists of 4-bedroom including a living room/parlour with Bar, dining room,

kitchen, ante-room with w/c toilets, lobby spaces, in-built Garage, store and green area, further presentation of the housing model occurred in my presentation to the United Nation Institute for Training and Research (UNITAR) in Port Harcourt (2006) and at the International Scientific Conference in the University of Economics, Varna-Bulgaria (2013). It is believed that these world bodies are poised to act on providing the Housing model in the Niger Delta built environment for sustainable development in the Niger Delta built environment.

Although the links between physical activity, proper nutrition, a clean environment and health are well known our current built environment does not promote healthy lifestyles. The environment is integral to encouraging physical activity, yet urban areas frequently lack adequate safe playground and green places. The “open space” that exists may be vacant lots covered with garbage and debris, which attracts vermin and can harbor criminal activities. Children may choose to play in the streets rather than in the broken glass, garbage and used needless of the vacant lots. This lack of safe places discourage a child’s play and exercise. In addition, neighborhoods without green space lack a sense of community and feature increased acts of violence when compared with those that surround green space. And land use patterns also affect the health of urban community, urban neighborhoods may be home to a region’s most toxic sites taking a close look at the recent outbreak of soot in Port Harcourt from illegal manufacturing of fuel in the creeks and neighborhoods around Port Harcourt metropolis. Our urban environment lack resources as well. Convenience stores and establishments that serve fast food may vastly outnumber grocery stores where people can purchase nutritious food.

- **Legal pathways for improving the built environment**

The law can be a potent tool in creating a good built environment that is conducive to public health. Legislators design broad policies and parameters including processes for making decisions that affect the built environment. The decisions of legislators are carried out and enforced by more specialized bodies such as planning boards/agencies, zoning/development control boards, and administrative agencies. Public health practitioners can best influence decisions by intervening early in the process, when broad policies are being made, about population density, land use configurations, transportation, and other important issues. Five main legal avenues for creating a good built environment are: environmental regulation to reduce toxic emissions, zoning ordinances that designate an area for a specific use and related developmental requirements; building and housing codes that set standards for structures, taxing to encourage or discourage activities or behavior; and spending to provide resources for projects that enhance the built environment.

2.4.5 Housing Design in Hot Climates and Future Communities

2.4.5.1 Design Standards/Specifications Functionality and Adaptability

Houses act as a hub for family life. Therefore, the following aspects need to be considered when designing new buildings. The present trend for home today and tomorrow calls for accommodation generally, to cease to be on minimum room size rather, to depend on functional requirements and level of performance, with minimum overall sizes for the dwelling related to the size of family. This implies, for instance, that there should be space for activities requiring privacy and quiet, for satisfactory circulation for adequate storage and to accommodate new household in which to take at least some meals.

Necessary, in this perspective, is providing sanitary appliances, kitchen fitments, bedroom wardrobes, electric sockets, outlets and minimum air system.

2.4.5.2 Design Problems

Until recently, architects were seldom tempted to depart from traditional construction and rely on inherited specifications which were based on the known effects of time, wear and weathering on local materials. Today, designers are faced with wide range of both old and new material components necessitating careful thought to design details and avoid unsatisfactory results. Cases abound where accelerated deterioration and/or unsightly appearance has resulted from the unsuitable placing of incompatible materials or inadequate attention to design details. Streaking by rain water, washing over walling, resulting from lack of suitable projecting features with adequate drips at the head of walls to building with flat roof is a typical example.

Some materials are commonly believed to be maintenance free, but this is not always so in practice. Untreated western red cedar often becomes unsightly, particularly in urban situations. An annual application of a Paraffin wax mixture containing a fungicide or a suitable wood stain is the minimum requirement to preserve appearance. Aluminium used externally requires anodic treatment followed by periodic washing to maintain satisfactory appearance could find expression in the design of building/housing development project.

2.4.5.3 Durability and Maintenance of Housing

Durability of building product such as Housing is associated with good design which also records high performance standards. Building maintenance work uses extensive resources of labour and materials. Although maintenance cost data nationally and state-wide are not readily available due to lack of maintenance culture in our national life. It is vitally important that the probable maintenance and running cost of a building should be considered at the design stage, and due attention directed towards the maintenance implications of alternative designs. Usually, a reduction in initial construction costs often leads to higher maintenance and running costs of buildings.

Average life cycle of a modern building is measured to more than 60 years. For this hypothetical figure to be meaningful, attention to defects in course of usage, perhaps broken down to the following viz rain penetration consideration, entrapped moisture, other causes of dampness, cracking, detachment, and miscellaneous defects, ought to be given attention in building/housing development activities.

2.4.5.4 Appearance of Housing in the Context of its Surroundings

Good design responds to and reflects the surroundings, local areas are frequently characterized by the use of traditional building materials or local building types. New buildings do not need to fully replicate these. Indeed 21st century lifestyles call for innovative housing design, but harmony and identity can be achieved by subtle referencing of local styles and materials in a modern context.

2.4.5.5 Ecosystems and Sustainability of Homes

New homes will be required to meet a zero-carbon standard code level 6 of the Code for Sustainable Homes that will require both radical improvements in the energy efficiency of housing and a renewable zero carbon energy supply. Already in London eco-towns are new towns being built by the Government of the United Kingdom (UK) to achieve exemplary standards of sustainability, preparing for this level of environmental sustainability will rely on pioneers to experiment with new designs and technologies and to promote environmentally friendly lifestyles and behaviors.

This will include, for example:

- Making use of renewable energy technologies, such as solar panels.
- Ensuring that there is adequate space for residents to store and separate waste for recycling.
- Ensuring that there is adequate drainage on the site to reduce flooding risks.
- Minimizing construction waste as it is built.
- Allowing space for trees and plants near homes to support biodiversity.

This implies that the introduction of new environmentally friendly building technologies will require provision for their maintenance over the lifetime of the building both in terms of how it will be carried out and who will fund it.

2.4.5.6 Sustainable Materials Management (SMM)

Globally, consumption of materials continues to increase, with the greatest increases for construction minerals, ores and industrial minerals. Within Nigeria alone, billions of tons of concrete, steel, cement, wood will be required to construct, maintain, and operate our nation's built environment, resulting in substantial economic costs. As competition for natural resources continues to intensify due to global population and economic growth, the availability of materials will be subject to increased uncertainty. Furthermore, the extraction, transportation, use and disposal of these materials result in substantial environmental impacts, including emissions to the air water and land, energy and petroleum consumption, use of non-renewable mineral resources, expenditure of fresh water, and land and habitat use.

Sustainable Materials Management (SMM) the use and reuse of materials in the most productive and sustainable way over their entire life cycles, can help the Nation address its material and resource needs in the built environment while remaining competitive in the global economy. The application of SMM in the built environment includes practices such as:

Beneficially using industrial non-hazardous secondary materials as replacements for virgin materials in construction e.g coal ash, foundry sand, iron and steel (slag etc) and sustainable management of construction and demolition (C & D) materials.

Apply SMM principles in the built environment is beneficial both economically and environmentally. In addition to economic benefits, advancing SMM in the built environment has the potential to conserve resources, reduce waste, enhance resiliency to natural and man-made disasters, and minimize the environmental impacts of the materials we use.

2.5 Green Building

Green building (also known as Green Construction or Sustainable Building) refers to both structure and the application of processes that are environmentally responsible and resource efficient throughout a building's life-cycle: from planning to design, construction, operation, maintenance, renovation, and demolition. This requires close cooperation of the contractor, the architects, the engineers and the client at all project stages. The Green Building practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.

It should be noted that Green Building concept is the direct opposite of Green House effect/gases where we talk about climate change, depletion of ozone layer and global warming environmental phenomena.

Leadership in Energy and Environmental Design (LEED) is a set of rating systems for the design, construction, operation and maintenance of Green Building which was developed by the United States (US) Green Building Council. Other certificates systems that confirm the sustainability of building is the British Building Research Establishment Environmental Assessment Method (BREEAM) for buildings and large scale development. Currently World Green Building Council is conducting research on the effects of green building on the health and productivity of their users and is working with World Bank to promote Green Buildings in emerging markets through Excellence in Design for Greater Efficiencies (EDGE) Market Transformation Programme and Certification. There are also other tools such as Green Star in Australia and the Green Building Index (GBI) predominantly used in Malaysia.



Plate 12a: Green Building.

Source: https://en.wikipedia.org/wiki/Green_building



Plate 12b: The Tallest Green Building of LEED.

Source: https://en.wikipedia.org/wiki/Green_building

Although new technologies are constantly being developed to complement current practices creating greener structures, the common objective of green building is to reduce the overall impact of built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources.
- Protecting occupants' health and improving employee productivity.
- Reducing waste, pollution and environmental degradation.

A similar concept is natural building, which is usually on a smaller scale and tends to focus on the use of natural materials that are available locally. Other related topics include sustainable design and green architecture. **Sustainability may be defined as meeting the needs of the present generations without compromising the ability of future generations to meet their needs.** Although some green building programmes do not address the issue of the retrofitting existing homes, others do, especially through public scheme for energy efficient refurbishment. Green construction principles can easily be applied to retrofit work as well as new constructions. A report by U.S. General Services Administration in 2009, found 12

sustainably-designed buildings that cost less to operate and have excellent energy performance. In addition, occupants were overall more satisfied with the building than those in typical commercial buildings. These are eco-friendly buildings.

- **Reducing Environmental Impact**

Globally, buildings responsible for a large share of energy, electricity, water and materials consumption. The building sector has the greatest potential to deliver significant cuts in emissions today, or the equivalent of 9 billion tonnes of CO₂ annually. If new technologies in construction are not adopted during this time of rapid growth, emissions could double by 2050, according to United Nations Environment Programme (UNEP). Green building practices aim to reduce the environmental impact of building. Since construction almost always degrades a building site, not building at all is preferable to green building, in terms of reducing environmental impact. Another rule is that every building should be as small as possible and thirdly, it should not contribute to sprawl, even if the most energy-efficient environmentally sound methods are used in design and construction. Buildings account for a large amount of land. The International Energy Agency released a publication that estimated that existing buildings are responsible for more than 40% of the world's total primary energy consumption and for 24% of global carbon dioxide emissions.

- **Goals of Green Building**

The concept of sustainable development can be traced to the energy (especially fossil oil) crisis and environmental pollution concerns of the 1960s and 1980s. The Rachel Carson book, 'Silent Spring' (1962) is considered to be one of the initial efforts to describe sustainable development as related to green building. The green building movement in the U.S. originated from the need and desire for more energy efficient and environmentally friendly construction practices.

Green building brings together a vast array of practices, techniques and skills to reduce and ultimately eliminate the impacts of building on the environment and human health, it often emphasizes taking advantage of renewable resources e.g. using sunlight through passive solar, active solar, and photovoltaic equipment and using plants and trees. Other techniques used are low-impact building materials or using packed gravel or permeable concrete instead of conventional concrete or asphalt to enhance replenishment of groundwater.

While the practices and technologies employed in green building are constantly evolving, fundamental principles persist from which the method is derived: siting and structure design efficiency, energy efficiency, water efficiency, material efficiency, indoor environmental quality enhancement, operations and maintenance optimization and waste and toxics reduction. The essence of green building is an optimization of one or more of these principles.

On the aesthetic side of green architecture or sustainable design is the philosophy of designing a building that is in harmony with the natural features and resources surrounding the site. There are several key steps in designing sustainable buildings: specify "green" building materials from local sources, reduce loads, optimize systems and generate on-site renewable energy.

- **Life Cycle Assessment**

A Life Cycle Assessment (LCA) can help avoid narrow outlook on environmental, social and economic by assessing a full range of impacts associated with all cradle-to-grave stages of a process: from extraction of raw materials through materials processing, manufacture, distribution, use, repair and maintenance and disposal or recycling. Impacts taken into account include among others embodied energy, global warming potential resource use, air pollution, water pollution and waste. In terms of green building, the last few years have seen a shift from a prescriptive approach,

which assumes that certain prescribed practices are better for the environment towards the scientific evaluation of actual performance through Life Cycle Assessment.

- **Operation and Maintenance Optimization**

No matter how sustainable a building may have been in its design and construction, it can only remain so if it is operated responsibly and maintained properly. Ensuring Operations and Maintenance (O&M) personnel are part of the projects planning and development process will help retain the green building criteria designed at the onset of the project. Every aspect of green building is integrated into the O&M phase of a building's life. The addition of new green technologies also falls on the O&M staff. Although the goal of waste reduction may be applied during the design, construction and demolition phases of a building's life-cycle, it is in O&M phase that green practices such as recycling and air quality enhancement take place. O&M staff should aim to establish best practices in energy efficiency, resource conservation, ecologically sensitive products and other sustainable practices. Education of building operators and occupants is key to effective implementation of sustainable strategies in O&M services. In Nigeria and Rivers State the concept of green building and green practices in construction project will be a tall order having come to incessant building collapse in our environment. The recent seven (7) storey building collapse at No. 169 Woji Road, GRA Phase II in Port Harcourt negates all effort in education training towards scientific and technological transfer and acquisition in the country. Nothing is done scientifically and others with utmost safety and green practices in our national life. The 21st century and beyond agenda 21 is a programme run by the United Nations (UN) related to sustainable development. It is a comprehensive blue print of action to be taken globally, nationally and locally by organization of UN, governments and major groups in every area in which humans impact the environment.

- **Regulation and Operation**

As a result of the increased interest in green building concepts and practices, a number of organizations have developed standards, codes and rating systems that allow government regulators, building professionals and consumers embrace green building with confidence. In some cases, codes are written, so local government can adopt them as by-laws to reduce the local environmental impact of building.

Green building rating systems such as BREEAM (United Kingdom), LEED (United States and Canada), Germany, Japan and Spain help consumers determine a structure's level of environmental performance. They award credits for optional building features that support green design in categories such as location and maintenance of building site, conservation of water, energy and building materials, and occupants comfort and health. The number of credits generally determine the level of achievement. Green building codes and standards, such as the International Code Council's draft, International Green Construction Code are sets of rules created by standards development organizations that establish minimum requirements for elements of green building such as materials, or cooling and heating.

Some of the major building environmental assessment tools currently in use include: United States International Green Construction Code (IGCC).

2.6 Intelligent Buildings

A building controlled by a Building Automation System (BAS) is often referred to as an intelligent building, "Smart Building", or if a residence, a smart home.

Every intelligent building starts with the Network. An intelligent building is a building in which the use of Technology, and process create a safer and more productive environment for its occupants and more operationally efficient for its owners. The key parameter and enabler of intelligent buildings is undoubtedly the network infrastructure and with the progression of technology, the scope of capability has been greatly widened with regard to flexibility on the architecture, performance and green credentials. The services will include:

- Cabling services
- Data centers
- Networking
- Redeployable CCTV
- Access Control
- Fire Systems
- Intruder Alarm etc.

Intelligent building solution will finally harness multiple technologies to:

- Provide a superior and safe environment
- Streamline your business processes
- Increase building security
- Reduce operational cost

Nigeria can identify massively with this innovation in housing provision, policy and implementation strategy if only she takes science and technology as a priority in Nation building

2.7 Vertical Housing Development

The concept of Vertical Housing Development Systems (VHDS) has shifted away from large collections of single use vertical building to a modern and current trend in Vertical Housing Development system that goes up to the sky and features Multifunctional Interests (MFI) that creates mixed use pattern of housing provision.

Conversely, horizontal housing development is where housing, malls, work places, infrastructure etc. spread (urban sprawl) over the ground, increasing the urban surfaces at the expense of rural and natural grounds or reclaimed land. The current trend therefore, is to create large, multifunctional buildings (MFBs), most especially combining residential, hotel, retail functions and many more others, of human activities in one building design. The multifunctional buildings (MFBs) evolution are also being hailed as Vertical Cities (VC). Considering this development, two questions often surface whenever vertical cities are discussed in any depth: First, what differentiates a Vertical City from a multifunctional building and second, what is the importance of that distinction?

Considering the Shanghai tower, the architects have created as Vertical City (VC), yet this building does not include residential spaces, much less medical, educational, or government facilities. Can one imagine a city without places to live, no doctors to visit, schools to attend or social and governmental services? Probably not. Clearly, the Shanghai Tower is a long way from actual city. Other buildings such as the De Rotterdam Tower, the vertical village in Singapore, China and the Burj Khalifa in Dubai, United Arab Emirate (UAE) and currently, the tallest skyscraper in the world are in that category. While both MFBs and VCs are by nature multifunctional, a vertical city is designed to provide all of the necessary functions that

a city typically possesses, including recreational spaces, free public spaces, social and governmental services, education, energy and food production. Existing MFBs at the most, include residential, hotel shopping and office spaces.

Benefits of MFBs

Numerous benefits to building multifunctional buildings include

- Diversity of spaces and functions provided for people
- Convenience of being able to live, work, eat and shop all in the same building. The convenience means that the need for transportation is reduced and in turn, so is pollution arising from carbon emission from commuters.
- A world in which everyone could live within a comfortable walking distance from their place of work to their homes.
- Energy and toil saved by a series of interconnected buildings that create horizontal green spaces in the sky that mimic ground spaces.
- The functions of our civilization such as food production, energy, manufacturing, housing, healthcare, recreation, commerce and exposure to nature can be seamlessly and comfortably clustered together.
- A new urban form in environmental point of view, MFB will curb global warming, preservation of arable land, local food made without preservation or refrigerants. In socio-economic/political consideration, mix uses to meet essential needs for housing, employment, education, recreation, healthcare and other services, optimizing the efficiency gains of centralized labour and consumption markets by eliminating away long wasteful and polluting commutes between home and work.

Vertical MF housing schemes have already started in India, considering the acquisition of Technology, the country embarked upon after independence their commitment to providing housing accommodation for different classes of people in India.

India and Nigeria had political independence from Britain in 1947 and 1960 respectively. India in recognition of the importance of Science and Technology in Building a Nation has made giant strides in uplifting their various sectors of their economy. With overwhelming population of 1.3 billion people compared to 180 million people in Nigeria, India has successfully positioned herself in critical sectors of their economy with the result that Vertical M.F. Housing Scheme is vigorously going on as an option to providing a solution to housing provision deficit. Housing provision whither Nigeria in the 21st century Technologies?

Vertical Multifunctional buildings are clearly a movement in the right direction, but that movement needed to come in Nigeria yesterday. Following development goals in other serious countries.

With the world population set to hit somewhere between 9 – 10 billion by 2050 and global climate change having ever more tangible effects, we as humans have found ourselves living in the eleventh hour with our back to the wall. **Other innovations and technological advances that ease this transition include: Agro-housing, a modern housing concept with a vertical green house.** Advances in agricultural and food sciences, alternative energies, materials science, transportation and computing may all have positive

outcomes. Perhaps more food can be grown on less land and more products can be produced using fewer natural resources.

Living and working in a building hundreds of stories high makes a great deal of sense, since it prevents the loss of farmland and natural green belts. It reduces air pollution (since all commuting is vertical where the distances are much shorter and the transport mechanism much more efficient and reduces the need for all the roads that service horizontal cities and people can just walk out into the park land).

VMF Agro-housing, as is suggestive from the name will not only be a housing unit but will also let people grow their own food according to their requirements. This will help bring urban agriculture and housing on the same platform. The design comprises of multistorey green houses that will be situated in the middle of the building where people can grow fruits, vegetables, flowers and spices. A system will collect rain water as well as grey water from apartments, which will be used to irrigate plants. The presence of soil loss system will be equipped with drip irrigation to keep the plants in a healthy state.



Plate 13: Vertical Multifunctional (VMF) Agro-housing

Source: https://www.archdaily.com/228981/agro-housing-knafo-klimor-architects/cls_s_04

Vegetables and fruits will be grown by individuals/families, these are likely to be free from harmful chemicals and fertilizers. This will also save transportation costs and cut down pollution levels as families grow their own organic produce. The eco-friendly housing solution also features solar system for energy requirements. VMF Agro-Housing model vows to give greater freedom and better health, while infusing a sense of sustainable living amongst people all across the globe. This concept is gaining support especially in Wuham – China, in order to support their ever-growing population in housing provision.

2.8 Skyscraper

A skyscraper is a continuously habitable high-rise building that has over 40 floors, and is taller than approximately 150m (492ft). Historically, the first skyscrapers referred to buildings with 10 to 20 floors in the 1880s. The definition shifted with advancing construction technology during the 20th century. Skyscrapers may host commercial offices or residential space or both. For buildings above a height of 300m (984ft) the term “super tall” can be used, while skyscrapers reaching beyond 600m (1,969ft) are classified as “mega tall”. An example of a mega tall skyscraper is the Burj Khalifa in Dubai (United Arab Emirates) completed in 2009 is currently the tallest skyscraper in the world, with a height of 829.8m (2,722ft). The setbacks at various heights are a typical skyscraper feature.



Plate 14: The Tallest Skyscraper in the World – Burj Khalifa in Dubai (UAE).

Source: <https://en.wikipedia.org/wiki/Skyscraper>

Modern skyscrapers' walls are not load-bearing, and most skyscrapers are characterized by large surface areas of windows made possible by steel frames and curtain walls. However, skyscrapers can have curtain walls that mimic conventional walls with a small surface area of windows. Modern skyscrapers often have a tubular structure and are designed to act like a hollow cylinder to resist wind, seismic and other lateral loads. To appear more slender, allow less wind exposure, and transmit more daylight to the ground, many skyscrapers have a design with setbacks, which are sometimes also structurally required.

After the Great Depression skyscraper construction suffered a hiatus for over thirty years due to economic problems. A revival occurred with structural innovations that transformed the industry, making it possible for people to live and work in “cities in the sky” and 3rd September is the global commemorative day for skyscrapers, called “Skyscraper Day”.

2.8.1 Economic Rationale

Skyscrapers are usually situated in city centres where the price of land is high. Constructing a skyscraper becomes justified if the price of land is so high that it makes economic sense to build upwards as to minimize the cost of the land for the total floor area of a building. Thus the construction of skyscrapers are dictated by economics and result in skyscrapers in a certain part of a large city, unless a building code restricts the height of the buildings.

Skyscrapers are rarely seen in small cities and they are characteristic of large cities, because of the critical importance of high land prices for the construction of skyscrapers. Usually only office, commercial and hotel users can afford the rents in the city centre and thus most tenants of skyscrapers are of these classes. Some skyscrapers have been built in areas where bedrock is near surface, because this makes constructing foundation cheaper. Today skyscrapers are in increasingly common sight in advanced countries of the world in order to save land for the future generations unborn.

Considering the high ratios of rentable floor space per unit area of land, a simple price of floor area in currency/m² is given by

$$\frac{\text{Price of land area (currency)}}{\text{total floor area (m}^2\text{)}}$$

One problem with skyscraper is car parking. In the largest cities most people commute via public transport, but for smaller cities a lot of parking spaces are needed. Multi-storey car parks are impracticable to build very tall, so a lot of land area is needed.

Also, there may be a correlation between skyscraper construction and great income inequality, but this has not been conclusively proven.

2.8.2 Environmental Impact

The amount of steel, concrete and glass needed to construct a single skyscraper is large and these materials represent a great deal of embodied energy. Skyscrapers are thus energy intensive buildings, but they have a long life span for example the Empire State building in New York City, United State of America completed in 1931 and is still in active use.

Skyscrapers have considerable mass which means that they must be built on a sturdier foundation than would be required for shorter, lighter buildings. Building materials must also be lifted to the top of a skyscraper during construction, requiring more energy, than would be necessary at lower heights. Furthermore, a skyscraper consumes a lot of electricity because potable and non-potable water has to be pumped to and from the highest occupied floors, skyscrapers are usually designed to be mechanically ventilated, elevators are generally used instead of stairs and natural lighting cannot be utilized in rooms far from the window and the windowless such as elevators, bathrooms and stairwells.

Skyscrapers can be artificially lit and the energy requirements can be covered by renewable energy or other electricity generation with low greenhouse gas emissions. There is Leadership in Energy and Environmental Design (LEED) Certification for skyscrapers. For example, the Empire State building received a gold Leadership in Energy and Environmental Design rating in 2011 and the Empire State Building is the tallest LEED certified building in the U.S.A., proving that skyscrapers can be environmentally friendly. Also the 30 St. Mary Axe in London, the United Kingdom is an environmentally friendly skyscraper.

In the lower levels of a skyscraper a larger percentage of the building cross section must be devoted to the building structure and serious than is required for lower buildings.

- More structure – because it must be stronger to support more floors above
- The elevator conundrum creates the need for more lift shafts – everyone comes into the bottom and they all have to pass through the lower part of the building to get to the upper levels.
- Building services – Power and water enter the building from below and have to pass through the lower levels to get to the upper levels.

In low-rise structures, the support rooms (chillers, transformers, boilers, pumps and air handling units) can be put in basement or roof space-areas which have low rental value. There is, however, a limit to how far this plant can be located from the area it serves. The farther away it is the larger the risers for ducts and pipes from this plant to the floor they serve and the more floor area these risers take. In practice, this means that in high rise buildings this plant is located on “plant levels” at intervals up the building.

Momentum in setting records passed from the United States of America to other nations with the opening of the Petronas Twin Towers in Kuala Lumpur, Malaysia, in 1998. Therefore, the world’s tallest building has remained in Asia since the opening of the Taipei 101 in Taipei, Taiwan in 2004. A number of architectural records, including those of the world’s tallest building and tallest free-standing structure moved to the Middle East with the opening of the Burj Khalifa in Dubai, United Arab Emirates.

This geographical transition is accompanied by a change in approach to skyscraper design. For much of the twentieth century large buildings took the form of simple geometrical shapes. These reflected the

“International Style” or modernist philosophy shaped by German Architects Bauhaus, early in the century. The last of these, Willis Tower and World Trade Center Tower in New York, erected in the 1970s reflected the philosophy. Tastes shifted in the decade which followed, and new skyscrapers began to exhibit post-modernist influences. This approach to design availed itself of the historical element, often adapted and re-interpreted in creating technologically modern structures. The Petronas Twin Towers recall Asian Pagoda architecture and Islamic geometric principles. Taipei 101 likewise reflects the pagoda tradition as it incorporates ancient motifs such as the “ruyi” symbol. The Burj Khalifa draws inspiration from traditional Islamic art. Architects in recent years have sought to create structures that would not appear equally at home, if set in any part of the world, but that reflect the culture thriving in the sport where they stand.

The following list in Table 1 measures height of the roof. The more common gauge is the “height of architectural detail” and such ranking included Petronas Towers, built in 1996.

Table 1: List of Selected Skyscrapers in the World

Year Built	Building	City	Country	Roof		Floors	Pinnacle		Current Status
1889	Auditorium Building	Chicago	USA	082m	269ft	17	106m	349ft	Standing
1890	New York World Building	New York City	USA	094m	309ft	20	106m	349ft	Demolished in 1955
1894	Philadelphia City Hall	Philadelphia	USA	155.8 m	511ft	9	167m	548ft	Standing
1931	Empire State Building	New York City	USA	381m	1,250ft	102	443m	1,454ft	Standing
1972	World Trade Center (North Tower)	New York City	USA	417m	1368ft	110	527.3m	1,730ft	Destroyed in 2001 in the September 11 attacks
1974	Willis Tower (formerly Sears Tower)	Chicago	USA	442m	1,450ft	110	527m	1,729ft	Standing
1996	Petronas Towers	Kuala Lumpur	Malaysia	379m	1,242ft	88	452m	1,483ft	Standing
2004	Taipei 101	Taipei	Republic of China (Taiwan)	499.2 m	1,474ft	101	509.2m	1,671ft	Standing
2010	Burj Khalifa	Dubai	United Arab Emirates	828m	2,717ft	163	829.8m	2,722ft	Standing

Source: <https://en.wikipedia.org/wiki/Skyscraper>

Where do we go from here as Nigerians? Are we part of this technological improvements and innovation in housing provision? Our universities are not well funded to encourage Research & Development in housing provision. Our yearly national and state budgets have never deliberately included any laudable scientific and technological innovation to reduce deficit in housing provision and we are totally falling

behind 21st century science and technology bias/inclination technology and innovation compared to many countries not as rich as we in natural endowment such as huge oil and gas and other mineral deposits extracted from our soil on daily basis. Is it just like that to be sustainable in our living? Where is our optimization plan for the wealth of the nation?

2.9 Affordable/Social Housing

2.9.1 Housing Affordability

There is a difference between ‘affordable’ housing and ‘housing that is affordable’. Affordable housing is the Government-subsidized kind. The latter, on the other hand, describes the way that architects or engineers have reduced the cost of owning a house, renting a house or constructing a house. Housing that is affordable is distinct from affordable housing which is not always cheap to build.

By the wording of National Housing Policy (2012), social housing is seen as government responsibility to provide these houses to the people by subsidy mechanism for its distribution and thus categorized them as follows: The NO-Income; Low Income and Lower-Medium Income groups and defined them as follows:

- (i) NO-Income group is all persons whose income does not exceed the national average of 25% of the National Minimum wage.
- (ii) The low income group is all persons whose annual income exceeds the ‘NO income’ level, but does not exceed the National Minimum wage.
- (iii) The lower-medium income group is all persons whose annual income exceeds the National Minimum Wage, but does not exceed four times the National Minimum Wage.

By the stretch of imagination of the housing policy, social housing falls under the term Affordable Housing which is government subsidized kind.

The objectives of Housing that is affordable are:

- (i) To significantly improve the well-being of the poor, the needy and other vulnerable groups in the society, such as women, single mothers, the elderly, widows and widowers, the physically challenged, the homeless and a critical mass of the citizens who fall into this group.
- (ii) Provide a sustainable way of reducing the housing deficit in the country, estimated at about 17 million units nationwide as at 2011.
- (iii) Provide a window of opportunity for government at all levels to demonstrate their commitment to the provision of Housing as a Social responsibility to the citizenry, thereby institutionalizing an efficient, responsible and sustainable mechanism for housing delivery.

Methods Designers can use to create Housing that is affordable include:

1. Deploy Technology
Harness the power of sensors and internet of things-branded products to make 200 sq. foot (18.6m²) prototype apartment perform like one four times that size. The system allows inhabitants to use hand gestures or voice commands to flip, move, and stow the house’s transformable furniture. Quite efficient but has all the comforts in a smaller space.

2. Build Modularly

Architects have championed the idea of modular home for decades, which only now has started to appear. 23.25m² to 34.4m² apartments are assembled from modules that are built off-site and later hoisted into place with a crane.

2.10 Housing Finance: The Role of Mortgage Banks

Vice-Chancellor Sir, Housing finance refers to money provided by any source other than the resident or builders of the dwelling for the construction or purchase of housing. It includes construction funds loaned to builders and mortgage funds loaned to individual families by private or public banks and by wide variety of other types of financial institutions. It also includes various types of housing subsidies provided by government agencies (United Nations, 1974). Thus, a housing finance system is the financial institutions themselves, their legal status and administrative procedures and the relationships and markets which link them. That is, it is a super structure of laws, institutions, and relationship between institutional and non-institutional units which facilitate the process of financial intermediation and capital formation in the housing sector. A well-developed housing finance system could be seen as one which significantly facilitates the purchase, rental, construction and improvement of homes for the population as a whole, in particular, it should be able to objective effectively and economically disadvantaged in the context of the high cost of housing. An effective housing finance system should be able to mobilize savings and protect their real value. In addition, the housing finance needs of those with income and/or assets above the eligibility level for government or other housing subsidies, but still too low to be able to afford decent housing at market prices must also be given due priority. Its effectiveness is able also judged by the extent to which the quantity and quality of housing in the active stock improves about a decade ahead. Finally, an effective housing finance system is judged in terms of its net macro-economic impact, namely, the effect of resources mobilization for housing on aggregate savings and availability of funds for other sectors; the impact on the national budget, and the amount of employment and value-added generated by the housing industry (World Bank, 1983).

Financing of housing in Nigeria currently constitutes a major problem for all households which are not in the super higher income brackets. To a certain extent, the importance that paying for sound housing plays in a family's budget is simply a consequence of the fact that a dwelling is the largest single consumer commodity a household can expect to buy. The full price of a house typically is often above five to ten times a family's annual income. Most families would not be able to buy or build a house unless they saved for it almost throughout their working lives. Indeed, the share of housing in the family budget has been magnified by the fact that the prices of land, construction labour and building materials are rising much faster than incomes. It is also true that interest rates have risen rapidly to very high levels in recent times following degeneration of interest rates as part of the Structural Adjustment Programme (SAP) commenced in July 1986. These have been compounded by rising population and urbanization coupled with the "revolution of rising expectations". At the national level the problem is magnified by dwindling government finance.

2.10.1 Housing Finance by Nigeria's Financial Institutions

The Nigerian housing finance system is made up of corporate financial intermediaries, corporate construction intermediaries (Federal Housing Authority (FHA) and Private Estate Developers), Mixed

Corporate Intermediaries (State Housing Corporations); Individuals and Government and Its Agencies (offering staff loans).

The corporate financial intermediaries include three groups of bank financial institutions – The Federal Mortgage Bank of Nigeria (FMBN), Commercial banks and Merchant banks – and a group of non-bank financial institutions (the insurance companies).

In a broad sense, with respect to housing finance, these financial institutions are supposed to perform two main functions vis-à-vis financing new homes and facilitating the change of ownership of old homes through refinancing. Infact, mobilizing financial resources for housing forms as part of the overall endeavor of increasing savings and improving allocation through financial intermediation.

2.10.2 Federal Mortgage Bank of Nigeria

The Federal Mortgage Bank of Nigeria (FMBN) which was set in 1977, absorbed the assets and liabilities of the Nigerian Building Society (NBS) earlier setup in 1956. The NBS itself, the first Mortgage banking institution in Nigeria, was originally jointly owned by the then Commonwealth Development Corporation (CDC) which held 60% of the equity the Federal Government with 31% and the then Eastern Nigeria Government subscribing 9%. In 1972, the Federal Government bought over the 60% equity holding of CDC; granted the society substantial loans at very low interest rates (3%) and directed it to reduce interest charges on mortgage loans. Given the lopsided nature of the society's mortgage loans, favouring only the upper and middle income earners the Federal Government in 1976 set up the Asaba Committee for the transformation of the NBS. Thus following the report of the committee in 1977, the Federal Government established the FMBN which commenced operation in the year.

In order to assist federal government in achieving a significant increase in the supply of housing units, by granting more credit for housing, the law establishing FMBN conferred the following main functions on it which are as follows:

- 1) Provision of long-term credit facilities to mortgage institutions in Nigeria for the purpose of building houses to be left out or sold at reasonable rates to the public.
- 2) Encouragement and promotion of the development of mortgage institutions at state and national levels.
- 3) Supervision and control of the activities of mortgage institution in Nigeria.
- 4) Provision of long-term credit facilities directly to Nigerians wishing to build houses to live in.
- 5) Providing, at competitive commercial rates of interest, credit facilities to commercial property developers of offices and other specialized types of buildings.

FMBN was also conferred with the following powers to perform these functions:

- To accept term deposits and savings from mortgage institutions, trust funds.
- To promote the mobilization of savings from the public etc.
- The FMBN also performs agency functions in the execution of the Federal Government Housing Programme as follows:
 - World Bank assisted Urban Development Programme
 - Federal Government Low Cost Housing Programme
 - Federal Government Staff Housing Loan schemes and cost recovery agent for the governments nation-wide housing projects

The initial authorized capital of the Bank was 20 million, but this was increased to ₦150 million in 1979 with Federal Government equity of 60% and Central Bank of Nigeria (CBN) 40%.

Other sources of funds are annual federal government budgetary allocations; soft long-term loans from the federal government, long-term loans from CBN and international financial institutions e.g. World Bank. Savings from the public at large/including individual savers, institutional and depositors etc.

The FMBN operates three types of Mortgage loans: Commercial loans; economic loans and social loans.

- Commercial loans are for the development of property for sale, rent or for business and are granted at the ruling market interest rate. The bank grants 80% of the amount while the borrower's personal stake is a minimum of 20%. The type of development covered include estate development, hotels, office development etc. while repaying period ranges between 7 – 10 years.
- Economic loans are for mixed property development, that is, where the property is partly residential (owner occupation) and partly for letting.
- Social loans are meant for owner-occupier or residential accommodation and attracted a “concessionary” or “subsidy” interest rate. The maximum amount lent was 90% of the total amount while the borrower's personal stake is not less than 10%.

Table 2 and 3 summarizes the FMBN lending rates and mortgage operations respectively since it started business in 1977 – 1987.

Table 2: Pattern of FMBN Lending Rates (%)

Year	Type of Loan		
	Social	Economic	Commercial
1977	3	4	5
1978	5	7	8
1979	5	8	10
1980	6	9	11
1981	6	9	11
1982	7.5	9.5	11.5
1983	7.5	9.5	11.5
1984	9.5	11.5	13
1985	9.5	11.5	13
1986	9.5	11.5	13
1987	12	13.14	15

Source: FMBN Journal, Vol. 2, No. 1 1987.

CBN, Annual Report and Statement of Accounts, December 1987.

Table 3: FMBN Mortgage Disbursements (1977 - 1987) (N)

Year	Retail (N)	% of Total	Wholesale (N)	% of Total	Total (N)
1977	17,802,903	89.9	2,000,000	10.1	19,802,903
1978	19,174,531	94.9	1,020,000	5.1	20,194,531
1979	40,675,984	92.3	3,400,000	7.7	44,075,984
1980	53,311,343	83.4	10,601,980	16.6	63,913,323
1981	67,384,484	89.5	7,923,000	10.5	75,307,484
1982	49,512,925	97.1	1,468,171	2.9	50,981,096
1983	50,289,578	86.6	7,813,007	13.4	58,102,585
1984	11,229,969	88.7	1,424,660	11.3	12,654,629
1985	13,033,328	91.6	1,190,000	8.4	14,223,328
1986	10,017,520.72	93.7	673,334	6.3	10,690,854.72
1987	16,200,000	95.3	800,000	4.7	17,000,000
Total	348,632,565.72	89.1	38,314.152	9.9	386,946,717.72

Source: FMBN Journal, Vol. 2, No. 1 1987.

CBN, Annual Report and Statement of Accounts, December 1987.

The data in Table 2 and 3 summarizes the FMBN's lending rates and mortgage operations respectively since it started business in 1977 to 1987 disbursed by analysis of the loans, not less than 80% in retail lending since inception till date. Wholesale lending that is, loans to housing corporations and estate developers constitute less than 20% and amounted to ₦38,314,152 million out of the total of ₦386,946,717.72 million granted between 1977 and 1987. The reason for these include lack of adequate funds; lack of secondary intermediaries, confusion in the relationship between institutions in housing finance system and lack of co-ordination, political environment and managerial history. Inability of FMBN to meet housing finance in Nigeria can clearly be seen if one looks at loan applications vis-à-vis loan disbursement. Table 3 presents data on FMBN loan applications for the period 1981 to 1986.

In 1981, while total of loan application was ₦722,034,432 FMBN could only disburse ₦75,307,484 leaving a yawning gap of ₦646,726,948. In 1986, a similar picture prevailed as in other years out of a total loan application of ₦79,000,000 only ₦7,000,000 was disbursed leaving another huge gap of ₦72,000,000. This goes to confirm that mortgage loan demand in Nigeria is largely not met due partly to inadequate funds at the disposal of the mortgage finance institutions and this problem has worsened due to decreasing government allocations and assistance in the face of decreasing government revenue due to nose-diving oil prices, hence the FMBN has been slated for partial privatization as part of the structural adjustment programme of the National economy.

Table 4: FMBN Loan Applications (₦)

Year	Retail (₦)	Wholesale (₦)	Total
1981	185,738,742	536,295,600	722,034,432
1982	132,670,014	22,306,036	154,976,050
1983	157,623,255	26,253,794	183,877,049
1984	40,540,761	3,500,000	44,040,761
1985	19,437,325	6,000,000	25,437,325
1986	72,000,000	7,000,000	79,000,000

Source: FMBN Journal, Vol.2, No.1, 1987

2.10.3 Commercial and Merchant Banks

Until 1987, housing was included in the preferred sector and these banks were required to lend an annually specified percentage of their total advanced (6% by 1986). Default was penalized by allocating the shortfall to the FMBN for on-lending.

Table 5: Data on Housing Finance by Commercial and Merchant Banks from 1978 – 1988

Year	Commercial Banks		Merchant Banks	
	Real Estate and Construction (a)	As % of Total Economy-wide Loans (b)	Real Estate and Construction (c)	As % of Total Economy-wide Loans (d)
1978	882.9	21.5	20.4	21.6
1979	1,051.4	22.7	37.1	16.4
1980	1,325.4	20.9	66.8	16.7
1981	1,750.5	20.4	103.2	14.5
1982	2,085.0	20.3	189.2	15.9
1983	2,260.2	20.4	245.0	16.5
1984	2,373.8	20.6	313.7	18.6
1985	2,493.7	20.5	297.2	16.5
1986	2,840.4	18.1	335.7	12.1
1987	2,892.4	16.5	311.8	7.5
1988	3,007.9	15.5	355.6	7.8

Source: CBN Economic and Financial Review (Various Years); and Anyanwu (1991).

Table 5 shows that the flow of funds from commercial and merchant banks into the housing sector is also limited, comparatively, it is clear that the merchant banks have played a lesser role in housing finance than the commercial banks. These institutions lending to housing is more on commercial terms and for shorter

periods. Loans to housing are available to corporate and non-corporate individuals. These banks find it difficult to grant long-term mortgage loans with predominantly short-term deposits. That is, the major problem faced by these banks in granting housing loan and derives from the constraints imposed by the maturity structure of their deposits. Before the interest rates deregulation in 1987, the participation of commercial and merchant banks in providing housing finance was also severely limited by the problem of differential interest rates for housing sector as compared with such sectors as commerce and industry.

Since the long-term nature of mortgage loan does not make it relatively attractive to commercial banks in particular, the non-inclusion of housing in the preferred sector from the 1987 fiscal year has contributed in dampening the bank's degree of participation. It has also been observed that from 1979 to 1983, the credit operations of commercial and merchant banks to the housing sector fell below institutional requirements. Thus the CBN loan arising from short-falls on sectoral lending by commercial and merchant banks were as follows: 1979, ₦3.9 million; 1980, ₦6.5 million; 1981, ₦6.7 million; 1982, ₦3.7 million; and 1983, ₦9.4 million (Oduoza, 1987). There is therefore, much room for these banks, particularly Merchant banks with greater long-term funds to increase loan allocation to the housing sector in Nigeria.

Table 6: Insurance Companies' Mortgage Loans on Real Estate

Year	Building Construction/Mortgage Loan		% of Mortgage to economy-wide loan
	Life	Non-Life	
1980	33,259,737	8,864,865	9.28
1981	39,952,602	7,655,406	8.94
1982	41,692,793	19,472,584	9.37
1983	48,921,742	10,085,122	7.62
1984	46,262,496	10,884,729	7.12
1985	46,819,831	12,835,128	4.85

Source: FMBN Journal, Vol. 2, No. 1 1987.

CBN, Annual Report and Statement of Accounts, December 1987.

2.10.4 Insurance Companies

Since, unlike commercial banks, insurance companies funds are of the long-term nature, they should be more effective in granting housing loans. On the other hand, existing regulations do in fact place effective restrictions on the proportion of funds that can flow into the housing sector. For instance, insurance act provides that an insurance company shall not invest more than 10% of its non-life insurance investible funds in real property and not more than 25% of its life insurance investible funds to real property. Therefore in keeping with the above legal provisions that insurance companies lend to individuals and corporate bodies for housing construction, in addition to staff housing loans (like other financial institutions). It is again evident that mortgage loans from insurance companies in Nigeria is meagre particularly when one considers their relatively long-term sources of finance. There is no gain-saying the fact that the removal of statutory provisions would make huge funds available from insurance companies to mortgagors.

2.10.5 Problems of Housing Finance

The federal government of Nigeria had indeed accepted that the area of housing finance constitutes the best point at which the most useful intervention can be made (Federal Republic of Nigeria, 1981) despite this high priority intervention statement enormous gap still exists between housing requirements and the financial resources required for its provision. Indeed, Nigeria's financial sector has grown rapidly and evolved in sophistication, during the last decade, but the system continues to be unable to provide adequate long-term finance to cater for the housing needs of the people. The constraints include the following:

- Inadequate funds: Loan Repayment problems absence of secondary mortgage market and guarantees; mass poverty; inefficiency of financial institutions in resource mobilization; rising population, urbanization, high cost of building materials and inflation; ineffective targeting of government subsidies and solutions suggested as follows
 - 1) Development of a secondary mortgage market and a mortgage insurance scheme should be vigorously pursued.
 - 2) Effecting the Apex role of the FMBN.
 - 3) Purchase of site and services loans.
 - 4) Involving the Nigerian Provident Fund (NPF) in Housing Finance.
 - 5) Reorganization of the dormant National Housing Fund (NHF) for effective and efficient performance.
 - 6) Modification of CBN credit guidelines and legal provisions.
 - 7) Effective loan recovery strategy
 - 8) Sources for increased funds mobilization.

3.0 Housing Provision and Delivery in Nigeria

Vice-Chancellor Sir, housing provision and delivery is a key area of government responsibility to the people of Nigeria and have become a problem. The following critical observations are made in the all-important sector – Housing provision and delivery.

- All governments in the world including Nigeria have highlighted housing provision and delivery as a major priority. In many developing countries, housing provision crisis is escalating unabated, despite a number of good and new policies, programmes and strategies being engaged in by public and private sectors in addressing this problem.
- The majority of those in need of housing in many less developed nations in Africa, Asia and South America are in the low income cadre and some require special housing programme to be able to live in decent housing.
- Today, the population of Nigeria is estimated to be about 160 – 170 million, with urban population constituting about 60%.
- The phenomenal rise in population, number and size of our cities over the past few years have manifested in the acute shortage of dwelling units which resulted in overcrowding, high rents, poor urban living conditions and standard and low infrastructural services and indeed high crime rates and inadequate responses by the government have contributed to the worsening housing provision situation in the country, to the extent that economic development and the welfare of the citizens are adversely affected.
- These problems are more critical in the cities where huge housing supply deficits, dilapidated housing conditions, high cost of housing as well as proliferation of slums and squatter settlements exist.
- The majority of those in need of housing in many less-developed nations in Africa, Asia and South America are in low income cadre and some require special housing programmes to be able to live in decent housing (Durojaiye, 2016).
- Since market solutions and lack of funds may not be satisfactory for housing this category of people in view of the vital role housing plays in the socio-economic and political development of any nation, governments in these countries have over the years been engaged in public housing provision.
- In Nigeria however, from the debut effort of the Lagos Executive Development Board (LEDB) in 1928 to date, public housing provision in the country has continued to lag behind the demand and supply as almost 90% of the nation's housing stock is provided by the informal sector.
- Various governments in Nigeria have often expressed interest in the housing provision for the masses as amply demonstrated in the new Housing Policy document of 2012, and it provided four categories/group of people such as:
 - (i) NO-Income group: for all persons whose income does not exceed the national average of 25% of the National minimum wage (Nigeria Housing Policy, 2012).
 - (ii) Low income group for all persons whose annual income exceeds the “NO income” level, but does not exceed the National Minimum Wage.
 - (iii) The low-medium income group for persons whose annual income exceeds the National Minimum Wage, but does not exceed four times the minimum wage.

(iv) Rural Housing Scheme

- A review of past efforts indicates that the achievement level of the various national housing programme was very low and indicated massive shortages in total housing supply required.
- The total housing needs of the country in urban and rural areas were put to some 8 million units by the year 2000 by Federal Ministry of Works and Housing, and 12 – 14 million units in 2007 and a more recent estimate puts the figure even higher at 16 – 17 million units. At an average cost of 2.5 million Naira (Low rise) bungalow per housing unit, Nigeria will require 35 trillion Naira to fund the housing deficit of 14 million housing units which is getting closer to the 17 million housing deficit facing the country.
- Studies based on the structure of public servants in Nigeria showed that no public servant in Nigeria below salary grade level 13 can afford a property costing ₦4.75 million on a 25 years mortgage at 6% if he devotes 50% of his salary per annum to housing. At 18% mortgage rate, only a federal permanent secretary or his equivalent on grade level 17 can afford the same house. This shows that in the absence of some assistance and **“Housing that is affordable” strategies**, adequate housing for the low, low-medium and rural dwellers remains impossible. With respect to affordable housing provision which I have christened “Housing that is affordable” looking at the houses built by the colonial masters for the railway staff in 1913 which made that area to be called township in Port Harcourt; those homes still standing and serving the general public today is an example of the concept of Housing that is affordable, as they have good architectural design, local construction materials and sanitary system that reduce housing cost.
- The government is yet to adopt that model despite their determination to provide accommodation for the low-income category of people in the country such that they gain access to decent housing at affordable cost.
- According to the 2002 National Housing and Urban Development Policy (UHUDP) it asserted that no Nigeria is expected to pay more than 20% of his or her monthly income on housing, but to the contrary, realities have shown that the targeted population of many past public housing schemes in Nigeria did not benefit from such schemes and this was due to high cost of housing units provided. **Consequently, several authors have contended that the constraints in accessing housing inputs (land, building materials and finance) as well as cost of providing infrastructure were partly responsible for the hike in the cost of public housing beyond the reach of an average Nigerian.** Promoting security of tenure is a pre-requisite for sustainable improvement of housing and environmental conditions. Squatter settlements upgrading projects need to be carried out addressing tenure issues to prevent/reduce evictions.
- Land that is affordable. Land has been described as the fulcrum of all types of development in any society, the constrain posed by its inaccessibility has reduced the provision of Housing that is affordable for about 60% of those who live below poverty line. Building materials often constitute the single largest input to housing construction in most developing countries/cities particularly in Africa. In Nigeria, building materials have been established to account for more than half of total housing expenditure and the high cost of material for building houses is a serious challenge militating against delivery of decent mass housing, and other challenges with

building arise because most housing developers insist on the use of conventional building materials and technologies. The cost of imported materials are very expensive when converted to the value of local currency at such ridiculous exchange rates. It is no wonder that most housing units produced by Public Private Partnerships (PPP) mass housing come at prices beyond the affordability limit of the target population. It is estimated that the cost of building materials alone can take up to 60% of a standard low income formal housing unit.

- The architecture of Africa has been seen and labelled international. The concept of Architecture as the art and science of building has over the years seen a lot of reforms to include usability, acceptability and comfortability. Although globalization has relegated them as being 'primitive', this 'primitive' classification comes partially from the building materials and their relatively low technological uses when compared to the present day Western (Architectural) construction techniques which result in skyscrapers. The use of local materials and building methods will cut costs/reduce it, to its barest minimum (Nyenke, 2004).
- Many African countries including Nigeria, despite the fact that we are endowed with abundant natural resources that can meet the need for building materials production, depend largely on imported building materials and technologies.
- Consequently, we need to return to local building materials and technologies to house our citizens and also re-invent a number of traditional technologies to cater for the modern housing requirements. The re-invention should not be on the material alone, but the methods in which the materials and its products are utilized for creating architectural splendor in structures. Really, these innovations are important in that, collectively they have evolved a methodology to architecture that is supported on the vernacular and traditions of the African building customs.
- There is a lamentation that Nigeria has been experiencing a very high rate of population growth and urban expansion. This has posed serious problems for physical and socio-economic development because of the inability of existing institutions and mechanisms to cope with emerging challenges. Thus over-crowding of the living space, poor sanitation, decaying infrastructure, growing rate of unemployment and under employment, inadequate land, over-stretched community and social services are some of the indicators of the problem as they affect orderly urban development.
- That effective demand/supply of housing provision is backed up by the ability to pay and consequently the following Federal Government of Nigeria budgetary allocation to Housing is shown below:

Table 7: Federal Government of Nigeria Budgetary Allocation to Housing

Year	Yearly target of Housing units	Federal Budgetary allocation	No. of Housing Units provided at 2.5m/unit	Housing Deficit
2013	8,000,000	₦14,444,361,227.17	5,000	7,995,000
2014	8,000,000	₦15,756,271,003.00	6,000	7,994,000
2015	8,000,000	₦1,663,000,000.00	665	7,999,335

Source: Federal Ministry of Housing and Urban Development Authority.

Vice-Chancellor Sir, from Table 7, it becomes glaring that there was no effective provision and delivery of housing units to the people of Nigeria, despite the Housing policy statement, that states the goal of government is to ensure that the people of Nigeria have access to decent housing. From the table the Federal Government yearly target of 8,000,000 housing units and the budgetary allocation to it merely provided 5,000, 6,000 and 665 houses respectively, leaving huge housing deficits of 7,995,000, 7,994,000 and 7,999,335 respectively in the years under reference. This simply means that there was inadequate attention and inadequate funds provided for housing provision and delivery by the Federal Government, and the goal of Federal Government therefore, was not achieved.

Vice-Chancellor Sir, the scenario is the same, when we look at the Housing situation in Rivers State of Nigeria. The state government vision, “is to provide indigenes and residents of Rivers State access to decent and affordable housing accommodation” with a mission, “to ensure the delivery/provision of decent and affordable housing for all in Rivers State in partnership with private sector” and a mandate “to provide a minimum of four thousand (4,000) units of social housing annually, sites and services scheme and create enabling environment for private sector participation in housing delivery in Rivers State”.

Table 8: Rivers State Budgetary Allocation to Housing.

Year	Yearly target of housing units	State budgetary allocation (₦)	No. of Housing units provided 2.5m/unit	Housing deficit
1992	4,000	76,726,000.00	30	3,970
2013	4,000	—	—	—
2014	4,000	—	—	—
2015	4,000	4,000,000,000.00	1,600	2,400
2016	4,000	2,000,000,000.00	800	3,200
2017	4,000	139,000,000.00	55	3,945
2018	4,000	484,000,000.00	193	3,807

Source: Rivers State Ministry of Budget and Economic Planning.

From the table 8, there was no budgetary allocation in 2013 and 2014 respectively to the housing sector and government commitment to housing the people did not materialize. In the other years under reference a very huge housing provision and delivery deficit dominated the sector and the government did not fulfill its mandate to the people. Vice-Chancellor Sir, the dominant and inescapable reason why the housing sector has very huge housing deficit lies in excessive housing unit cost, arising from the use of expensive and conventional imported building materials, instead of application of local materials in abundance in the country. Building material consumes 50% of the housing fund, followed by 30% labour, 10% transport and equipment and 10% profit/overhead therefore, attention should be paid on the ways and means to reduce material cost in any housing scheme for the low income and less privileged group in the society.

As I said earlier in this lecture, the architecture of Africa has been seen and labelled international. The concept of architecture as the art and science of building has over the years seen a lot of reforms to include usability, acceptability and comfortability. Although, globalization has relegated them as being primitive, this primitive classification comes partially from the building materials and their relatively low technological uses when compared to the present day Western architectural construction technologies which are employed in skyscrapers. The use of local materials and building methods will cut cost/reduce it to its barest minimum (Nyenke, 2004). There is urgent need for a paradigm shift.

- **Housing that is affordable**

Vice-Chancellor Sir, I introduced this concept in my earlier discussion on affordable/social housing. And I said, there is a difference between “affordable/social housing” and “Housing that is affordable”. **Affordable housing is the government-subsidized kind. The latter on the other hand, describes the way that architects or engineers have reduced the cost of owning a house, renting a house or constructing a house. Housing is capital intensive. Housing that is affordable is distinct from affordable housing which is not always cheap to build.** From this point Vice-Chancellor Sir, distinguished Ladies and Gentlemen our approach to housing provision and design for the low income bracket, the needy and the vulnerable in the society need to change, in order to embrace the concept of “Housing that is affordable”. This concept may be referred to as a **paradigm move in the housing sector**. The alarming huge housing provision and delivery deficit ought to provoke our minds to search for solution to it. Vice-Chancellor Sir, the question that should be on our lips concerning housing provision for a greater number of people is, “Is it affordable?” **Bearing in mind that affordability is the ability to be afforded inexpensiveness.** Examples of public housing programmes that have left good memories on Housing that is affordable are:

- The railway staff quarters in Port Harcourt Township, built in 1913 with local materials and labour with special architectural design to meet requirements of usability, acceptability and comfortability, is a shining example to emulate in our determination to embark on mass housing scheme for the low income group in the society. Those houses are “Housing that is affordable”, built by the Colonial Government and standing the test of time.



Plate 15: Railway Staff Quarters in Port Harcourt Township.

- When in 1967 the Rivers State was created the 1st Military Governor of the state. Commander Alfred Diete-Spiff now His Majesty King Alfred Papapriye Diete-Spiff the Amayanabo of Twon Brass assumed office in the State, Housing was his immediate problem in governing the State, he used wisdom to acquire and to provide houses for the Rivers people which led to enactment of Abandon Property Law, and he delivered effective governance to the people of the state. The Rivers State and its people became proudly identified in the comity of States in Nigeria. He settled down to govern and laid a solid foundation in both socio-economic and political advancement of the State with massive infrastructure notable among them was the College of Science and Technology (CST) now the Rivers State University (RSU) in similar way of government budgetary allocation and implementation. Sadly, the university is not fully engaged with its mandate of research activities in socio-economic issues such as Housing and Building materials manufacturing and production to reduce building cost and make provision of “Housing that is affordable” in the State a focus, and this calls for a complete reassessment of factors of production in the housing sector vis-à-vis land, building materials locally made, funding, labour, indigenous construction technology and tools, instead of depending on imported conventional building materials, which makes it impossible for government to achieve its mandate of Housing Provision and Delivery for the people of the State and Nigeria.
- Also in this regard, an architectural model under the paradigm move in “Housing that is affordable” in the Niger Delta region of Nigeria is presented here and properly articulated. Considering a national average size of family of 4 children and their parents, the building plan shows a storey building/bungalow of 4-bedroom and living room, kitchen, dining room, in-built garage, entry porch, ante room, lobby etc. to be erected with local building materials in Nigeria. Usually, earth, timber, straw, stone/rock and thatch were constructed together with the simplest of tools and methods to build simple livable dwellings.



Plate 16a: Proposed Housing Elevation of Four Bedroom Single Storey/Bungalow with local materials and technology.

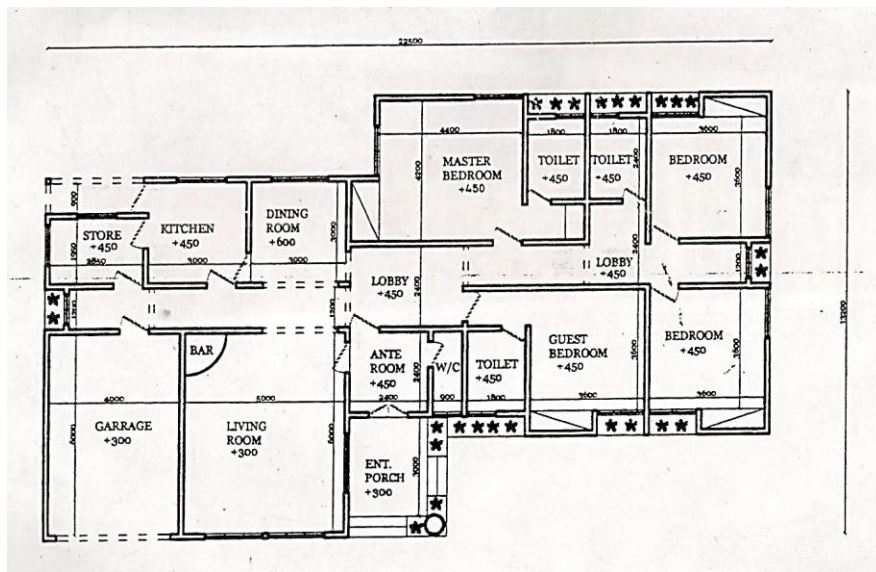


Plate 16b: Proposed Housing Plan of the Four Bedroom Single Storey/Bungalow

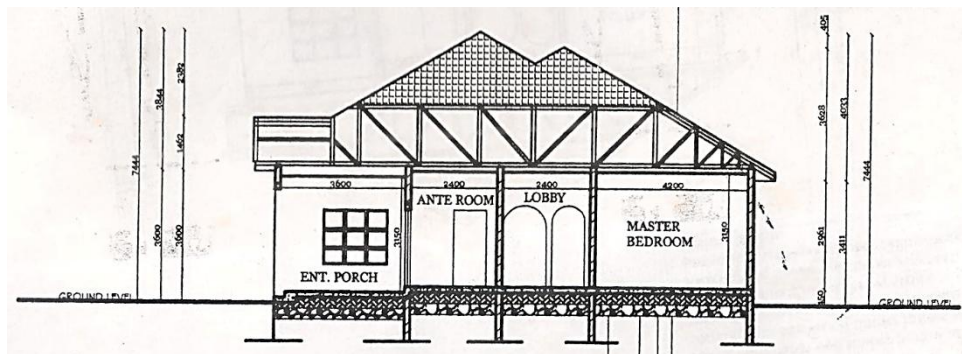


Plate 16c: Proposed Section of the Four Bedroom Single Storey/Bungalow

4.0 The Role of the Quantity Surveyor in the Construction Industry Worldwide

4.1 The Nature and Place of Construction Industry in the National Economy

The construction industry covers a wide range of loosely integrated groups and organizations involved in the production, renewal, alteration, repair and maintenance of certain capital goods. These capital goods whether building or civil engineering works, are produced by combining land with a variety of raw materials and semi-processed components. By combining land and other factors of production in this way the utilization derived by the community is very much enhanced. This process of resource combination involves all the usual elements and functions associated with the production of a commodity. The construction manager/management has to plan, coordinate and organize the factors of production. Capital funds are required on a long-term basis to finance plant and equipment and short-term for the purchase of materials and labour. Detailed design of the product is undertaken by specialists. Raw materials must be purchased and stored, workers must be hired and risks must be borne.

4.1.1 Characteristics of the Industry and its Products

Besides the above information, the construction industry also has distinguishing features. Production takes place at the site in the open air, where the product is to be used with fixed position (immovable) and seated deeply in the ground rather than in a factory. This brings organizational problems such as the shifting of men and materials from one job to another, rotation of men and materials around it and the need to store materials and components at the construction site. With few exceptions products are unique. Each product is in itself a separate design, engineering and production problem. The products are of considerable size, bulky and weighty, highly durable and difficult to alter or demolish.

As a result of the long-life of constructional products a high proportion of output of the industry is devoted to the maintenance and repair work, necessary to keep existing buildings and construction works in a usable state. The actual production of new works that is the length of the construction operation, takes considerable time from the time a project was first thought of until the occupation of a completed building or the first use of a new road the amount of time which elapses may range from about twelve months on comparatively small project to upwards of four years on the largest schemes.

In its widest sense the construction industry embraces not only the firms which erect buildings and undertake civil engineering projects but also the Architects, Quantity Surveyor and the Consulting Engineer who participate in or advise on design cost, the merchants responsible for materials distribution, the building material manufacturers, together with those central and local government employees directly concerned with some aspects of construction activity.

4.1.2 The Construction Industry in the National Economy

The construction industry rates high in the national economy by comparison of its composition as an industrial unit in the National economy and its economic link with other industrial firms and factories. See Plate 17 below.

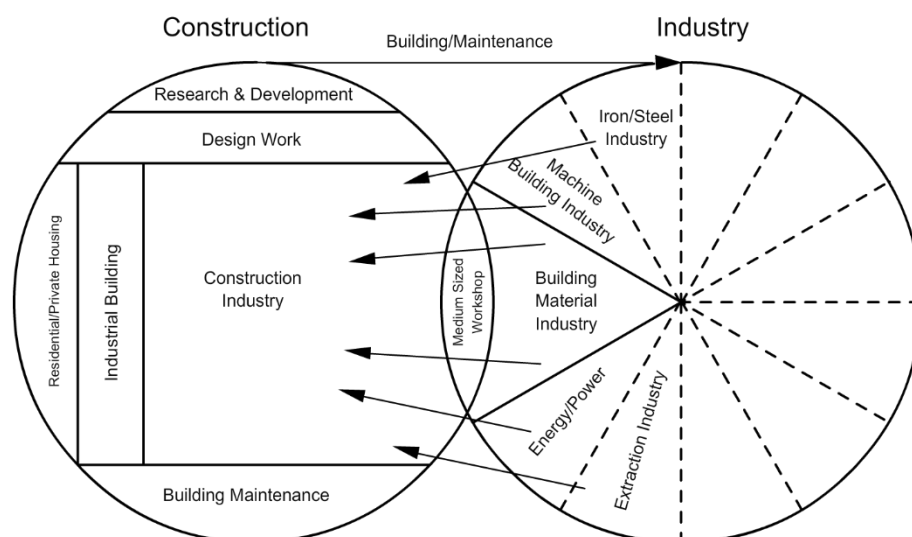


Plate 17: Construction Industry and the National Economy and its Relationship with Other Industries.
Source: Hadjev (1975).

Construction industry procures the services of other industries and provides them with basic means of production i.e. Building where their production processes are undertaken.

Although measures, such as the proportion of the force employed in a given industry and the contribution and industry makes to Gross National Product (GNP) are used, the importance of the construction industry is best reflected by its contribution to gross fixed capital formation. Investment in building and construction work accounts for one-half of the capital goods produced in the country each year.

Table 9: Gross Domestic Product (GDP) of Key Sectors of the Nigeria Economy in 2013.

Industry Year	Building & Construction	Agriculture	Crude Petroleum & Natural Gas	Solid Mineral	Manufacturing	Wholesale & Retail Trade	Services
2013	1.6%	33%	30%	0.16%	1.9%	16.6%	11%

Source: Central Bank of Nigeria.

The contribution of the construction industry in Nigeria's GDP fell within 3% to 6% from independence to the 80's before crumbling to about 1% in the nineties. The last few years saw an upward progression in its contribution, rising to about 1.6% as shown in Table 9. Sadly, the industry is the second lowest contributor to the country's GDP among the seven key sectors indicated on the table. Notwithstanding the successes recorded by the construction sector over time expectations of high performance remains unachieved as a result of many challenges militating against its growth and development. Such challenges include poor finance, dearth of technical expertise, corruption, long gap for improvement implementation.

4.2 The Role and Functions of the Quantity Surveyor in the Construction Industry

Vice-Chancellor Sir, before I go into the role of the Quantity Surveyor in the construction industry two pertinent questions are often asked by the general public. They are:

1. Who is a Quantity Surveyor? And
2. What can he do for us – the client?

On the basis of the above questions, Vice-Chancellor Sir, may I inform this distinguished audience that the answers to the above questions are not farfetched in the sense that the role and functions of the Quantity Surveyor has expression from the Holy Bible when it said in Luke Chapter 14 verses 28 – 30 and I quote “For which of you, intending to build a tower, sitteth not down first, and counteth the cost whether he have sufficient to finish it? Lest haply after he hath laid the foundation, and is not able to finish it, all that behold it began to mock him. Saying, this man began to build and was not able to finish”. And again the Banwell Committee on the placing and management of contracts for building and civil engineering works, appointed by the Minister of Public Building and Works in 1962, stated in its report that the Quantity Surveyor, “should be regarded as the Economist of the Construction Industry”. More recently the Quantity Surveyor has been described in a report by the Department of the Environment on Research and Development in the industry as, “one who advises on all ‘COST’ and ‘CONTRACTUAL’ arrangements and acts as ‘ACCOUNTANT’ to the project”. This may be accepted as very fair, if somewhat broad definitions of his function. He does in fact provide a link between the Designer (Architect/Engineer) and the Producer (Contractor). As ‘Cost Adviser’, ‘Technical Accountant’, and specialist on Contractual matters, he is concerned with a building project from its inception to its ultimate financial settlement, which may be some considerable time after the project is completed and occupied or in use.



Plate 18: The Quantity Surveyor in the Construction Industry.



Plate 19: Residential House.

Further roles and functions of the Quantity Surveyor include but not limited to the following:

- Measurement of building, civil engineering and thereby engineering works.
- Interpretation of Architectural and Civil Engineering drawings in respect of the above details.
- Preparation and pricing of Bills of Quantities for contract works, estimating and costing.
- Carrying out valuation of contract works
- Preparation of interior certificates for payments and final accounts for contract works.
- Acts as a construction adviser on matters relating to cost and in most cases he is referred to as a Building Accountant.

- In the course of disputes between building owner/clients and the contractor, he acts as Mediator and Conciliator as ARBITRATOR in settlement of claims.
- Preparation of tender analysis, reports and adjudication.
- Management of contract works.
- Specification writing.
- Feasibility studies of capital projects, cost modelling; procurement management; cost management of development and infrastructural projects, public-private-partner transactions advisory services; value engineering and management, project management, construction and contract management, risk management, project control and monitoring, construction contract/technical auditing, reinstatement cost assessment for insurance purposes.

The quantity surveyor, considering the way in which building project is documented and the way in which building work is carried out, is first consulted at the inception of a project, when it is first in the mind of the client (prospective owner) or of the architect or engineer who is going to design it. He advises on the probable cost of the scheme, and in collaboration with the designer considers alternative possibilities of structure layout and materials when the design has been finalized and drawings prepared, the quantity surveyor takes detailed measurements of the labour and materials required in the construction and prepares the Bill of Quantity, a copy of which is sent to each of the contractors tendering for the works.

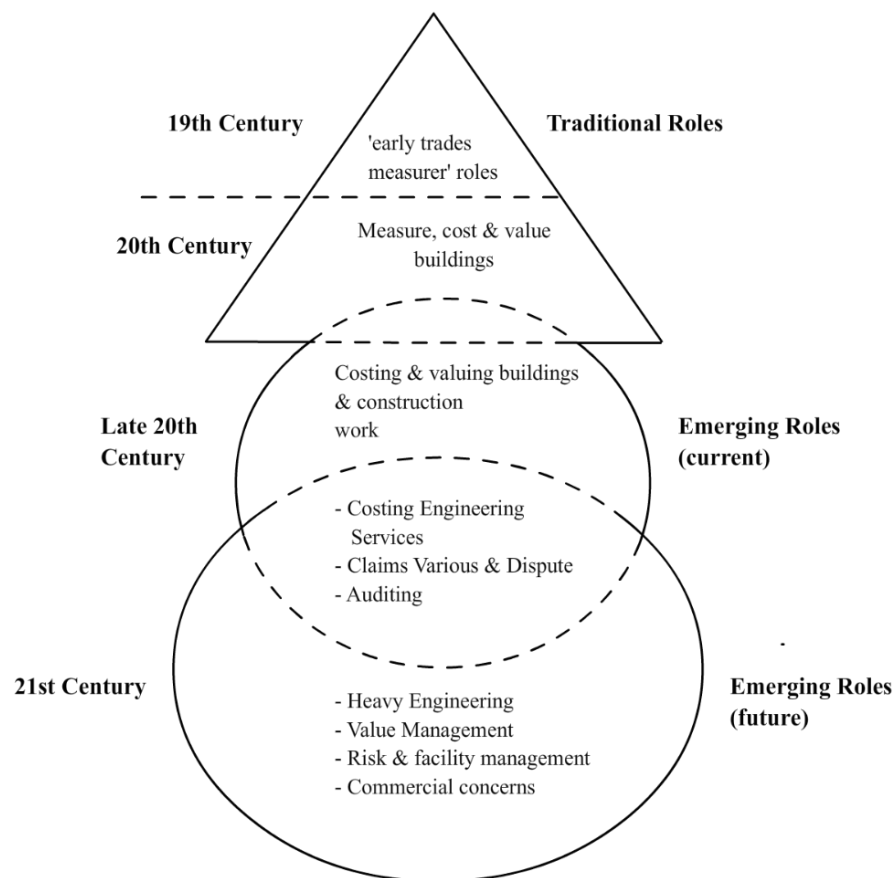


Plate 20: Schematic presentation of Development of Quantity Surveyor's role.
Source: Anunike (2015)

It is usual for a number of contractors to be invited to submit tenders for building works and normally, all other things being equal, the contractor who submits the lowest (within reason) will be invited to enter into a contract with the client for the construction of the project. Each individual contractor therefore has to arrive at an estimate of the probable cost of the building project. Except in the most simple of cases, it cannot be done just from an inspection of the drawing however detailed and comprehensive these maybe (Nyenke, 2005).

4.3 Education and Training

The profession of Quantity Surveying offers a career of considerable scope and great opportunities within the construction industry to young people who have

- (1) Certain basic qualifications of temperament and who have
- (2) The requisite passes in the Senior School Certificate Examination (SSCE), General Certificate of Education (GCE) and other equivalent certificate examinations.

To meet those of item 1 above, it may be said that a boy or girl should be of at least average intelligence, should possess or be capable of developing an orderly and meticulous mind should be reasonably quick at figures, should feel naturally attracted to the idea of learning how buildings are planned and constructed and to the possibility of playing an important part in getting them built.

Quantity surveying is a profession in which success can be won only by hard work and much earnest study. But its reward can be considerable, not only in terms of financial remuneration but also, and more importantly in the satisfaction that is always to be derived from the performance of an interesting and worthwhile job. Furthermore, it is perhaps unusual in offering the best of both worlds in terms of academic “office” work and practical “out-door” experience. The work of the quantity surveyor involves a fair share of each.

4.4 Prospects and Remuneration

There are four main spheres in which quantity surveyors are engaged:

- Private practice
- Quantity surveying departments of local government authorities and governmental ministries.
- The offices of Building and Civil Engineering Contractors
- Educational Institutions (Teaching, Research and Development)

In the four spheres the same basic training through in each case the precise duties of the Quantity Surveyor may vary to some extent. It should be noted however, that considerable mobility is possible and Quantity Surveyors frequently move from one sphere to the other.

There is no national wage fixing, body to standardize the salaries of Quantity Surveyors. The principal in private practice will work on a scale of minimum fees laid down by his professional institution and his annual income will naturally depend upon the size and success of his practice, while a salaried man will find a wide range of salaries offered by different firms.

4.5 The History and Dynamics of Quantity Surveying Profession

The role of Quantity Surveyor shifted from traditional activities of measurement of building works, when in the seventeenth and eighteenth centuries artisans involved in construction of building projects in ancient

Egypt, Greece and Rome and for the landed gentry, feudal barons and the church became dissatisfied with the practice of valuing their works at customary rate by the Architects who employed measures. A project would be designed, and the Architect acted as organizing contractor, ordering materials and hiring local labour. Artisans, often thinking that the measurers were not measuring all their work and therefore were less adept, they began to employ measures themselves to settle their payments with the Architect. And slowly Architects ceased to operate as building organizers and concentrated on the Design and Supervision side of their schemes.

Many artisans set up in business as building contractors and employed craftsmen at an hourly rate, and the practice of architects sending out drawings of a proposed building to a few contractors and asking them to quote a price for the erection of a building developed. By this time many builders employed MEASURERS and SURVEYORS on their staff to measure the work involved from the drawings and in many cases priced the work.

One or two builders' surveyors set up in business on their own account and specialized in the preparation of Bill of Quantities (BOQ) for all the contractors tendering for a contract, ready for them to price. This system offered many economics to the Contractors with the result that surveyors appeared in the building industry, specializing in this type of work.

About the middle of nineteenth century (1850) many architects realized that they could make use of the contractor's bill of quantities with the prices inserted, for the settlement of any variations and final account. They however, knew that the building owner was indirectly paying for the preparation of the document and so, persuaded building owners to employ the surveyor to prepare the Bills of Quantities for their schemes, ready for issuing to tendering contractors. The Bill of Quantities became a document incorporated in the Contract and the independent Quantity Surveyor measured variations and settled the final account for both parties.

4.6 The Bill of Quantity

4.6.1 Definition

The contractor or the building owner requires detailed measured quantities of, for example, how much earth is to be moved? How much concrete is to be placed? How much brick work is to be built? In quantities to which they can their unit rates and so build up his total estimate for the work. The document providing these information is the Bill of Quantities (BOQ) and it is the Quantity Surveyor who prepares it. The Bill of Quantity is supplied to each of the firms invited to tender so that each contractor tenders on the same quantities, rather than each contractor or building owner taking his own measurements and perhaps all arriving at different quantities. The Bill of Quantities therefore, (Nyenke, 2001) is a document containing a schedule of different items of work categories to be executed (under the construction contract) taken into account their quantities, types of materials, and labour and their quantities prepared in accordance with the Standard Method of Measurement (SMM), United Kingdom (UK) 11th version and now Building and Engineering Standard Method of Measurements (BESMM), Nigerian Institute of Quantity Surveyors (NIQS) version of building works (Nyenke, 2004).

4.6.2 Functions of the Bill of Quantities (BOQ)

The function of a Bill of Quantities is to assist building contractors to estimate the cost of building project before and construction work commences. The building owner however cannot give the contractor an 'open

cheque' to be made out when the building is completed. If this is done the result would be a day work of cost plus account and more than satisfied building contractor (Wain Wright and Whitrod, 1977).

Thus the building owner must have a definite agreed figure in advance before he can commit himself to a contractual agreement. The cost of a building project is usually unknown at the design stage, as buildings are not like articles of goods standing for sale in the showroom, with price label attached. To obtain a price for a building the method is that the building owner has a detailed and itemized list of various work components of the building prepared by a professional cost adviser. Building contractors are invited to price the work components on this list called Bill of Quantities, and arrive at a total sum of money which form the cost of the building project. The list of items in the bill is a matter of fact whereas the prices/estimates attached to these items by the contractors is a matter of expert opinion. This is why not two tenders are identical. However, there are many occasions when the building contractor has to prepare his own bill of quantities from the building owner's drawings, where this is the case, the quantities are prepared by the building contractor's surveyor. The Quantity Surveyor reads the drawings and should be able to visualize every detail of the building. In addition the Quantity Surveyor should be competent to convey to his professional colleague, who is to price the Bill of Quantities the quantity and quality of the materials required and the nature of the labour/workmanship to be applied to the materials in the construction of the building. The Bill of Quantities therefore provides a uniform information on Quantities for a tender but with different prices. It also leads to accurate tendering and forms the basis for tenderers to have identical documents to work from.

4.6.3 Content of Bill of Quantities

Bill of Quantities is divided up into sections, each section being based on the traditional trades. Each division of a bill of quantities would be as follows: Preliminaries; Excavation and Earth Work; Concrete Work; Brick and Block Work; Drainage; Roofing Work; Carpentry and Joinery; Plaster Work and other finishes; Plumbing Installations; Electrical Installations; Painting and Decoration; Prime Cost and Provisional Sum (PC & PS).

Table 10: A typical priced Bill of Quantities of Excavation and earth work section are shown below:

Items	Descriptions SUBSTRUCTURE	Quantity	Unit	Unit Rate	Amount	
					₦	K
A	Excavate over site average 150mm deep and remove from site	520	m ²	5.00	2,600	00
B	Excavate trench for foundation starting at formation level and not exceeding 1.50m deep	195	m ³	20.00	3,900	00
C	Ditto pit for column base	12	m ³	25.00	300	00
D	Return, fill and ram selected excavated materials around foundation	105	m ³	15.00	1,575	00
E	Remove surplus excavated materials from site	90	m ³	18.00	1,620	00
	To collection				9,995	00

Source: 1992 Rivers State Urban Renewal Housing Programme/Projects

Other forms of Bill of Quantity are:

- Operational Bill
- Elemental Bill

Operational bills are essentially found in use in America, Canada and other European countries construction industries. Although it is used in Germany and Bulgaria. Generally however, the Bill of Quantities is not used as a contract document outside the commonwealth or ex-commonwealth countries. It is more of British development which is used for most substantial contracts in Great Britain and spread to most parts of the commonwealth.

There is no separate profession of Quantity Surveying outside the commonwealth, although there are some signs of the development of the profession in some continental countries for example, France, Holland and Denmark. Whereas in the commonwealth the Quantity Surveyor prepares the BOQ, negotiates the pricing of variations and generally acts as the building accountant, in countries not following this practice, the Architect as a professional adviser, fulfils this function with the aid of operational bill. For example, in America the tender documents consist of plans and specifications only. Each contractor competing for the work takes off his own quantities in order to price out the work, but reveals only the total price to the client professional advisers.

The bill of quantities as normally used under the British system, has come under considerable criticism both from the Design and from the contracting sides of the Industry. The bill is said not to reflect the way the work is carried out and that hence it does not reflect the actual costs of the construction. The work of construction is of course carried out by operations and site records are compiled in this form, which thus provides no basis of costing the measured work units given in the bill of quantities.

In Elemental Bill, items would be grouped by building element instead of by trade. This system would be convenient as a basis for analyzing elemental costs and for preparing elemental cost plans.

4.6.4 Construction and Project Management Techniques

4.6.4.1 Network Analysis or Arrow Diagram

The quantity surveyor moves into the management and organization sphere of his function by the use and application of modern and scientific planning techniques in construction and project management.

The term planning appeals by its suggestion of considered, orderly and rational action. It implies tidiness, method, system, discipline, regularity and a measure of exactness. It gives the impression that someone responsible is in charge, has a hand on the wheel, and a sense of direction and destination. It represents co-operation and co-ordination and contrasts with the inevitable disorder which generally obtains, when men act independently in their own interests with not overall framework into which they are constrained to fit. Construction planning and project management are generally concerned with completing a construction contract in the shortest possible time compatible with economy (cost, time and quantity) and to the stakeholders satisfaction.

It is of the greatest importance that adequate period, before starting site operations is made available for proper planning of equipment and method, ordering of materials and preparation of a balanced programme.

The predominant factor in the erection of traditional houses and flats is normally the output of the bricklayers or in the case of reinforced concrete structures the rate of form work preparation. However in multi-storey buildings the tower crane, considerably influences the production cycle and in the field of industrial building and civil engineering, it becomes overly important fully to utilize expensive mechanical plant. This is so, in order that the client can be given the intended completion or handover dates, and the suppliers and such contractors may be notified when their goods or services will be required. The contractor must also know what his future commitments will be for staff, labour and plant.

4.6.5 Network Analysis, Programme Evaluation Review Technique and Critical Path Method (PERT and CPM)

4.6.5.1 Basic Concepts

PERT and CPM are network techniques or models especially useful for planning, scheduling and executing large time bound projects which involves careful co-ordination of a variety of complex and inter-related activities and resources. PERT stands for Programme Evaluation and Review Techniques, CPM for Critical Path Method. Both techniques were developed by US Navy Engineers to plan and control the huge Polaris submarine programme.

PERT and CPM converge on several aspects and are almost treated as twins; there are however some points of difference between them. The techniques recognize the system or inter-related nature of activities in large work projects. The application of PERT and CPM is intended to answer the following questions:

- (i) How soon will the project be completed?
- (ii) When is each individual phase of the project scheduled to start and finish?
- (iii) Which are critical phases of the project to be finished on time and require close managerial attention to avoid delay? The application of PERT and CPM for construction and project management involves the following steps:
 - (a) Identification of all key activities and events or phases for completion of the project.
 - (b) Determination of sequence of activities and events in a project and arranging them in a logical work/sequence.
 - (c) Determination and assignment of time for starting and completion of each activity are evaluated. They are optimistic time (shortest time), pessimistic time (longest time) and normal time (most likely time). After these three time estimates have been made they are combined into a single workable time value known as expected time. This is done algebraically by using a weighted average:

$$t_e = \frac{t_o + 4t_m + t_p}{6}$$

Where t_e is the expected time, t_o optimistic time, t_p pessimistic time and t_m normal time. The three time estimates are used in PERT because the originators of PERT thought the estimated time for an activity is better described and by a probability distribution than by a single estimate hence called probabilistic model of time estimate.

The network analysis is generally called Arrow Diagram. It is a technique for planning work. It reduces the examination of any complex project to three essential stages:

1. A breakdown into a set of individual jobs which are subsequently arranged into a logical network – Work Breakdown System (WBS).
2. The estimation of separate job durations and scheduling to discover which jobs control completion of the project.
3. Re-allocation of total resources to improve the schedule.

4.6.6 Construction of Network CPM Diagram

4.6.6.1 Separating Planning and Scheduling

The planner who draws a bar chart is trying to do two things at the same time. One is planning, that is, analyzing the project into individual jobs and showing the logical relationships between them. The other is scheduling which imposes a set of times upon the plan. Network analysis separates these two functions, in that the network or arrow diagram can be drawn up to give a plan of the project without any consideration of its timing or the resources it needs. An arrow diagram is built up from only three symbols: full arrows which represent jobs, nodes which correspond to events and dummy arrow for logical sequence. Again the time schedule here is a Deterministic model.

- Use of arrows based on past project information

Each individual job is represented by an arrow, and a job may be an operation, inspection, transportation or other types of process. They are not differentiated as in the conventional flow process chart. The length of an arrow has no significance and it is not drawn to scale. The arrow does no more than show the direction of the job in time, the arrowhead indicating the end of the job. It signifies the simple fact that the end of a job cannot precede its beginning (although in some cases a job may have zero duration, so that its beginning and end are simultaneous).

- Events and Nodes

The beginning and end of a job are events, they are represented as numbered circles called nodes. Fig. 1a. An event or ‘milestone’ represents the achievement of a certain stage in the development of a project as distinct from the jobs or activities which it contains.

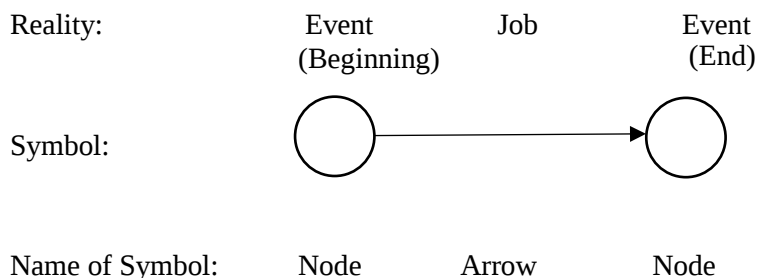


Fig. 1a: Symbol for jobs and events.

- Labelling jobs and events

It is convenient, before drawing an arrow diagram to label the individual jobs either by letters of the alphabet or letters followed by numbers. The events are identified by numbers but the numbers

cannot be allocated until the jobs have been assembled into a network. Note that a job may be identified by its beginning and end events as well as its label.

- **Sequence of jobs**

For each job, one must ask:

What jobs precede it?

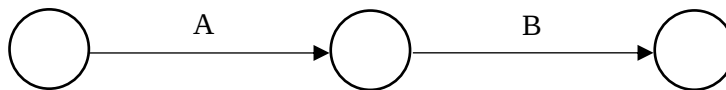
What jobs run concurrently?

What job follows it?

What controls the start?

What controls the finish?

The arrow can then be assembled into a sequence:



Job A precedes job B, job B follows Job A.

Fig. 1b: Simple Sequence of Jobs.

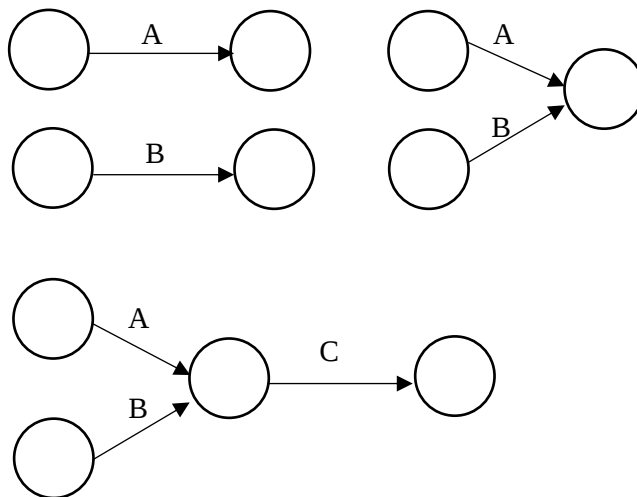


Fig. 2a: Concurrent Representation

Job A and B are concurrent and job C can only begin when A and B have been completed.

- **Dummy Arrow**

Sometimes one may wish to establish that a particular event cannot occur before some other event I, although no specific job occurs between the two. In such a case, a dummy arrow is inserted, the function of which is simply to indicate the sequence of event. All dummies take zero time, no resource allocated and they are represented by broken arrow.



Fig. 2b: Dummy Arrow

- **Completion of Labeling**

When all the jobs have been built up into a closed network numbers can be allocated to the events. The nodes which represent the events are numbered successively from the beginning to the end of the network. For any individual jobs, the number j of the end event must always be greater than the number i of its beginning event. This is called i,j rule. This will be illustrated later in this lecture.

Using the information from the Bill of Quantities Substructure: Excavation and Earth works.

Table 11a: Table of Schedule

Items/Jobs/Activities	Description	Duration in days
A	Excavate over site average 150mm deep and remove from site	3
B	Excavate trench for foundation starting at formation level and not exceeding 1.50m deep	2
C	Ditto pit for column base	10
D	Return, fill and ram selected excavated materials around foundation	5
E	Remove surplus excavated materials from site	4

- **Earliest Event Time**

The earliest date (ES) of an event, (using the Network Diagram in Fig. 3) is defined as the earliest date by which all activities leading into that event can be completed. This information is recorded in the left hand box in the network diagram. The process of calculating the earliest date of an event in a network is known as FORWARD PASS. The value is calculated by the following rule: **To the earliest time of each, immediately preceding event, add the duration of the job which connects it and select the highest of the values.**

- **Latest Event time**

Having established the earliest time an event may be completed, we also wish to know the latest date by which all activities leading into an event must be completed, so that, the start of activities leading from that event are not delayed. This will ensure that total project (network) is completed on time. This is obtained through a reverse process called BACKWARD PASS using the rule: **From the latest time of the succeeding event subtract the duration of the intervening activity and select the lowest value obtained. This is recorded at the right hand side of the box.** The network is developed into Fig. 3 below and the values of earliest time, latest time and float are calculated using the rules, and shown in Table 11b.

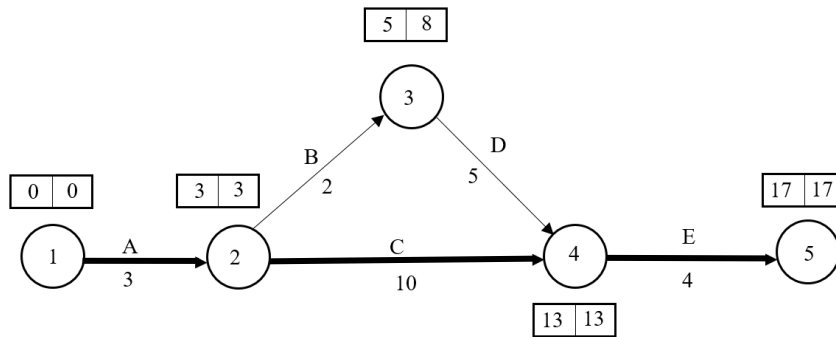


Fig. 3: Network or Arrow Diagram

- Calculations

Earliest start (ES) for jobs

$$1 - 2 = 0 + 3 = 3 \text{ ----- (1)}$$

$$2 - 3 = 3 + 2 = 5 \text{ ----- (2)}$$

$$\left. \begin{array}{l} 2 - 4 = 3 + 10 = 13 \\ 3 - 4 = 5 + 5 = 10 \end{array} \right\} \text{ Concurrent jobs, select the highest value = 13} \text{ ----- (3)}$$

$$4 - 5 = 13 + 4 = 17 \text{ ----- (4)}$$

Latest time of an event start takes the reverse order for jobs.

$$4 - 5 = 17 \text{ ----- (5)}$$

$$3 - 4 = 13 - 5 = 8 \text{ ----- (6)}$$

$$\left. \begin{array}{l} 2 - 4 = 13 - 10 = 3 \\ 2 - 3 = 8 - 2 = 6 \end{array} \right\} \text{ Concurrent jobs, select the lowest value = 3} \text{ ----- (7)}$$

$$1 - 2 = 3 - 3 = 0 \text{ (showing the calculation is correct) ----- (8)}$$

Table 11b: Table of Technical Data

Jobs/Activities i < j		Duration (days)	Earliest		Latest		Total float (6-3-2) (6-5)
			Start	Finish (6 - 2)	Start (3 + 2)	Finish	
i j							
1 2			3	4	5	6	7
A	1 - 2	3	0	0	3	3	0
B	2 - 3	2	3	6	5	8	3
C	2 - 4	10	3	3	13	13	0
D	3 - 4	5	5	8	10	13	3
E	4 - 5	4	13	13	17	17	0

Critical Path

In summary, from the illustration, the critical path in the Network diagram Fig. 3 passes through all the event for which the earliest and latest times are the same and equal. The overall duration of the earth works in the project is 17 days and the jobs represented with thick arrows are critical. Any delay in completing them will cause a corresponding delay in the overall duration of the project

itself. Conversely, speeding them up may finish the project more quickly. **The critical jobs form a chain running through the network, which is called the Critical path, otherwise known as the longest path and determines the overall duration of the project.** In any network, there is always at least one critical path and there may be more. The critical path in the illustration are jobs 1 – 2, 2 – 4, and 4 – 5. All jobs which are not on critical path are non-critical i.e. jobs 2 – 3 and 3 – 4.

Float is considered to be the difference between latest and earliest event times. Thus in Fig. 3 event 3 has a slack or float of $8 - 5 = 3$ days. Float (slack) has many forms such as total float, free float, independent float and interfering float, all considered as free time available in an activity. It is very helpful in project management exercise/duty in that it enables the project manager, re-allocate resources to improve the schedule.

Therefore jobs 1 – 2, 2 – 4 and 4 – 5 control the completion of the earth works and the construction manager or project manager has a duty to pay special attention to them, in order not to exceed the 17 days duration, but to reduce it by 3 days using float mechanism.

- **The Quantity Surveyor moves into ARBITRATION**

What is Arbitration?

Arbitration is an alternative to litigation which is much used for settling disputes which involves technical or commercial elements. It is also known as Alternative Dispute Resolution (ADR), other nomenclatures are Appropriate Dispute Resolution or African Dispute Resolution (rooted in African Culture). The essence of arbitration is that disputes are determined by a tribunal of the parties' own choosing. The right to arbitrate and the powers of the Arbitrator depend largely upon agreement between the parties. An arbitration agreement is often to be found as one of the clauses of a standard form of contract. That is why in our conditions of contract clause 35 expressly states as follows:

“Provided always that in case any dispute or differences shall arise between the employer or architect on his behalf and the contractor either during the progress or after the completion or abandonment of the works, as to the construction of this contract or as to any matter or thing of whatsoever nature arising thereunder or in connection therewith (including any matter or thing left by this contract to the discretion of the Architect or the withholding by the Architect of any Certificate to which the contractor may claim to be entitled or the measurement and valuation mentioned in clause 30(5)(a) of those conditions or the right and liabilities of the parties under clause 25, 26 of these conditions), then such dispute or difference shall be and is hereby referred to the arbitration and final decision of a person to be agreed between the parties, or, failing agreement within 14 days after either party has given to the other a written request to concur in the agreement of an Arbitrator, a person to be appointed in accordance with the provisions of the Nigerian Arbitration Ordinance with such amendment as of the time shall be in force”. Arbitration proper therefore is to be distinguished from various less formal processes met in construction contracts.

The essentials of arbitration are that there must be a dispute which is referred to an independent Arbitrator for decision, usually after hearing the parties and receiving any evidence they wish to put forward. His decision is final, subject to review by the courts. Other analogous processes which do not constitute arbitration include the following: mediation, conciliation, negotiation of claims, dispute resolution board (Adjudication) often found in International Federation of Consulting

Engineers (FIDIC) conditions, mini trials, mutual fact finding, mutual expert, private judging, settlement conference.

Arbitration is generally preferred to litigation for the following reasons:

- Arbitration usually achieves quicker resolution of disputes than litigation.
- It is generally cheaper.
- The proceedings are usually confidential, not for the public.
- The procedure is generally more flexible and the approach could be determined by the parties themselves.
- The parties decide their own adjudicator and is usually knowledgeable in the particular matters of dispute.
- Generally, Arbitrators are freer than judges to make decisions, because they do not have to abide by principles established by legal precedent, and do not have to give reasons to support their awards, although they are expected to abide by the Code of Ethics for Arbitration.

- **Role of the Quantity Surveyor in Dispute Resolution**

By reasons of their good background in Construction Management and expertise in cost-related matters which are the bone of contention in most disputes, Quantity Surveyors play key roles in dispute resolution. They are obvious and good candidates for:

- Arbitrators in adjudication.
- Neutrals in Alternative Dispute Resolution (ADR) proceedings such as mediation, conciliation, negotiation, mini-trial etc. provided they have good negotiation skills and have undergone the necessary training.
- **Witnesses of fact:** As Quantity Surveyors involved in a project may act as witnesses of fact because he witnessed most of the things that happened.
- **Expert witnesses:** An expert evidence is evidence of opinion to assist in the analysis of technical assertions of each party. The expert witness therefore assists the court. Arbitrator or tribunal in areas of professional opinion hence must be neutral, stating the facts without dilution.
- **Lay-advocate:** In matters of technical presentation e.g. Measurements, final account etc. the arbitrator may direct that technical experts present the cases of the parties in dispute. In a situation like this, quantity surveyors are very good experts to be used by the parties to present their cases. In addition to presenting the case the Quantity Surveyor may be recognized to cross-examine the other party's expert and also respond to his/her cross-examination and this is lay-advocacy.

5.0 My Contributions

Vice-Chancellor Sir, my contributions academically and professionally in the global area of the Built Environment are legion. Let me therefore highlight key areas in the Housing Provision and Delivery expertise as the Project Quantity Surveyor and Project Manager in the Rivers State Government Urban Renewal Housing Programme/Projects in 1992.

I was appointed as Project Quantity Surveyor/Project Manager/Team leader in 1992 by the former Governor of Rivers State, His Excellency Chief Rufus Ada George to Design/Cost/Supervise the above Housing Programme/Projects which involved the following:

- (i) Project – (01 & 05) – RVSG (State House of Assembly Speaker's Complex).
- (ii) Project – (02) – RVSG (State House of Assembly Members' Quarters)
- (iii) Project – (03) – RVSG (Staff Housing Scheme of Various Categories of Workers in the Civil and Public Service).
- (iv) Project – (04) – RVSG (Low-cost Housing Scheme for the Citizenry).
- (v) Project – (05) – RVSG (State House of Assembly Boy's Quarters).

The total cost of the projects was estimated at the cost of Ninety Million Naira (₦90,000,000.00) and it was a gigantic Housing project at the time. As the Project Team Leader, Quantity Surveyor and Project Manager my deep knowledge of Construction Management and Finance and Contract Administration was brought to bear on the Housing Scheme when the following approach was adopted for the implementation:

i. Pre-contract planning tools/activities.

ii. Post-contract planning techniques.

- Pre-contract planning involves pre-tender activities carried out during the preparation of an estimate Bill Of Quantity (BOQ) as a contribution to a tender or bid and the following processes must be considered in the stage and they are: **Decision to tender, pre-tender report, site visit report, enquiries to subcontractors and suppliers; statement of method estimate build-up; pre-tender programme preliminary build-up; estimate adjudication and analysis of results.**
- Post-contract planning involves pre-contract planning and contract planning activities. Pre-contract planning takes place after the award of contract, immediately prior to commencement of construction work on the project and contract planning takes place during the building construction process. It is the responsibility of the contractor to complete the contract within the specified time period to achieve the stakeholders satisfaction of Time, Cost, Quality and Scope while monitoring tools such as Project Network diagram and bar chart are put in place by the Project Manager to establish standards against which progress can be reviewed at regular intervals during construction. The Urban Renewal Housing Projects enjoyed the expert supervision of the Project Quantity Surveyor and Project Manager who is the inaugural lecturer of today, and his Project team. The goal of the State Government on the Urban Renewal Housing Programme/Projects was achieved with resounding success. The project locations are: **Orije Housing Layout (Benin Street/Uyo Street, PH), Oromineke Housing Layout (Khana Street, PH), Abuloma Road (Speakers Quarters), Marine Base Project, PH.(See Plates 23a & 23b).**



Orije Housing Layout



Oromineke Housing Layout



Speaker's Housing Complex, Abuloma Road with Boy's Quarters



Marine Base Housing Layout

Plate 21a: Rivers State Urban Renewal Housing Programme/Projects and Assembly Members Quarters

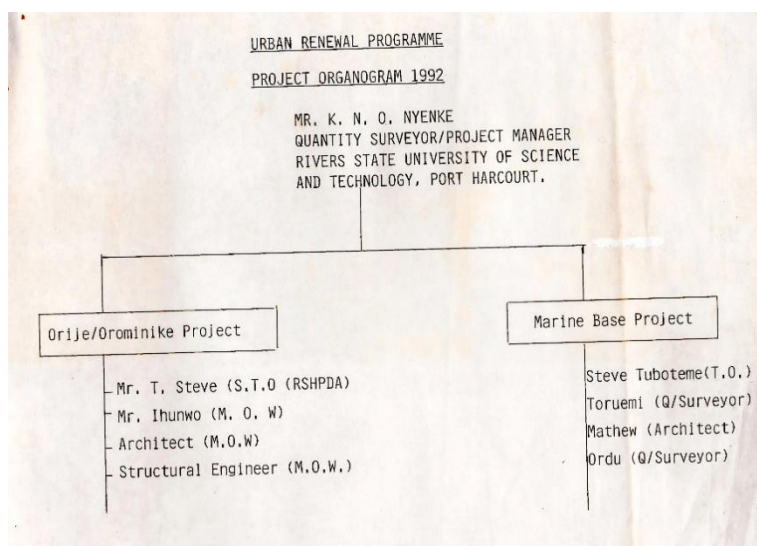


Plate 21b: Approved Organogram of Rivers State Urban Renewal Programme/Projects.

Vice-Chancellor Sir, another milestone was made in my contribution to mankind and society when in 1996, I was appointed Acting Chairman of Rivers State Project Monitoring and Implementation Committee under Operation Service to the People Programme/Projects (OSTOP) by the military administrator Col. Musa Shehu and I was engaged, to build and supervise the completion of two storey classroom block at Kalabari National College (KNC) – Buguma in Asari-Toru LGA (ASALGA) and Primary Healthcare Centre at Rumuepirikom in Obio/Akpor Local Government Area (OBALGA). With insufficient fund available to me for the project, I applied periwinkle shells in place of chipping aggregate for the concrete work in the KNC classroom Project. I was commended by the Military Administrator when I reported on the project progress

report that the classroom has been completed for use within a short period, at a minimum cost. At the same time, the Primary Healthcare Centre was also commissioned for use by the community at a minimum cost. The healthcare building is now serving as a police station in the community. (Plates 24a & 24b).



Plate 22a: OSTOP – Healthcare Centre, Rumuepirikom.



Plate 22b: OSTOP – KNC Buguma Classroom

Vice-Chancellor, another contribution was made in the academic domain when in 2006, I made my contribution in the work of United Nations Institute for Training and Research (UNITAR) on the Niger Delta Environmental Profile, wherein I presented a paper titled “The Niger Delta Environment and Sustainability: A Global Concern”. The paper captured **Natural Environmental issues, such as flood and coastal erosion, water hyacinth subsidence, siltation, remediation. Development issues include: land degradation and soil fertility, oil spillage, air pollution, gas flaring, sewage and waste water, water pollution and aquatic system, biodiversity depletion, deforestation, low agricultural production, fisheries decline, waste management. Socio-economic problems include: education and training, food and health, infrastructural decay, economic empowerment, poverty and environmental degradation, moral decadence, conflict resolution and corporate and good governance. A letter of appreciation was written to me, in which I was commended. (Plate 23).**

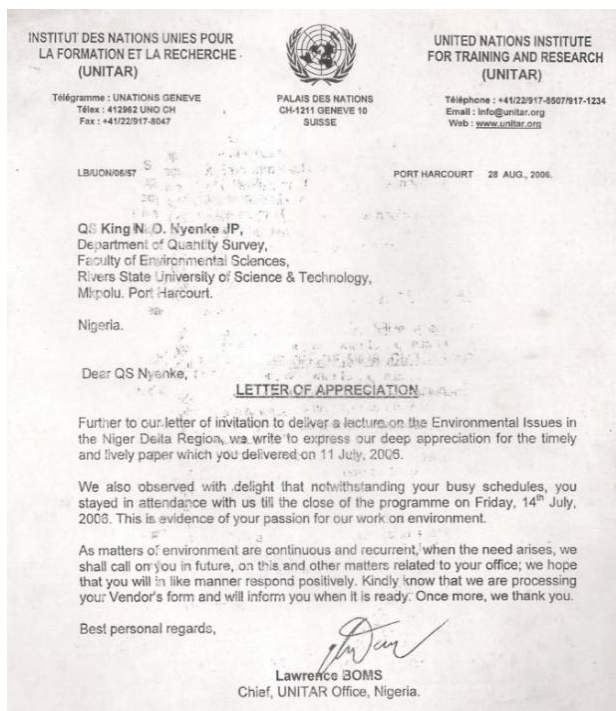


Plate 23: Letter of Appreciation

My Contributions in Community Services

Non-balkanization of Ikwerre Nation in Nigeria

Vice-Chancellor Sir, it was during my able leadership of Ikwerre Nation as the Secretary-General and Vice President (defacto President) of Ikwerre Development Association (IDA) in 1996 states creation exercise in Nigeria, under the administration of Late General Sani Abacha era as Military President of Nigeria, that I led IDA group to National Constitutional Conference at Abuja, and worked with Late Paramount Ruler of Port Harcourt, His Majesty Eze Sunday Nnanta Woluchem of blessed memory, His Majesty Eze S.I. Alete of blessed memory, His Royal Highness Eze C.C. Nwuche of blessed memory, His Majesty (Flt. Rtd.) Eze Robinson O. Robinson, Eze Ekpeye Logbo of Ekpeye land, Eze Princewill Nyebuchi Ehor, Eze Odulokwu IV of Elelenwo, to mention a few, to resist the balkanization and fragmentation of Ikwerre Nation in the exercise of state creation by unprogressive forces in Nigeria.

Today, Ikwerre Nation is a homogeneous geographical and cultural group/entity that has fairly political, social and economic significance in Rivers State of Nigeria. This was the climax of my contribution, commitment and dedication to the service of the fatherland, and a legacy in my leadership role in Rivers State of Nigeria.

Peoples Democratic Party (PDP) in Rivers State

Vice-Chancellor Sir, I served Rivers State as the Pioneer Secretary of Peoples Democratic Party (PDP) on the aegis of G34 under the leadership of Late and Distinguished Senator Francis John Ellah of blessed memory in 1998/1999. During the period, I facilitated the registration of the Rivers State Branch of the party.

Peace Initiative in Ikwerre Nation

In another milestone, I contributed immensely to the development of Ikwerre Nation through Ikwerre Development Association (IDA) as General Secretary whose tenure was elongated more than the constitutional requirement of a maximum of two years, and was recognized with a certificate of appreciation as Secretary-General based on my dedication to duty in Ikwerre Nation. I was elected in 1993 – 1995 as Vice President of Iwerre Development Association, a defacto President, and I led IDA Peace Committee of Prominent Elders of Ikwerre to resolve Okporowo-Ogbakiri Chieftaincy Dispute and similarly Eze Gbakagbaka of Woji Community Chieftaincy dispute. I accordingly made and ushered peace to these communities in Ikwerre land.



Plate 24: Certificate of Recognition as Secretary-General for my immense contributions to Ikwerre Nation.

My Contribution to the World

Vice-Chancellor Sir, I contributed to the world when in 2008 I presented a paper titled: Provision of Affordable and Functional Housing in the Niger Delta Region of Nigeria, during the World Habitat Day Conference organized by the Rivers State Government, Ministry of Housing. I posited that in the provision of Housing which will satisfy basic needs, extravagant additions and finishes should be eliminated, while urgent attention should be paid to the use of local construction materials and technology, such as periwinkle shells and cracked palm kernel shells abundant in the Niger Delta Region (NDR) for reinforcement and concrete mixtures/aggregates, Nigeria Building and Road Research Institute (NBRI) compaction machine, clay slate roofing materials, Reinforced Cement Stabilized Bricks (RCBS) were recommended as a means of cost reduction in housing project.

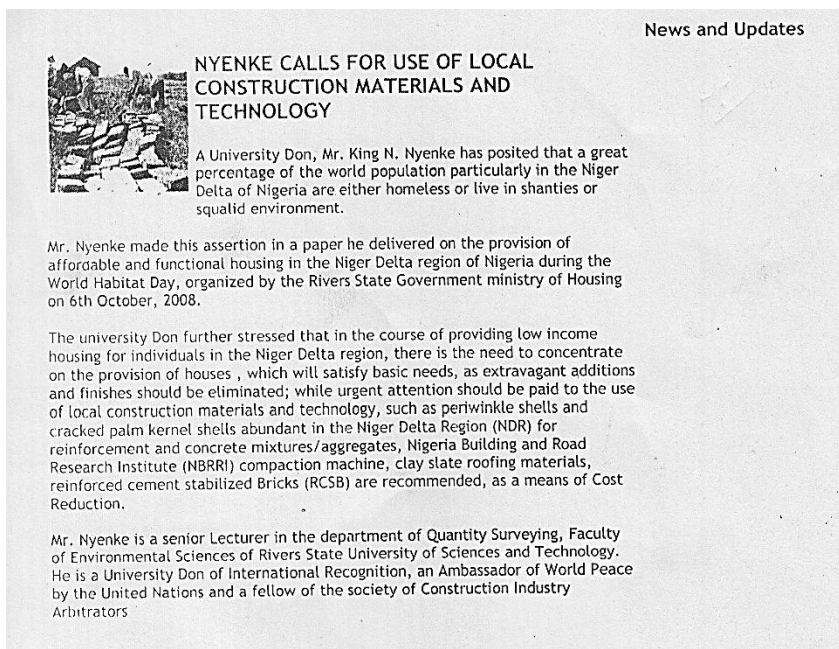


Plate 25: Update for the Use of Local Construction Materials and Technology

My Contribution to Rivers State University (RSU)

Vice-Chancellor Sir, my contribution was showcased within the Rivers State University, Nkpolu Oroworukwo – PH, when in 2003, I was appointed by the former Vice-Chancellor, Emeritus Prof. S.C. Achinewhu to provide Preliminary Design and Cost Estimate on the onshore/offshore University Capital Development Project Loan Scheme of Eighty million US Dollars (80,000,000USD) approximately Eight billion Naira (₦8,000,000,000) and the cost breakdown stood as follows:

See Table 12 and Plates 26 – 33.

Table 12: Cost Breakdown

S/No	Project Title	Qty (Nr.)	Unit Cost (₦)	Total Cost (₦)
1	Staff Quarters			
	(a) Junior	5	120,000,000.00	600,000,000.00
	(b) Senior	10	75,660,480.00	756,604,800.00
	(c) Professional Duplexes	20	65,000,000.00	1,300,000,000.00
	Faculty Buildings			
2	Env. Sc. Agric, Sc. & Tech. Ed, Mgt. Sc.	4	150,000,000.00	600,000,000.00
3	Guest houses	20	60,000,000.00	1,200,000,000.00
4	Student hostel	5	208,000,000.00	1,040,000,000.00
5	Institute Bldg	3	85,000,000.00	255,000,000.00
6	Staff Club	1	84,403,000.00	84,403,000.00
7	Conf. Centre	1	150,000,000.00	150,000,000.00
8	Adm. Bldg.	1	1,000,000,000.00	1,000,000,000.00
9	V-C Complex	1	1,000,000,000.00	1,000,000,000.00
10	Infrastructural Facilities (Roads, Water, Electricity & Drainages)			921,000,000.00
	Grand Total			
	(Eight billion and Seven million and seven thousand eight hundred Naira)			₦8,007,007,800.00

Vice-Chancellor Sir, today I am pleased to state that the University has built a befitting and imposing Vice-Chancellor's lodge on campus, and also three (3) additional magnificent faculty buildings namely Faculties of Environmental Sciences, Management and Education. The Senior Staff club upgraded, the NDDC Hostel and Administration building completed and functional, all in recognition of my Professional Cost Planning advice.



Plate 26: Administration Building



Plate 27: Faculty of Environmental Sciences Building



Plate 28: Department of Quantity Surveying Building



Plate 29: Faculty of Management Sciences Building



Plate 30: Faculty of Education



Plate 31: Vice-Chancellor's Lodge



Plate 32: NDDC Prototype Hostel Building



Plate 33: Senior Staff Club

Socio-economic Innovation in the Nigeria Market Economy

On the socio-economic sector of Nigeria economy, Vice-Chancellor Sir in 1988, I was appointed a Project Manager by the Federal Ministry of Trade and Commerce, Metrological Division, Weights and Measure Department, to improve the market economy. The appointment became necessary in view of the massive cheating habit found in selling food grains such as rice, garri, beans, salt etc. using fake and falsified cigarette cups with lifted and padded base predominantly used in trading in Nigerian market. Again Nigeria has no standard measuring instrument such as weighing machine, measuring in grams or kilograms as it is in the developed countries of the world. Therefore, the food quantity and the price vary from one trader to another, so the family budget for the quantity, number of people and the price can never be foreseen. Vice-Chancellor Sir, since majority of the traders cannot read and sell by weight, I brought innovation to the use of cigarette cups and reproduced it with standard cup measure and the cigarette cups were abolished and stopped from circulation by the government.

With the knowledge of science of materials, I used aluminium sheets, in order to avoid rust/corrosion effect, and fine metal wire as a ring at the top and bottom of the cup, to deter compressive force and provide strength to the entire cup not to yield to deformation when compressed to reduce the volume of the content. All these passed engineering test and quality control measures using the Faculty of Engineering of this great University to produce the new cup called 'Standard Cup' also known by the traders as 'Government Cup' with government number and seal on it, to avoid duplication of it. Plate 34 & 35.



Plate 34: Standard Cup Measure

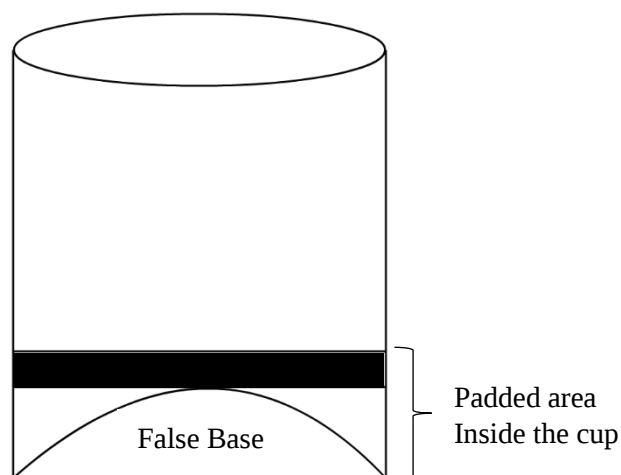


Plate 35: Fake Cigarette Cup

The Chairman Sir, the idea behind the manufacture of the standard cup for use in Nigerian market was to have the quantity of food the same all over the market in Nigeria, using standard cup measure. What could vary is the price based on market forces at any point in time, but reasonable prediction of the cost of food grain per cup for a household would be achieved, instead of all the items varying at the same time making household expenditure on food grain unpredictable. The standard cup was produced and circulated using Rivers State market system as a case study. Vice-chancellor Sir, it was not up to one year various market associations and unions in the Rivers State Market system protested against the cup saying that the

innovation was good, but government should produce the food to sell with the cup and immediately the traders returned to status quo ante.

Department of Quantity Surveying, Rivers State University

Vice-Chancellor Sir, I contributed immensely to the growth and development of the Department when in 1990 a Quantity Surveyor who is the inaugural lecturer of today was appointed the Acting Head of Department (HOD). I was saddled with the responsibility of transiting from HND programme to B.Tech. programme in Quantity Surveying, which I successfully accomplished. I served as HOD for many years to extent that my name was synonymous with the Department. And I have imparted knowledge to over 1000 graduate Quantity Surveyors from the Department. I also contributed to staff development and welfare issues; encouraging and promoting them through assessment/appraisal activities to various ranks.

Most of them are working in Niger Delta Development Commission (NDDC), a project organization/parastatal of the Ministry of Niger Delta in Nigeria and many others in public and private sectors of the economy and overseas.

Faculty of Environmental Sciences of the Rivers State University (RSU)

Vice-Chancellor Sir, I contributed to the growth and development of the faculty when I was appointed from 1990 – 1994 as Chairman, Dean's Honour's Roll Committee, Member, Dean's Standing Advisory Committee 1998 – 1990, Secretary, Faculty Examination Malpractice Committee and in May 2001, I served as Member, Faculty NDDC Committee on Regional Development Plan for Niger Delta region and also appointed as Acting Dean of the faculty for a brief period.

Niger Delta Development Commission (NDDC)

Vice-Chancellor Sir, I contributed in the NDDC set up, when in 2001 I called for a Bill to set up the Niger Delta Development Commission (NDDC) in a paper titled: "Niger Delta Bill - A Technical Input" published in African Journal of Agricultural Teacher Education (AJATE). The paper drew the attention of the public and former President of Federal Republic of Nigeria, Chief Olusegun Obasanjo and concerned Niger Delta indigenes and political groups, committed to the environmental neglect of the region moved to establish it.

Other Universities in Nigeria and Overseas

Vice-Chancellor Sir, I have contributed enormously to the growth of Universities in Nigeria, when I was contacted by Vice-Chancellors to assist them assess their academic staff for promotion to the rank of Reader/Associate Professors and Professors respectively, and I have also served as an external examiner and participated in National University Commission (NUC) accreditation of various departments running Quantity Surveying courses to improve the system.

Vice-Chancellor Sir, I ably demonstrated the zeal I have for the growth and development of Nigerian Universities equally to the overseas universities counterpart when in 2013, I was invited by the University of Economics (UE) in Varna-Bulgaria my Alma Mater, to present a paper in the International Scientific Conference organized by the University. I was selected to lead the procession of Professors and eminent scholars with a lead paper titled, "Current trends in Construction and Project Management: An Entrepreneurial Perspective". The paper elicited unprecedented applause during the conference and Vice-Chancellor Sir, at the end I was honored and bestowed with an Award for Academic Excellence and Leadership which I am pleased to show to the Vice-Chancellor and Chairman of this occasion and the distinguished audience of Ladies and Gentlemen present here today.

6.0 Concluding Remarks

Vice-Chancellor Sir, may I conclude by saying that Housing provision and delivery is a key priority in the scheme of things we do, and the constitutional responsibility of the Nigerian government to the people of Nigeria in view of its socio-economic and political significance.

- A situation where every government budgetary allocation yearly does not provide adequate number of houses and to deliver same to the people of Nigeria could be described as most unfortunate and totally disappointing. Housing is capital intensive construction product, not easily accessible by the common man. Housing having been universally accepted as the most important human need after food, requires that government should provide a vibrant mortgage system, in order to facilitate the provision of “Housing that is affordable” to greater number of Nigerians unable to access decent and comfortable accommodation.
- Whether in economic prosperity or not the Quantity Surveyor has a duty and unshakable role to play in cost reduction and control, total cost management, construction management and finance and project management services in order to provide value for money to the client.
- Nigeria’s housing problem still remains intractable, despite all interventions and programmes to have been implemented to address the problem.
- There is a need for a paradigm shift in design and construction of mass housing production to allow the concept of “Housing that is affordable” since affordability is the ability to be afforded inexpensiveness. Nigeria is very slow in this regard compared to India.
- In order to be close to modern construction technology and innovations, we must join the technological world.
- Nigeria’s population is growing at geometric progression without future prospects for the citizens and generations yet unborn. Housing crisis is escalating unabated, despite a number of new policies, programmes and strategies being engaged by public and private sectors in addressing the problem.
- In the last few decades, the influx of people into urban areas, the natural population increase and inadequate responses by the government have contributed to the worsening housing situation in the country to the extent that economic development and the welfare of the citizens are adversely affected. These problems are more critical in the cities, where huge housing supply deficits, dilapidated housing conditions, high cost of housing as well as proliferation of slums and squatter settlement exist.
- Even housing delivery is a highly contentious and politicized issue. The new housing policy document of 2012 has provided for critical categories/groups of people in addressing the huge housing deficit in the country. Therefore, government should be pragmatic about it and not theoretic and mere electioneering campaign and political window dressing as it were. It is no gainsaying, that the constraints in accessing housing inputs such as land, building materials, finance, as well as cost of providing infrastructure are partly responsible for the hike in the cost of public housing beyond the reach of an average Nigerian.

We need to return to alternative building materials and indigenous technology to house our citizens and also re-invent a number of traditional technologies to cater for the modern housing requirements. The re-inventions should not be on the materials alone, but the methods in which the materials and its products are utilized for creating architectural splendor in structures. These innovations are important in that collectively they have evolved a methodology to architecture that is supported on the vernacular and traditions of the African building customs. To have a house in

Nigeria one must belong to the upper class. This means that in the absence of some assistance and “Housing that is affordable” strategies, adequate housing for the low, low-medium and rural dwellers remains impossible.

The real issue with Housing provision and delivery is that the real estate developer or private developer or real estate market has spent years investing in high-dollar commercial buildings and expensive single family homes, as the pool of units for working people/class is close to nothing anymore.

- Housing provision and delivery for poverty alleviation has a system through building planning, design, cost and comfort studies.
- There is the need to promote the use of local materials and Construction Technology as a tool for Revitalization of the dormant building industry and construction technology in Nigeria.
- Our building research establishments and universities are dormant in carrying out their research functions due to lack of funds.
- Housing delivery is also a contentious and politicized issue that is of great concern to administrators, scholars and the public at large in Nigeria, considering high level corruption practices as a hindrance.
- Today, the national population is estimated to be about 170 million, with urban population constituting about 60 percent.
- A review of past efforts indicated that the achievement level of the various housing programme was abysmally low.
- Despite the fact that Nigeria is endowed with abundant natural resources that can meet her needs for building material production, she depends largely on imported building materials and therefore cannot continue that way.
- Nigeria has not exploited to the full, the pre-fabrication technology/innovation in mass housing provision. Nigeria has not invested sufficiently in construction technology acquisition which will bring about increased productivity in the housing sector and thereby increasing the GDP of the nation. The construction industry GDP currently is sadly very low.
- Mechanization of building materials manufacturing and product cannot be overemphasized as this process is key to the survival of the ailing and dormant construction industry in Nigeria.

7.0 Recommendations

Vice-Chancellor Sir, based on Governmental ineptitude in Housing Provision and Delivery matters concerning Nigerians, the following recommendations are advocated:

1. Governments all over the world should minimize or depoliticize Housing provision and Delivery in the society in the sense that housing is the mirror of the socio-economic and political well-being of any nation including Nigeria.
2. Nigeria should promote and embark seriously on the use of local materials and construction technology as a tool for revitalization of the dormant building industry and construction technology in the country.
3. The government in Nigeria is called upon as a matter of urgency to revamp all building research establishments and Universities by providing adequate funding to carry out research in the housing sector, thereby making the universities to fulfill their mandate in research and development functions.

4. Federal, State and Local governments should as a deliberate effort, increase the budgetary allocation to the housing sector, if the housing policy objectives are to be achieved and sustained.
5. The concept of “Housing that is affordable” is hereby recommended in Housing provision and Delivery system since affordability is the ability to be afforded inexpensiveness. Therefore there should be a paradigm shift in the housing provision sector.
6. Population control in Nigeria can no more be overemphasized, therefore government should take drastic measures to control birth rate and family size.
7. Whether in economic prosperity or not the Quantity Surveyor has a duty, major and unshakable role to play in the nation’s procurement and contract management, cost reduction and control, total cost management, construction management and finance and project management services in order to provide value for money to the client.
8. Housing has been universally accepted as the most important human need after food, therefore government should provide a vibrant mortgage system, revamp the existing ones in order to facilitate the provision of “Housing that is affordable” to greater number of Nigerians unable to access decent and comfortable accommodation.
9. Our built environment does not speak well of healthy living, therefore government should be proactive on issues of environment vis-à-vis development control issues and construction of green building concepts.
10. There has been lack of provision of site and services infrastructure as part of best practices for housing development projects, government as a matter of deliberate action should embark on sustainable site and services as a requirement for housing provision and Delivery.
11. Cost reduction as opposed to excessive cost is the focus on Housing that is affordable in a mass housing development scheme/project, therefore, government should strive to reduce/cut down the cost of a housing unit by the application of alternative building materials in Housing provision and delivery system in the country.
12. Corruption has eaten deep into the fabric of the nation therefore, government should as a matter of deliberate effort adopt best practices devoid of corruption, ethnicity, religious bigotry, nepotism among others in housing provision and delivery system.

Acknowledgements

Vice-Chancellor Sir, I came, I saw and I conquered. My profound gratitude goes to my parents, Late Oha, Eze, Councillor Amos Wofuru-Nyenke, the legendary Uvuawhu man of blessed memory and fondly called “Ekirika Oribi” and “Okohia Mini” by his admirers and Madam Helinah Wuchegbule Nyenke, a virtuous woman of blessed memory and fondly called “Ada Wejinya” by her admirers, for their steadfastness in bringing me up in the right way, by sending me to school, and inspiring me despite the vagaries of life. I remember quite clearly after the Nigerian Civil War in 1970 there was no money to go back to school, having made Distinction in my First School Leaving Certificate examination result in 1965. In 1971, I came to my father and informed him that Government Technical College (GTC), Tombia was admitting students and my father replied, ‘If that information is correct, then consider it done. I will wake you up at 5am, and so get ready. Since I cannot afford to pay for a Grammar School, I have a friend in Tombia whose name is Chief Abbey. He worked with me in Degema Court with the District Officer - W.S. King from whom your name also originated’, my father said, ‘You can go from his house to school if all things are not equal’. We set out to Tombia and met Chief Abbey who embraced my father warmly. My father told the Chief that he came to see him concerning my admission into the school. Chief Abbey quickly took us to the Principal to put the request before him. Immediately, the principal told us that admission into class one is closed as no vacancy existed. I whispered to my father to request the principal to admit me in class two. The principal listened to Chief Abbey’s second request and said, it is impossible. ‘How can I admit, someone who has not done class one to do class two?’ the principal queried. I insisted by telling my father that if I am admitted and I failed, they should pack my things out of the school. Chief Abbey put another pressure on the Principal giving him a condition that, if I wasn’t admitted, he would not supply food to the school, as that was the way students in schools were fed – through food supply contractors. The principal finally bowed to Chief Abbey’s request and issued me an admission letter to study Electrical Installation in class two. The first term result came out, I took 4th position and there was a thunderous ovation in the school for the very high performance. The second term result came out, I took first (1st) position, and there was uneasy silence in the school and in the third (3rd) term, I took first (1st) position and the Principal said to Chief Abbey, ‘This was the man I wanted to send out, he is the one sending me out!’. All other results in my subsequent years maintained the first (1st) position in the school and I laced it with excellent performance in my General Certificate of Education (G.C.E) result in 1973, and completed the school programme in three (3) years duration, instead of four (4) years. I am unequivocally grateful to Chief Abbey, his family and those he left behind.

My appreciation goes to another great mind in the family Chief Barr. Dr. Eze Kingsley Ejikeme Nyenke, the Eze Omusunu ancient kingdom. He is the train head or engine, when it moves others follow. He taught us and directed us well as the First son in the family. Eze Nyenke, my warmest regards to you, your wives and children. My appreciation to Dr. Sunday Nyenke (Los Angeles California, USA), Mr Godwin Iwedi Nyenke (Los Angeles California, USA) and members of their families for their concern throughout the struggle. Chief Anele T. Court and members of their family, are appreciated for their support. The entire Omuoda community are appreciated for their support. Also to be appreciated are Madams Gloria George and Priscilla Nyenke. Nnam Nwakanma, Otuonye Nwakanma, Chilegide Nwakanma, Femi Ogingwa, Ow'honda Nwakanma and their entire family for their contributions to my success. For Henry Wadsworth Longfellow once said, “The heights that great men reached and kept were not attained by sudden flight, but they, while their companions slept, toiled and burnt the midnight oil”.

May I acknowledge with profound gratitude to the Scientific Vice-Chancellor, Professor Blessing Chimezie Didia, 'The Tidy Mind' who played also the role of the Biblical Moses who took the Israelites to the land of Canaan, and also demystified the office of the Vice-Chancellor for the greater good of all in the University. Without his intervention, I wouldn't have stood here today as a Professor of Quantity Surveying of this prestigious University. Vice-Chancellor I doff my hat for you, for cleaning the tears in my eyes. Your good nature goes to say that "When the righteous rule, the people rejoice". We rejoice to have you in our midst. Thank you immensely.

I appreciate the immense support of the Deputy Vice-Chancellor, Professor Boma Oruwari, and the Registrar Mrs V.T. Jamabo and their families.

Vice-Chancellor Sir, it is my pleasure to acknowledge the wisdom of the former Governor of Rivers State, His Excellency, Chief Rufus Ada George, the Perepelebo I of Okirika in appointing me the Project Quantity Surveyor and Project Manager of the Rivers State Urban Renewal Housing Programme/Projects in 1992. Be rewarded abundantly Sir and once more thank you.

In the same vein, I appreciate the former Special Adviser for Lands and Housing Bureau, Chief Barr. Chris O'Nyeche for recommending me to His Excellency the former Governor of Rivers State Chief Rufus Ada George. Also Chief Ebenezer Isokrari, the Director-General of the Bureau for his support. Thank you immensely.

Vice-Chancellor Sir, may I express my unflinching appreciation to my Lord Hon. Justice Adolphus Enebeli, an eminent Jurist, a Cicero and Brainbox of the Rivers State Judiciary for the speedy dispensation of justice on my matter brought before his court. My lord, I thank you and your family immensely.

Vice-Chancellor my evergreen and profound appreciation goes to the great minds in the University of Economics (UE) the Faculty of Accountancy and Department of Construction Management and Economics where I received the light, and the light was received and kept burning, and to produce more light. Let me therefore thank Late Professor George Dimitrov of blessed memory who was the Vice-Chancellor/Rector of the University during my study period and a Quantity Surveyor and professional colleague as a Quantity Surveyor, who taught me Construction Management. The erudite and Distinguished Professor gave me special attention and warm reception upon my arrival and throughout my stay in the University. I pray for his family and those he left behind for longevity.

My appreciation deeply goes to the Vice-Chancellor/Rector of the University Of Economics (UE), Professor Plamen Iliev and his amiable wife, his Deputy and his wife for hosting and accommodating me during the International Scientific Conference in the University in 2013. They revived my sweet memories of Varna through their hospitality. And I say thank you.

Also deserving my immense commendation is Late Professor Stanislav Hadjev of blessed memory, who produced a voluminous textbook, like a Block, we call "TUXLA" in Bulgarian language. He was a great Construction Economist who taught me Construction Economics. There erudition were uncommon.

Late Engr. Andrev my thesis supervisor, Late Architect Pavlov and Late Tveskov, a brilliant Architect for that matter, Engr Markov, Engr. Lazorov and many others who prepared me for the journey of life. I thank them and their families immensely.

And to my classmates: Associate Professor Ivan Zhelev, who is an academic staff in the Department and who is in contact with me, Ludmila Gaidarova who is an Accountant now in Plovdiv, Donka Pecheva, Madam Bakalova the able Secretary of the Department, I thank all of you individually and severally.

Vice-Chancellor Sir, may I acknowledge the unflinching support of the former Chief Judge of the state, retired Chief Hon. Justice Iche Ndu who is now the Governing Council Pro-Chancellor and Chairman of this great University. The Hon. Justice did not allow my promotion case in the court to suffer unnecessary delays and I sincerely thank you, Sir.

I most heartily acknowledge and appreciate the numerous fatherly care given to me by the First Military Governor of our beloved state and is no other person than His Majesty King Alfred Papapriye Diete-Spiff, the Amayanabo of Twon Brass. He took my promotion matter seriously and supported me and I was appointed Professor in Novena University, where he is as the Chancellor of the University. His Majesty Sir, I thank you and bow with trepidation.

Let me acknowledge the contribution of Chief Godpower Nwoka who incidentally was my secondary school mate in Government Technical College (GTC), Tombia. Chief Nwoka upon hearing from me that I cannot pay my flight to Bulgaria to present a paper in the International Scientific Conference holding in Varna-Bulgaria in 2013, decided immediately to pay for the flight and I went to the conference and presented my papers which earned me an Award for Academic Excellence and Leadership. My Chief you are a great son of the land and I shake your hands with great joy.

My million thanks goes to Eze Princewill Nyebuchi Ehor, Eze Odolukwu IV of Elelenwo. He is a statesman and I thank him and his family immensely.

Vice-Chancellor, may I acknowledge the unflinching support given to me by His Majesty Eze (Flt rtd) Robinson O. Robinson, Eze Ekpeye Logbo of Ekpeye land in my various endeavours. Eze thank you.

My appreciation goes to Dr. Lawrence Boms the UNITAR Chief, for involving me in the United Nations (UN) work on Environment for the Niger Delta Region in 2006. Also to appreciate are Andrew Minadiki, Christopher Ohaka, who are my classmates in GTC Tombia, for their moral encouragement and support.

More appreciation goes to Sidney Enyinda the Special Assistant to the Vice-Chancellor and his family for their unflinching support during the trying period.

My great regards goes to Professor George Akaninwor fondly called by me “The Sitting President” of Senior Staff Club of this great University. He is always there despite his busy schedule.

Also appreciated is Professor Zeb Obipi, the University Orator and the President of the Senior Staff Club fondly called by me “The Amazing President”.

My regards and unfettered appreciation goes to ASUU-RSU: Associate Prof. E. Ekwulu - ASUU Chairman; Prof. Mrs. Emilia Jaja, Prof. Puyate, former ASUU chairpersons for their immense contributions to the success of my promotion.

Vice-Chancellor Sir, my profound appreciation goes to the Hon. Commissioner for Housing Hon. Elder Chinedu Tasie and his counterpart Hon. Commissioner for Budget – Hon. Kamalu the Arc. in the Ministry of Housing Arc. David and the Permanent Secretary, Budget – Mrs Titilola Clime, Director Budget Blessing Edumabo and David Okuru for their commitment in making data available to me.

The same appreciation goes to Arc. I.S. Cookey, former General Manager of Rivers State Housing and Property Development Authority and Staff of the authority Mrs Ahiakwo - Asst. Director and Arc. U.C. Nwaubeta.

Vice-Chancellor Sir, let me acknowledge the profound support given to me by the following NDDC staff: Former, Executive Director Projects (EDP) – Engr. Tuoyo Omatsuli. Fmr. EDP – Engr. Ben Ojum; EDP – Engr. Samuel A. Adjogbe; Engr. Emma Audu – Director; QS. Ndu Ahiakwo – Director; Engr. Nkamere – Director; Mr. Chidi Nwankwo – Finance & Admin.; Mr Linus – Financial Admin; Engr Nelson; Engr Gbenga; Engr Boniface Sese; Mr QS Kingsley Oboh (PMS); QS Chukwudi Obowu (PMS), QS. Kelechi; QS Tereke; QS Chita Ekiye. I thank you immensely severally and individually.

My sincere thanks also go to the following professional colleagues; QS. Chief Emmanuel Asawo; QS. Ewa, QS Agi and many others in the profession. I thank you immensely.

At Federal Secretariat, I acknowledge the immense assistance given to me by Alhaji Yusuf, Federal Housing Authority (FHA), Mr. Emma Eba, Hon. Chris Amaefula, and Onuoha all of URP Dept. of the Secretariat. Mrs Helen of the administration is gratefully acknowledged.

I acknowledge the support given to me by Chief Ferdinand Alabraba a high Chief in Kalabari land, Godson O. Moneke, the Registrar of Quantity Surveyors Registration Board of Nigeria (QSRBN) for their encouragement and support.

I appreciate Chief Fred O.O. Amadi, Eze Oha Madike of Aparo Kingdom in Rivers State and his family for their great support. I once more thank you.

My acknowledgement goes to Professor N.O. Imaah, a vibrant faculty member, who worked with me during the struggles. I thank you and your family immensely.

I warmly appreciate the encouragement given to me by Emeritus Professor Steve Odiwei, the former Vice-Chancellor of this great University, I thank you Sir.

Also acknowledged is the support given to me by my Mentee – Dr. Andawei Mee-Edoiye who graduated from the Department of Quantity Surveying.

I acknowledge the immense contributions of Late Professor K.I. Idoniboye of blessed memory the father of Engineering in this prestigious University. He was the Chairman of my Faculty approval committee and other members included Prof N.O. Isirimah and Prof B.A. Okwakpam all of blessed memory, that assessed me and established a prima-facie case for my papers to be sent out to external assessors. I thank them and remain grateful.

May I appreciate heartily the mentoring I received from Emeritus Professor Augustine A. Ahiauzu during his period in this University as the Vice-Chancellor. He was an astute University administrator with great vision. I am happy to have worked with him as Head of the Department of Quantity Surveying. My regards to the family and thank you Sir.

Vice-Chancellor Sir, four names that remain indelible in my mind are: The erudite Professor Godwin Jagboro, of Obafemi Awolowo University (OAU), Ile-Ife, Professor Deji Rufus Ogunsemi of Federal University of Technology – Akure (FUTA), Professor Henry Odeyinka of Obafemi Awolowo University (OAU), Ile-Ife, and Professor K.S. Odusami of University of Lagos (UNILAG). They are academic

colossuses. From all of us, the Nyenke family, we cherish you and your family heartily. Thank you all for being with us during the trying periods and the good Lord shall reward you abundantly.

I appreciate the immense support given to me by Late Professor F.E. Opara of blessed memory and may your soul rest in peace.

My many thanks goes to my Faculty, the Dean and all the Heads of Departments, Staff and Students of this great University for cooperation and synergy.

Vice-Chancellor Sir, let me appreciate the immense contribution of my immediate family members and call them up for special recognition by this distinguished audience. My wife, I call her “My Choice” and she calls me “My Daddy”, and wish to say that I found a good wife. She graduated from the Department of Estate Management of this prestigious University. Her name is Ireju Sophia Nyenke, a Director in the Ministry of Lands in the State. We have four (4) brilliant and hardworking children, and the first one is Chisanum King Wofuru-Nyenke, a graduate of Biochemistry, University of Port Harcourt; Ovundah King Wofuru-Nyenke, a graduate of Mechanical Engineering and the Best Graduating Student in 2014, now pursuing his Post-Graduate programme in this University. Oroma King Wofuru-Nyenke, a graduate of Accountancy of this University and the last but not the least is Nmazole Elizabeth King Wofuru-Nyenke fondly called “Daddy’s Girl” by me, attending her Senior Secondary School and an Award Winning Scholar for maintaining the highest average yearly in the school. I appreciate you all and your efforts to work hard.

Vice-Chancellor Sir, Ladies and Gentlemen.

Thank you all.

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