Nigerian Journal of Arts and Humanities (NJAH), Volume 4 Number 1, 2024 (ISSN: 2814-3760, E-ISSN: 2955-0343)
Indexed in Google Scholar (Email: njahjournal@gmail.com) Nnamdi Azikiwe University, Awka, Nigeria

THE PUBLIC WORKS DEPARTMENT AND THE POLITICS OF SOURCING AND PROCESSING LOCAL BUILDING MATERIALS FOR INFRASTRUCTURE DEVELOPMENT IN COLONIAL NIGERIA, 1931- 1960

LAWRENCE CHICHEBEM SOLOMON
Lecturer, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria
E-mail: cs.lawrence@unizik.edu.ng
&
LAWRENCE HANNAH OLUWABAMISE
Department of Estate Management, Nnamdi Azikiwe University, Awka, Nigeria
E-mail: lawrencehannah2024@gmail.com

Abstract
Building materials are very important in the construction value chain. The Public Works Department which was in charge of constructing public infrastructures relied both on imported and local building materials. The recourse to local building materials got official backing in the early 1930s following the global economic meltdown of that era, from when it became more pronounced. This was because it was found that the use of local building materials was far cheaper than that of the imported ones. This study focuses on how the PWD went about the procurement and the processing of local building materials for carrying out construction works in colonial Nigeria. The overall essence is to reveal strategies for cutting down rising cost of building materials through the sourcing, processing and use of local building materials. It will also show that the local natural resources of the country went into public infrastructure provision and not just the forced and unpaid labour of the people. The study adopts a historical approach combining both primary and secondary sources which are analyzed qualitatively using a narrative and discursive approach. The primary sources used are archival documents obtained from the National Archive, Enugu, while secondary sources used are textbooks and journal articles. The study finds that local building materials were extensively used by the PWD to complement the imported ones, albeit, with caution to protect British market interest. Moreover, the main reason for their use was to cut down building costs.
Keyword: The Public Works Department (PWD), Sourcing, Processing, Local Building Materials, Colonial Nigeria

Introduction

Building materials are very essential in the delivery of public goods such as socio-economic infrastructures in any part of the world. In the colonial era under review, the construction of roads and houses required substantial quantity of building materials. Up to today, building materials are indispensable in the whole value chain of construction. The cost of building materials have been identified as a crucial factor to be considered in making budgets for the construction of physical infrastructure.[i] The building materials that PWD needed for their work often included stones, bricks, timber, planks, doors, shutters, metal plates, roof slates, tiles, white lime, cement, house paints, brushes, door locks, keys, hinges, bolts and bars, window frames, glass and fastenings, asphalt, concrete etc. Many of these materials were imported from outside the country. They were however used in conjunction with local building material.

The use of imported building materials contributed to the transformation of the country's architectural traditions to a great extent. Although the old building patterns with locally sourced materials were not immediately done away with, they began to share the Nigerian built environment with modern and more attractive ones. It should be understood that what brought changes in the country's built environment was not just the new architectural designs that were advocated and used by British officials in Nigeria, but also the new building materials used for construction.

However, unlike the locally sourced building materials, the problem with the use of imported materials was that they were not always available when needed. Sometimes, they arrived late due to communication challenges. One strategy used to handle this challenge was the maintenance of a store. The PWD had a store of imported building materials from which they drew from time to time. Maintaining a store helped PWD to save time and avoid unnecessary delay and compulsory curtailment of projects in the case of unavailability of materials. Circumstances could lead to the rise of the price of building materials, thereby distorting the expected expenditure on building materials. It could also make them scarce. For instance, in 1944, delays in the road works were experienced. These

delays resulted from the non-arrival of tars and bitumen from abroad due to the Second World War. Prices of imported materials skyrocketed to about three times their pre-war prices.[ii]

Another problem with the use of imported building materials was the fact that it was more expensive than the locally sourced ones and so significantly increased the cost of infrastructure development. What further added to the cost of these materials was the fact that they had to be supplied by the Crown Agents, who received large commissions on every material supplied.[iii] The cost of materials thus went up significantly. The Crown Agents also supplied professional consulting engineers as contractors to the PWD for highly technical projects on commission basis. These consultants preferred to use imported materials supplied by their cronies – the Crown Agents. Works executed by contract were discovered to be much more costly than those executed otherwise.[iv] Sometimes, the cost difference was up to half.[v] Apart from the high pay demanded by the consulting engineers or contractors, one cardinal reason for the high cost of works done by contract was the cost of building materials. Works done with imported building materials had to be also maintained with such materials. The cost of maintaining the new buildings and roads became also more expensive.

One strategy used to reduce the cost of building materials was the decision to make more use of local building materials especially when the colonial economy faced distress. In 1931, during the period of economic meltdown, the colonial government deemed it fit to reduce the cost of building materials significantly. For instance, in that year, a committee on Workshop and Foundries carried out a survey and test of the timbers available in Nigeria as substitutes for the various classes of imported ones, and recommended the use of several in the workshops of the Public Works Department.[vi]

It is indisputably true that scholars have written on the subject matter of local building material sourcing and processing. For instance, Don C.I. Okpala (1983)[vii] studied the problems and prospects of using local building materials for house construction in Nigeria. Oladiran (2015),[viii] investigated the use of local materials for building construction. The study discovered that although several local building materials that can be sourced locally abound in Nigeria, these materials are rarely and seldom used .K.T Alade, A.N. Oyebade and N.U. Nzewi (2018),[ix] assessed the use of locally available materials for building construction purpose, focusing on a particular city in Nigeria, Ado-Ekti. Many other scholars have written on the subject matter. Most of the available works focus on the investigating the use of building materials, the problems, prospect of using local building materials, finding out the local materials used and also focus on specific region. This research is not just unique for dwelling on how an institution of a colonial government, especially the PWD sourced and used local building materials but also for focusing on the strategies used for the sourcing and processing the materials. Works on the PWD are very rare to come by. This study will therefore be useful to historians, building engineers and other researchers. It essentially examines the strategies the colonial government PWD went about the sourcing, processing and use of local building materials for public infrastructure construction.

Local Sourcing of Building Materials by the PWD

The colonial government often resorted to the use of locally sourced building materials when it wanted to cut cost. Tests carried out on local materials like that of the Committee on Workshop and Foundries most of the time confirmed that they were of good quality. Local materials were not always inferior in quality to the imported ones as the outcome of the tests did not warrant the rejection of the materials. One then wonders why the imported costly materials were often used in the time of plenty when a lot of costs would have been saved by the use of alternative local building materials.

In sourcing for local materials, the PWD was sometimes careful to protect Britain's market interest. Even where it was possible to produce building materials, using local resources, the PWD hesitated. This was especially true if it did put Britain's market in jeopardy. Thus, local industries for producing building materials were sometimes killed or even nipped in the bud. For instance, in 1945, investigations on a working scale were carried out on the manufacture of cements from the limestone deposits at Igumale in the Eastern Provinces. After much careful investigation lasting for about two years, it was concluded that cement limes and pozzolanas could be manufactured of a sufficiently good quality. However, it was argued that in the presence of the British Portland Cement, demand for it would not justify the establishment of the industry.[x] This was an excuse to shield British cement from competition. Cement was one building material that was on constant demand, and most frequently imported from Britain. There was in fact, a standing order for cement; and PWD was the highest consumer of cement of all government departments.[xi]

Cement Importation into Nigeria in Tons

Year	PWD	All Government	Commercial
1951-52	47,339	_____	____
1952-53	49,007	_____	____
1953-54	53,992	69,188	235,200
1954-55	51,800	70,500	333,100
1955-56	46,926	50,800	358,600

Source: Cement Importation into Nigeria in Tons, Public Works Department Annual Report, 1955-1956, 58

Recourse to local materials that could pose threat to British market interest was only done when there was lack of supply from abroad due to belligerency. In 1917, during the 1st World War, it was stated in the Colonial Annual Report, "the development of the limestone deposits at Enugu are in progress. Lime will be burnt and used in lieu of cement."

Clay Mining

Clay-mining was one of the material sourcing operations of the PWD. Clay was mined by the PWD for making burnt clay bricks used for building staff quarters, departmental offices and very important government buildings and projects.[xii] Before the colonial era, clay mining, which was mainly about soil excavation in search of clay soil, was undertaken among the Igbo. A good example is the people of Ishiagu in present day Ebonyi State. Other localities in Eastern Nigeria that got involved in pottery included but not limited to Inyi, Ibeku, Anam, Ekwe, Eha Alumona and Ohuhu.[xiii] Other pottery producing centers outside Eastern Nigeria included Oshogbo, Oyo-Ile, Abeokuta and Ilorin in Yorubaland; Jebba Island, Baro, Badagi and Bida in Nupeland and Rahama, Kwom, Naraguta, Birom and Abuja.[xiv] Clay was mined and used for pottery and building of houses in Igbo land, especially in places with abundant clay deposit.[xv] Although there is no archaeological evidence showing the use of clay for building clay-walls in the Southeastern region, such evidence exist for pottery.

The Igboukwu site of the 9th century A.D, Nsukka and Afikpo archaeological sites discovered by D.D Hartle among others,[xvi] have all revealed evidence of potsherd, a reliable evidence of the use of pottery by the Late Stone Age.[xvii] It also points to the fact that the mining and use of clay for pottery has a long history in the Southeast. Some of the pottery products included pots (e.g. Aka-eru), Water flask (e.g. Aria-Mmiri and Okpuekpo), plates, dishes, trays, coolers, musical pots, cups, saucers, ritual pots etc.[xviii] Clay pots wee also used for storing grains and for soaking cassava tubers.[xix] The clay was also used to build houses.

No doubt the Igbo had the culture of building mud houses with clay. Rev. G. T. Basden wrote, while trying to describe Igbo traditional building style:

> *The arts and crafts of the Ibo manifest themselves first in his house. The ideas and tastes of both husband and wife are indicated by the care bestowed in the building and decoration of the house…The styles are many, the materials are practically alike for all… the walls are always composed of clay of terra-cotta colour.*[xx]

What is obvious from this assertion is that building with clay has long been a tradition of the Igbo people, especially areas with clay soil deposits and their neighbours. For instance, Ishiagu people of present Ebonyi State where there is significant deposit of clay, built extensively with clay. Also in its neighbouring towns like Awgu, Ndiagbo, Odume, Okpanku and Mpu, among others, the habit of building houses with clay was practiced.[xxi] An old man from Ishiagu, when being interviewed by J.C. Chukwuma about the origin of clay-house building in Ishiagu replied:

> *I don't know and my father did not tell me. All I know is that clay house culture is as old as Ishiagu. Nobody can say when it started, why it started or how it started.*[xxii]

A large portion of land was involved in the mining exercise which lasted up to 1960, and even continued thereafter until 1967 when the Nigerian Civil War broke out.[xxiii] A substantial portion of land was mined by the PWD during the period. Clay mining started right from the surface of the earth and continued up to about 20 metres below the surface of the earth.[xxiv] Although there is no record of the exact land breadth and depth covered by the PWD, estimated figures of about 100 metres square and 8 metres respectively have been given.[xxv]

Rock /Stone Quarrying and Excavation

Another material sourcing activity of the PWD in the Eastern Province, and later Region, was stone and rock excavation and quarrying. Quarrying is the "excavation, extraction and breaking of rocks or stones into aggregates for construction purposes such as bridges, houses, roads, railways and others."[xxvi] Gravels were also generated

through the process of quarrying. In the Eastern Region, the PWD established a quarry at Aro, in the present day Abia State. The *Aro* people *are* an Igbo subgroup with a blend of Akpa and Ibibio ancestry. They formed the Arochukwu kingdom in present-day Abia state, *Nigeria*. The Aro Quarry supplied stones, concretes, gravels, granites and other stone-related materials used by the PWD in the Eastern Region.

Quarrying was either done manually or with machine. When the stones or rocks involved were small and could be carried and broken by hands using hammer and other simple breaking tools, machines were not used. Also when the scale involved was small, there was no need for machines. In the early colonial days, people in a locality around which a road was being constructed were compelled to bring stones. They were to go to the river-sides to bring stones and get them broken into aggregates for road and other building works. Later, this kind of job was paid for. A petty contract was given to people to supply those stones at an agreed price.

After the British colonial government established its district headquarters in Abakiliki in 1904, it saw it wise to use the stone deposits there for infrastructural development. The need for cheap stones to build houses, administrative buildings and road infrastructure made the PWD to resort to forced labour. The PWD officials coerced the indigenous populace to provide them with lumps of stones cracked manually from the existing surface sedimentary rock deposit at Juju Hill.[xxvii] Before the advent of colonial rule what later became quarry stones were used mainly for traditional and domestic purposes, such as tripods for kitchen fire, in sharpening knives and cracking palm kernels e.t.c. The PWD however found new uses for them.[xxviii]

When however the scale or quantity of rocks or stones needed was high, the quarrying was more organized and also mechanized. Machines were used to blast rocks and cut them into needed usable sizes, while hu,an labour complemented by either breaking small-sized stones or packing and separating the quarried stones into various end-products. Stones for masonry, concrete, road-making and for foundation of buildings were obtained through rock excavation by the PWD. The method and manner of breaking and other quarrying operations were subject to the approval of the PWD engineer in charge of a quarrying site.

The material or stone worked on had to be clean, hard and tough. It should not disintegrate when exposed to air and water. (Nigeria PWD, NPW Specifications, Minworks 11/1/7, Government Printer, Western Region, Nigeria). However, the chief requirement of stone for building purposes are strength, density and durability combined with a reasonable adaptability to working.[xxix] Most of the excavations were done by drilling, and hand drillers were more often than not used. The rock was first wet with water. Special well sharpened drill steels were used. The mouth of the drill was about 1 inch in diameter.

The rock to be excavated was first wet with water to soften and ease up the drilling process. Two drilling points were chosen. The distance between them was double the depth of each of the holes to be drilled. The depth of the hole (the distance of the hole from the working face) varied from two to five feet. The drilling was not an easy task. In hard granite, two labourers could drill an average of two to four feet per day.[xxx] Cracks on the rock had to be studied by the drillers as the drilling point was not to be nearer the crack than one foot.[xxxi] Holes were preferably drilled along the line of rock cleavages. In each hole, 'feathers' (two half round pieces of steel) were placed with wedges in-between. Either steel or wood could be used as wedges. If the edges were of steel they were driven in simultaneously with successive blows. As the wedges were driven in the rock split along the face of the holes. If on the other hand wooden wedges were used, there was no need for blows, the wooden wedges expanded on being soaked with water and the effect was that the rock split as in the case of the steel wedge.[xxxii]

Some of the machines used as at the 1940s were Blasters, Drillers, Crushers, Compressors and Drill Sharpening Plants.[xxxiii] Plans were made to replace old machines in the quarry in order to maintain expected output. The products of the Aro Quarry were distributed to as far as PWD in Lagos and Abeokuta, Lagos Town Council, Nigerian Railway and other government departments.[xxxiv] It was also used internally, that is in the Southeast.
The Aro Quarry had an inspector who ensured that PWD specifications and safety rules were adhered to in the quarrying process. The quarrying process was hazardous. Sometimes, workers were injured. As a result, there was a first aid post in the Aro Quarry.[xxxv] Workers were sometimes injured. When this occurred as it did in 1949, those that had minor injuries were treated at the quarry first aid post, while those with more severe injury cases were moved to a nearby hospital for treatment.[xxxvi]

The Quarry received demands from government agencies and departments. In the financial year, 1944/45, all demands for stones were met.[xxxvii] The total output of granite for the year 1944/45 was 37, 259 tons.[xxxviii] The PWD and the Railway Department consumed more of the stone materials produced by the Aro Quarry. Of the 37, 259 tons produced in the year 1943/44, 20, 871 tons were sent to the PWD and the Railway, 13, 693 tons to the

Marine Department and 2, 695 to other consumers.[xxxix] In 1947-48 and 1948/49 financial years deliveries of stone from the Aro Quary were as follows:

Table Showing Deliveries of Stone from the Aro Quary in the financial years 1947-48 and 1948-49

Stone Destination	**1947-48**	**1948-49**
	Quantity in tons	**Quantity in tons**
Marine Department	10,844	13,280
Railway Department	9,251	4,010
PWD, Lagos	4,814	6784
Cash Sales	1,958	1,040
Used in Quarry	1,428	577
Other consumers	4,621	4,100
Total	32,916	29,791

Source: Annual Report, Public Works Department, 1948-49, 28

Stones were first collected by mammy wagons, but the use of lorries instead started making headway in the 1940s.[xl] Shortage of water affected the Quarry in 1949. Local water was needed for the operation of steam cranes and locomotives used for quarrying.[xli] From December to the end of the financial year, there was no regular supply of local water.[xlii] The management of the quarry was contracted out to one of the most popular European construction companies in the colonial period, Messrs Richard Costain (W.A) in December 1950 by the Government.[xliii]

Apart from the Quarry at Aro whose activities were always reported in the PWD Annual Report, there were other PWD quarrying centres in Southeastern Nigeria though not as popular as the Aro Quarry. There were quarrying locations in present day Abakiliki as already noted earlier.[xliv] Two types of important stones namely shale/sedimentary and granite were found in abundance in Abakiliki.[xlv] These stones were predominantly found in Onuebonyi-Izzi, Ezzamgbo (Odomoke) and Ezillo in Abakiliki.[xlvi] Even in Nkalagu in Southeastern Nigeria, Stones were quarried for construction purpose.[xlvii]

Forest Exploitation, Timber Sourcing and Wood Processing/Working

Most of the trees from which timbers were gotten for construction were cut from the Nigerian forest. They were used for electric poles, mile poles, bridges, roofing, walling, making furniture used for furnishing government houses, and so on. Timbers were gotten and processed more in the west, because of the big wood workshops in the PWD Headquarters in Lagos. The main wood-working workshops and saw mill were situated in Ijora, mainland of Lagos. A lot of timbers were also gotten from the forests of Southeastern Nigeria. The Central wood workshop in Lagos got involved in the exploitation of unknown timbers of the Southern Provinces and in designing of proper methods of seasoning and working those timbers.[xlviii]

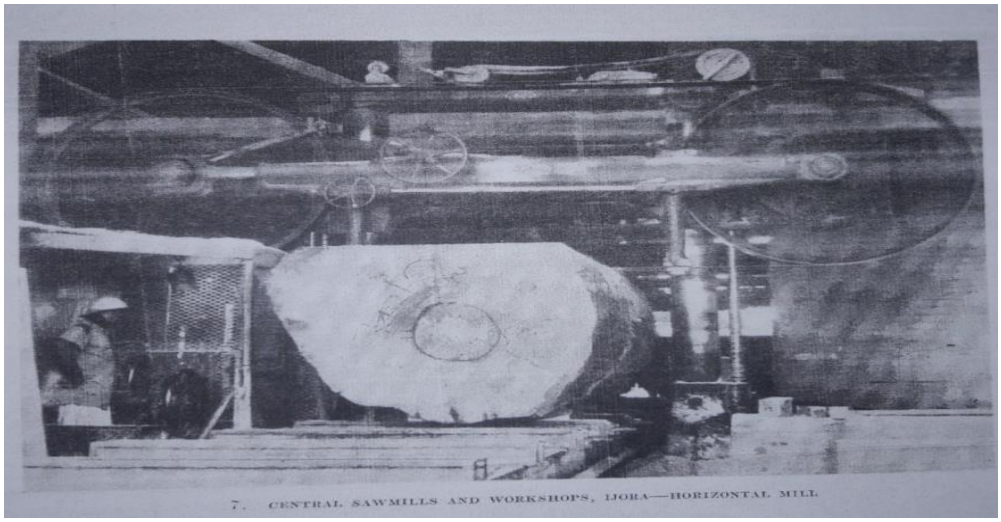
One of the great roles the workshops played was the reduction of timber importation for construction and furniture works. One main timber that was imported in a large scale was pitch pine. Due to its high cost, efforts were made by the PWD workshop managers to discover suitable local timbers to serve as its substitute. The PWD workshop managers did this in collaboration with forest authorities.[xlix] Trees commonly used for building in the target provinces were subjected to tests to determine their usability for big construction works, even though they were all used for local building constructions.

Among the timbers commonly used for building purposes in the Southeastern region, from which the PWD picked for their building include *Uri*, *Ude*, the silk cotton tree or *Akpu* and *Spata*, *Owo*, *Oduree*, *Ugba*, *Inyi*, *Ugbaka*, *Uko*, *Ugiri*, *Mkpoochi*, *Okwe*, *Odo*, cam wood or *Ufie*.[l] Those used were subjected to tests before they were used. Apart from the physio-chemical tests carried out by the PWD, other factors determined the usability of a particular tree for construction work in Igboland, or the extent of its use if it was to be used at all. There were trees in Igboland known to be sacred; such trees were forbidden to be used for construction works even if they passed the PWD usability test. Examples of sacred trees are the ngwu and ofo trees. These trees are trees known to represent gods or trees in which particular gods resided. Edible-food producing trees are normally used, but with caution.[li] After the logs had been cut, they were transported either by canoe, like in Lagos, or by lorries like in the Southeast to the saw mill. They were offloaded sometimes manually and sometimes with the help of cranes. The logs were then stacked together in a place, awaiting the next line of action. The picture below shows how the PWD logs were stacked.

6. CENTRAL SAWMILLS AND WORKSHOPS, IJORA—LOG STACK

Source: PWD Annual Report, 1960

The next line of action was to move the logs to the sawing machines. There were the horizontal sawing machines which cut the logs horizontally as the picture below shows.



7. CENTRAL SAWMILLS AND WORKSHOPS, IJORA—HORIZONTAL MILL

Source: PWD Annual Report, 1960

Owing to the cheapness of local timber in Lagos, most manufacture of wood works were carried out in Lagos and transported to the area offices in the various regions. Between late 20s and early 1930s, the Government considered privatizing these concerns, but concluded it was not yet time. Due to the central importance of these concerns to the overall works of the PWD, they were not eventually privatized like the Aro Quarry was in 1950. Another reason was the absence of sufficient private enterprise to engender competition in the timber market.

However, the Area officers found it preferable to manufacture their own wood works. They manufactured doors and window frames and small building wood works locally. Although the timber products manufactured in the Southeast and other geopolitical regions were believed to be of lesser quality compared to the ones produced from the central sawmill at Ijora, Lagos, the ones brought in from Lagos suffered damages while in transit. In addition, timber manufactured locally did not show tendency to warp and crack.[lii] The workshop had experts who conducted exhaustive tests to determine the physical characteristics of these timbers and had the results recorded. They also got involved in the training of apprentices who underwent a five-year course as a way of producing workers for the workshops.[liii] There were two main workshops in Eastern Nigeria at Enugu and Port Harcourt.

The timbers used, if not prepared by the PWD, had to be purchased from sources approved by the Director. Certain characteristics were looked out for in timbers to be purchased from outside for public works use. A typical PWD-approved timber was to be strong, straight, sound, well seasoned and free from sap, shakes, large or dead knots, wavy edges, worn holes and other harmful defects.[liv]

Manufacture/Production of Building Materials - Brick Making and Cement Production

Use of clay for building houses among the Igbo no doubt has a long history. However, the PWD introduced new method of transforming the clay mined into bricks used for erecting modern buildings. Before now, brick-making

had been experimented locally in some places in the Southeast,[lv] but not largely with clay, and not at very large scale. As early as 1900, a brick field was established on the left bank of the Cross River at a place called Etetim.[lvi] It was estimated that when in full capacity bricks would be produced as cheaply as a little over half of the imported ones.[lvii] However, the technology of moulding burnt bricks in a very large scale in Igbo land was first introduced by the PWD at Ishiagu, specifically Amonye Village in 1920.[lviii] This PWD-run block making factory was established in order to reduce the expenses incurred on building materials. Within the same logic line, it was an attempt to curb the importation of cement used for moulding building blocks. Cement for moulding the conventional block was even scarce at that period.

The location of the bricks industry at Ishiagu had economic undertones. First, the abundant availability of clay, which was the major raw material for burnt bricks production, influenced the move. Another foreseen economic advantage was the presence of the Railway Station at Amonye Village of Ishiagu and the rail line that ran from Port-Harcourt through Aba, Umuahia, Ishiagu to Enugu and to the north. It was calculated that the rail line would help in conveying the burnt bricks to various railway stations where they were utilized.[lix] The absence of an alternative and dependable mass transport mode then, that could convey large quantity of bricks to other several locations, made the railway the indispensable choice. There were no tarred roads to compete with the railways yet.

The Railway station was established in about 1917.[lx] The popularity of Ishiagu then for palm produce production, an important factor for the development of the Port-Harcourt – Enugu Railway, explains the choice of the location.[lxi] The location of the railway station attracted a good number of people to the area, who took up employment with the railway station. While the rail lines provided the required transport for the evacuation of the burnt bricks to various railway stations, the station at Amonye acted as the take-off point and the people provided labour force both for the railway and for the PWD. The burnt bricks were actually used not only for the nearby railway station. They were also used to build railway offices at the other stations in the eastern railway division (from Port-Harcourt to Enugu).[lxii] Most of the railways stations buildings in the former Eastern Region (Port-Harcourt to Enugu) were built with burnt clay-bricks, most of which were produced at the Ishiagu block industry.[lxiii] At virtually every railway station in the former Eastern Region, from Port Harcourt to Enugu, it is common to see bunt bricks houses.

The burnt bricks produced by the PWD were not only for the needs of the railway station buildings. Other government departments and agencies also benefited. Lorries and tippers evacuated some of the burnt bricks to other government agencies and departments where the PWD utilized them for fencing, building offices, staff quarters etc. Thus, in the colonial period, building with clay was no longer limited to places with sufficient clay deposits, but the PWD used it for the purposes of building houses, not only within the immediate environment but the burnt bricks were transported to other places where they were used for building purposes. Also, unlike in the pre-colonial era when clay used for wall buildings were not fired, the PWD introduced the technology of firing clay used for building purposes.

The PWD bricks production passed through some processes flagged off by pre-mining activities like the clearing of the land to be mined. Diggers, shovels and hoes were used to dig up the clay from the clay pits by those in charge of digging. Then the carriers used vessels like enamel basins and head-pans to convey the clay from the clay pit to the site. A local wooden vessel called *Abo*, which was a long basket with a wooden base, was also sometimes used.[lxiv] When the clay got to the site, the production process continued and finished there. Apart from bricks, cement was sometimes produced with local materials (mainly limestone), though in small quantity. British Portland cement which was imported from Britain was the main cement used. Local production of cement was deliberately limited to some extent to preserve market for this foreign cement.

Materials Testing and Analyses

The PWD had a Headquarters Laboratory in Lagos. It was in 1932 that the Headquarters Labouratory was established. It was responsible for tests of the materials, assessment of results of the tests and recommendations of specifications for designs. In the labouratory, tests on Mechanical and Physical Analyses were carried out.[lxv] This constituted the routine work of the laboratory. The labouratory was equipped with machines and equipments for carrying out the tests. However, it still lacked some equipment for running some tests. Most of the equipment available were for testing of soil materials.

By 1949, the soil tests or investigations had broadened to include liquid and plastic limit tests, hydrometer analyses, proctor compaction test, Shear tests e.t.c. The most frequent problems were whether the soil would be suitable as a sub-grade for a road or runway or whether the soil could be satisfactorily stabilized with cement.[lxvi] As at 1952, the laboratory was still not yet able to conduct complete investigations of every kind even though it

had made some progress in capacity building. The lack of an expert trained in advanced methods of soil mechanics was felt when some investigations were carried out.[lxvii] By 1960, the Headquarters Labouratory conducted tests on hundreds of samples of soils, aggregate, building blocks, concrete cubes, steel, soil-cement and bituminous materials. Other building materials like paints, iron rods, roofing sheets, timbers *et cetera* were subjected to tests to ascertain their quality and behavior over time.

Material Quality Control

The PWD had a Material Section due to the importance of building materials in the whole construction chain. Actually, the PWD Material Section was divided into two main sub-divisions viz Field Control and Headquarters Labouratory.[lxviii] The Field Control Unit was responsible for preliminary investigations and quality control of materials used during construction, and observation for the behavior of the materials after construction.[lxix] The Headquarters Labouratory on the other hand complemented the quality control work of the Field Control Unit through its materials testing responsibility. The activities of both units helped to check the quality of materials that went into PWD construction projects. The road labouratory that tested and ascertained the quality and type of soil on which roads were built also helped in quality control.

Conclusion

Building materials contribute significantly to the cost of construction. One great way to reduce and manage this is to explore the use of locally sourced materials. This study has examined how the PWD went about the sourcing, processing and the use of local building materials. It has been underscored that one of the main reasons the PWD explored the use of locally sourced building materials was to cut down construction cost, especially as the colonial government was not ready and willing to spend on the development of their colonies from their own coffers. The strategies used by the PWD in procuring and processing these materials can be helpful to current construction workers in the country. At the same time, it must be understood that the extensive use of local building materials by the colonial government for public infrastructure construction in colonial Nigeria reveals that the exploitation of the resources of the country by the colonial government went beyond the tapping away of mineral resources for their use but also extends to the exploitation of indigenous materials for the erection of the instruments of exploitation. In the same vein, it should be understood that the boast made by Eurocentric writers of the great contributions of the colonial government to the development of Africa especially in terms of infrastructural development is flattened by the fact that Africa made huge contributions, not just in terms of labour provision, but also in terms of building materials to make this feat possible.

Endnotes

[i] D.O. Mac-Barago and A.A. Shittu," Budgetary Allocation to the Housing Sector and the Price of Some Building Materials" in *International Journal of Social Sciences and Management Research* Vol. 3 No.1 2017, 40-52, accessed on the 1st of June 2019, https://iiardpub.org/get/IJSSMR/VOL.%203%20NO.%201%202017/BUDGETARY%20ALLOCATION.pdf

[ii] Public Works Department Department Annual Report [WDR], 1944/45,13

[iii]G. Fiddes, *The Dominions and the Colonial Office* (London: The Nova Scova Veteran Publishing Co, 1926), 27

[iv] This is well documented in F.D. Lugard's*The Dual Mandate in British Tropical Africa*,(London: Frank Cass, 1965), where Lugard himself criticized the execution of public works projects by contract

[v] NAI, RG/W4, PWD, Recommendations on the Organization, Federal Ministry of Works and Survey, 1/1/58

[vi] Colonial Annual Report, 1931

[vii] Don C.I. Okpala, "Promoting the use of local building materials in Nigerian House Construction**:** Problems and Prospects," Jstor, 1983

[viii] O.J. Oladiran, Investigating the Use of Local Materials for Building Construction, Centre for Research and Development (CERAD), , Federal University of Technology, Akure, 2015

[ix] K.T Alade, A.N. Oyebade and N.U. Nzewi, "Assessment of the Use of Locally Available Materials for Building Construction in Ado-Ekti," *Journal of Construction Business and Management,* Vol 2, No. 2, 36-41, 2018

[x] Don C.I. Okpala, "Promoting the use of local building materials in Nigerian House Construction**:** Problems and Prospects," Jstor, 1983"

[xi] PWD R, 1956, 58

[xii] Joseph Chukwuemeka Chukwu, "Mining Operations in Ishiagu, Lekwesi, Lokpaukwu And Uturu Communities In Nigeria, 1900 – 2005" Phd Thesis, Department Of History And International Studies, University Of Nigeria, Nsukka, February 2012, 15

[xiii] O.N. Njoku, "Women in Traditional Igbo Economy" in A.E. Afigbo ed., *New Bridges, More Hopes: Igbo Women in Socio-Economic Change Before the Dawn of the 21st Century,* Published by the Institute of African Studies, University of Nigeria, Nsukka, 2008, 113; there were probably scores of others but the mentioned ones are those best known in published literature. (O.N. Njoku, "Economic History of Nigeria, 19th and 20th Centuries (Enugu: Magnet Business Enterprises, 2001), 57

[xiv] O.N. Njoku, "Women in Traditional Igbo Economy"

[xv] O.N. Njoku, "Women in Traditional Igbo Economy", 28

[xvi]Inclusive are the archaeological sites at Ukpa Rock Shelter, Ugwuagu Rock Shelter, and Abakaliki. They all strongly suggest that clay was extensively used in the region especially as pottery materials. See Okpan Kalu Oyeoku, "Igbo Women and the Plastic Arts: Igbo Pottery Tradition" in A.E. Afigbo, *New Bridges, More Hopes*, 126

[xvii] T. Shaw, "Prehistory" in O. Ikime, *Groundwork of Nigerian History* (Ibadan: Heinemann Educational Books Nig. Ltd, 1980), 29 – 32. See also V. E. Chukwendu, "Archaeology of Igboland: The Later Prehistory" in G.E.K Ofomata, *A Survey of the Igbo Nation* (Owerri; Africana First Publishers Ltd., 2002), 24 – 30.

[xviii] J.C. Chukwu, "Mining Operations in Ishiagu, 50

[xix] Njoku, "Economic History of Nigeria" 59, 60

[xx] G. T. Basden, *Among the Ibos of Nigeria*, (Lagos: Academy Press, 1983), 165 – 177

[xxi] J.C. Chukwu, "Mining Operations in Ishiagu," 35

[xxii] Uche Ndukwe Aja, farmer, aged 70 years, interviewed on 5 November, 2007 at Amagu Ishaigu by J.C. Chukwu, "Mining Operations in Ishiagu," 35

[xxiii] Uche Ndukwe Aja, farmer, aged 70 years, interviewed on 5 November, 2007 at Amagu Ishaigu by J.C. Chukwu, "Mining Operations in Ishiagu,", 61

[xxiv] Uche Ndukwe Aja, farmer, aged 70 years, interviewed on 5 November, 2007 at Amagu Ishaigu by J.C. Chukwu, "Mining Operations in Ishiagu," 61

[xxv] Uche Ndukwe Aja, farmer, aged 70 years, interviewed on 5 November, 2007 at Amagu Ishaigu by J.C. Chukwu, "Mining Operations in Ishiagu," 61

[xxvi] L.C. Amajor, "Stone Turbidite like Deposit. An example from the Turanian Ezaku formation, at Nkalagu South Eastern Nigerian*" Journal of Mining and Geology,* Vol. 28, June 1989,2

[xxvii] The Juju Hill is at the back of the present Ebonyi State Government house, which had a significant deposit of sedimentary rocks.

[xxviii] L.C. Amajor, "Stone Turbidite like Deposit. An example from the Turanian Ezaku formation, at Nkalagu South Eastern Nigerian*" Journal of Mining and Geology,* Vol. 28, June 1989,2.

[xxix] Nigeria Public Works Department Specification, 1938, 69

[xxx] Nigeria Public Works Department Specification, 1938, 11

[xxxi] Nigeria Public Works Department Specification, 1938, 10

[xxxii] Nigeria Public Works Department Specification, 1938, 11

[xxxiii] Nigeria Annual Report of the Public Works Department for the Financial Year 1944-45, Printed and Published by the Government Printer, Lagos, 1946, 15

[xxxiv] Nigeria Annual Report of the Public Works Department for the Financial Year, 1949/50, 41

[xxxv] Nigeria Annual Report of the Public Works Department for the Financial Year, 1949/50, 40

[xxxvi]Nigeria Annual Report of the Public Works Department for the Financial Year, 1949/50, 40.

[xxxvii] Nigeria Annual Report of the Public Works Department for the Financial Year, 1944

[xxxviii] Nigeria Annual Report of the Public Works Department for the Financial Year, 1944

[xxxix] Nigeria Annual Report of the Public Works Department for the Financial Year, 1944

[xl] Nigeria Annual Report of the Public Works Department for the Financial Year, 1949/50, 39

[xli] Nigeria Annual Report of the Public Works Department for the Financial Year, 1949/50, 40.

[xlii] .Nigeria Annual Report of the Public Works Department for the Financial Year, 1949/50, 40.

[xliii] Nigeria Annual Report of the Public Works Department for the Financial Year, Report, 1951/2, 43

[xliv]Uga, A. Okoronkwo, "The Quarry Industry in Abakaliki, 1970 – 2007," MA. Dissertation, Submitted to the University of Nigeria Nsukka, Department of History and International, Studies, 2014

[xlv] M. Hogue, "Petrographic Differentiation of Tectonically controlled cretaceous sedimentary cycles, South Eastern Nigeria" *Journal of Sedimentary Geology* Vol. 17, August 1977, 25-27.

[xlvixlvi] Okoronkwo, The Quarry Industry

[xlvii] L.C. Amajor, "Stone Turbidite like Deposit. An example from the Turanian Ezaku formation, at Nkalagu South Eastern Nigerian*" Journal of Mining and Geology,* Vol. 28, June 1989,2.

[xlviii] Advisory, 14

[xlix] Advisory, 14

[l] Godwin, Chikwendu, Nsude, Building Materials in Igbo land, 132

[li] Godwin, Chikwendu, Nsude, Building Materials in Igbo land, 132

[lii] Hoey, 78, 23rd of Sept

[liii] Advisory, 14
[liv] Ministry of Works, Eastern Region Nigeria, Specifications for Magistrates Courts and Headquarters at Onitsha, NAE, Minworks, 18/4/5, 40
[lv]Major Gallway to Mr Chamberlain, Southern Nigeria Colonial Annual Report for 1989-1900,
[lvi] Major Gallway to Mr Chamberlain, Southern Nigeria Colonial Annual Report for 1989-1900, Printed by Darling and Son Limited, England, 1901
[lvii] Major Gallway to Mr Chamberlain, Southern Nigeria Colonial Annual Report for 1989-1900
[lviii] .C. Chukwu, "Mining Operations in Ishiagu," 35
[lix] Chukwu, Mining Operations in Ishiagu, 15
[lx] Ishiagu Ibid., 35
[lxi] C. Chukwu, "Mining Operations in Ishiagu," 122
[lxii] C. Chukwu, "Mining Operations in Ishiagu,"., 57
[lxiii] C. Chukwu, "Mining Operations in Ishiagu,", 58
[lxiv] C. Chukwu, "Mining Operations in Ishiagu,"., 62
[lxv] PWD Report, 1944/45, 17
[lxvi] PWDR, 1949/50, 40
[lxvii] Annual Report, PWD, 1951-52, 58
[lxviii] Annual Report, PWD1960, 13
[lxix] Annual Report, PWD1960, 13