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# Attributes Influencing the Choice of Wood Species Utilized for Roofing in Port Harcourt

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**ABSTRACT:** The study identified the attributes that influence the choice of wood species utilized for roofing in Port Harcourt. Data were collected through the administration of a well-structured questionnaires, oral interview, and reconnaissance survey. A total of 120 wood plank traders comprising of 40 respondents in Marine Base, Iloabuchi, and Igwurita timber markets and 45 onsite carpenters consisting of 15 respondents involved in Flats, Duplexes, and Bungalows roof truss construction were studied at construction sites within the study area. From the study, out of the forty-five (45) wood species that were listed, thirty (30) were found to be available in the timber markets. The choice for wood attributes varied among the three timber markets and construction sites. However, Durability was the most influential attribute in all the timber markets and construction sites with a rate of (100%). Customer demand rated (95.7%) in Marine base timber market. In Iloabuchi and Igwurita timber markets, it rated (100%).Local Council Regulation was the least influential attribute with a rate of (22.5%) in both Marine base and Igwuruta timber markets. While in Iloabuchi timber market, it rated (12.5%).The result also shows that quality and durability were the highest attributes which influenced the choice of wood species utilized for roofing by onsite carpenters involved in roof truss construction of Flats, Duplexes, and Bungalows with a rate of (100%).While source was the least influential attribute for the specification and selection of the wood species with a rate of (46.7%). The sustainable harvesting and utilization of these highly prioritized species which have been affirmed to be available and durable, will decrease relentless rooftop disappointments, guarantee the preservation of human wellbeing and furthermore lessen tension on the overexploited Commonly Used Species (CUS) in Port Harcourt. Durability and strength properties of Lesser Used Species (LUS) should be studied and the data made accessible to consumers. To boost confidence in the use of wood for roofing, consistent quality of wood ought to be guaranteed through proper quality control and product verification.

[Queen Aguma., Charity Fredrick., Ihuoma Amadi., Kufre Edet Okon. James John. **Attributes Influencing the Choice of Wood Species Utilized for Roofing in Port Harcourt.** *Nat Sci* 2021,19(11):54-61]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature 7. doi:10.7537/marsnsj191121.07.

**Keywords**: Roofing, trusses, wood species, commonly-used species, lesser-utilized species

## INTRODUCTION

Forests play a crucial role in the socioeconomic wellbeing of man. The Nigerian forest estate covers 10.2% of the country landmass of 98,321,300 hectares (Aruofor, 2001; Arowosoge *et al.,* 2010). Wood species for furniture making and construction in Nigeria are derived from the forest. According to Beak Consultants (1999), Only 60 of the 600 total recognized wood species that abound in the Nigerian forest have been identified as having commercial value, while the rest are ignored or lost during harvesting. The importance of wood and its usage cannot be over emphasized. For millennia, wood has played an important role in man's life as a building material (Ernest, 2015). Wood was used to build shelters, cook food, create tools, and make weapons by the earliest humans (Rowell, 2005). As a result of the various features and characteristics of the wood, the choice of wood species for a specific use or usage potential varies. These features are wood strength, natural durability, colour (appearance), ease of machine and workability, cost of construction, hardness and availability (Ogunjobi *et al.,* 2018; Rowell 2005).

The roof serves as a shelter and protection for all life from external elements and properties and hence a building is not complete and its content will be damaged without a roof (Mijinyawa *et al.,* 2007). In Port Harcourt, the trusses of roofs are mostly fabricated with either steel or wood, with wood being widely used in the construction of trusses for residential buildings

and steel for industrial buildings. According to Hawkins (2012), the roof is the most vital component of a building to maintain but the most disregarded. Nigeria which is endowed with forests of diverse wood species has been rendered wood deficient due to overexploitation of the Commonly Used Wood Species (CUWS). The decline has resulted in the use of poor quality species and continuous roof failures (Mijinyawa *et al.,* 2007). Neglect by managers of wood resources (Forests) on the crucial need for conservation has led to the decline in the availability of desirable wood species for roofing in timber markets and thus changes in consumers' choices. According to Yeon, (1989), it has not been easy for researchers to obtain information on the physico-mechanical properties of most timber species due to inadequate knowledge about their local, trade, standard and botanical names. Wood can only be used effectively and efficiently if their attributes and basic characteristics are well understood. Several wood consumption-based studies have already been carried out on choices for species across the globe (Luppold 1983; Bullard *et al.*1988; Pakarinen 1999; Karki 2000; Bigsby and Ozanne 2001; Teisl 2002; Vlosky and Shupe 2002; ITC/ITTO 2005; Sandberg and Johansson 2005; Ilce *et al*. 2010; Sood 2014; Boampong *et al*. 2015). All these studies reported different attributes for the choice of wood species. Information about attributes influencing the choice of wood species utilized for roofing in Nigeria is insufficient especially in the South-South region of Nigeria. This calls for a survey of the attributes influencing the choice of wood species utilized for roofing in Port Harcourt while developing a priority class for the wood species attributes.

## METHODOLOGY

### Study Areas

This study was carried out in Rivers State, Nigeria. Rivers State was created by decree 19 of 31ist May 1967, during the administration of General Yakubu Gowon. Rivers State is situated between latitude 4°44' and 59.06" North and longitudes 6°49' and 39.58" East of Greenwich Meridian (Tamunoitekena, 2003). The state is located in the south-south region of Nigeria. Rivers State is bounded on the North by Imo State, on the south by the Atlantic Ocean, on the East by Asia and Akwa Ibom State, and the West by Bayelsa. Out of 23 LGA, 14 are in the upland area, eight (8) in the riverine, and one (1) is a combination of upland and riverine (Dosunmu, 2003). The state is made up of various ethnic groups, which include: Ekpeye, Ikwerre and Etche, Ibani, Opobo, Ogoni, Eleme, Obolo, Engenni, Kalabari, and Okirika. Obio-Akpor is an LGA in the metropolis of Port Harcourt, one of the major centers of economic activities in Nigeria. The LGA covers 260km and at the 2006 Census held a population of 464,789. Obio-Akpor LGA has its headquarters at Rumuodomaya. Igwuruta timber market, Marine Base timber market, and Iloabuchi timber market are registered markets all located in Port Harcourt. These three timber markets are very important sawmills for wood products and are the main wood markets within the Port Harcourt metropolis. They are areas with a high population of people belonging to the middle and high-income groups with relatively decent buildings. The main activities are sales of lumber, secondary and tertiary processing of lumber.

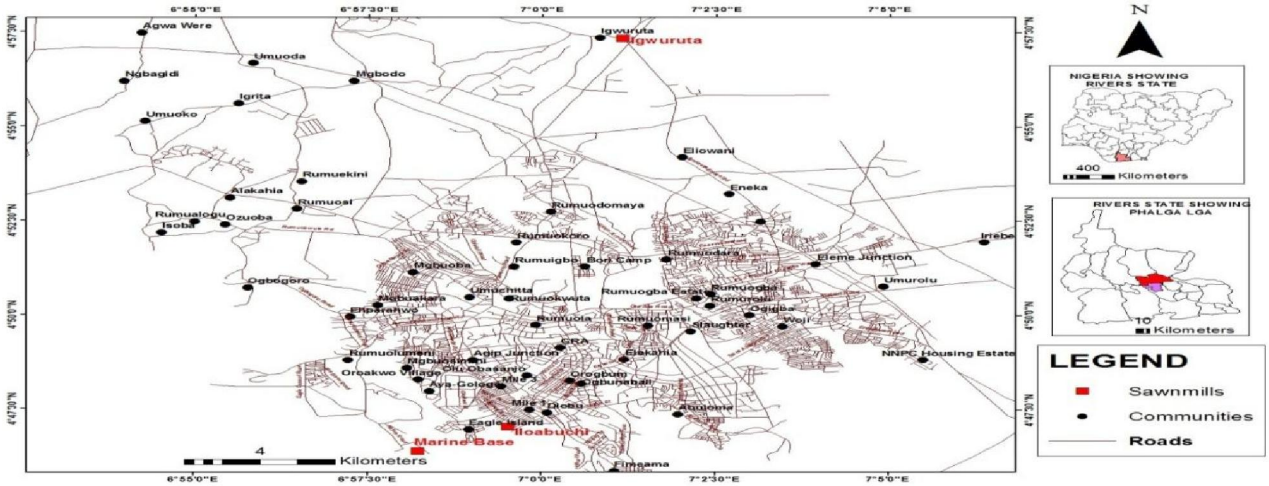


**Figure 1**: Map of Port Harcourt showing the study areas

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**Source**: Geography Department, University of Port Harcourt

**Methods**

A reconnaissance survey was carried out. Purposive Sampling Technique was adopted to select the target respondents. A total of 120 respondents comprising 40 wood plank traders involved in selling wood planks for roofing were studied in Iloabuchi, Marine Base, and Igwuruta timber markets respectively and a total of 45 respondents consisting of 15 on-site carpenters involved in timber roof truss construction within the timber markets were studied. Structured questionnaires and interviews were used to generate data on the wood species commonly utilized for roofing in the study area. A total of 165 questionnaires were administered. Each set of questionnaires were categorized into different sections. The questionnaire was drawn up in such a way that the respondents were guided on all the wood species used for roofing. Timber species for roofing were compiled from a visit to the Sawmills and interviews with carpenters in construction sites. Section A; contained 45 listed timber species for roofing. The section required the respondents to indicate the available species sold at the timber markets and those used by the carpenters in the construction sites and respond to Yes or No based on the type of wood species. Section B elicited information on the factors that influenced the respondent sellers in the selection of the species for roofing. A total of 11 attributes of wood were included in the study, which are; customer demand, sources, finish quality, cost, building comfort, thermal insulation, durability, fire resistance, building standards, local council regulations, transportation cost, color, uniqueness. Attributes that influenced the respondent plank sellers and onsite carpenters in the selection of wood species utilized for roofing were rated using percentages, from the highest to the lowest. Data were presented using tabulation. Photography was used to capture important scenes of the study and to strengthen evidence of important events.

**Plate 1: The researcher interviewing and administering questionnaire to one plank seller in Illoabuchi timber market**

## RESULTS AND DISCUSSION

### Wood Species Available for Roofing in the Timber Markets

Results from the study proved that out of the thirty (45) timber species that were outlined in the questionnaire, thirty (30) timber species were available in the timber markets. Sixteen (16) of them were found to be available in Marine Base timber market, seventeen (17) in Iloabuchi timber market and thirteen (13) of them were found to be available in Igwuruta timber Market.

These were arrived at; from the wood species that obtained fifty percent (50%) and above for the 'Yes' response (Ernest *et al.* 2015; Ametsistsi *et al*. 2009 and Oteng-Amoako, 2006). Table 1 indicates the wood species available in the timber markets studied.

Table 4.1: **Wood Species Available for Roofing in the Timber Markets**

| B/N | TRADE NAMES/COMMON NAMES | SCIENTIFIC NAMES | MARINE BASE | | ILOABUCHI | | IGWURUTA | |
|---|---|---|---|---|---|---|---|---|
| | | | FREQUENCY (n=40) | PERCENTAGE (%) | FREQUENCY (n=40) | PERCENTAGE (%) | FREQUENCY (n=40) | PERCENTAGE (n=40) |
| 1 | *Ngala/Mangrove red* | *Rhizophora racemosa* | 40 | 100 | 35 | 87.5 | 30 | 70.5 |
| 2 | *Okololo/Hog gum tree* | *Symphonia globulifera* | 40 | 100 | 40 | 100 | 35 | 87.5 |
| 3 | *Achi/Achi* | *Brachystegia eurycoma* | 39 | 97.5 | 35 | 87.5 | 36 | 65.0 |
| 4 | *Obobi/English butter tree* | *Pentadesma butyracea* | 25 | 62.5 | 25 | 62.5 | 35 | 87.5 |
| 5 | *Abura/Abura* | *Mitragyna ciliate* | 40 | 100 | 40 | 100 | 30 | 70.5 |
| 6 | *Opepe/Opepe* | *Nauclea diderrichii* | 15 | 62.5 | 23 | 57.5 | 17 | 42.5 |
| 7 | *Yeghere/Black afara* | *Terminalia ivorensis* | 39 | 97.5 | 35 | 87.5 | 30 | 70.5 |
| 8 | *Ekpela/Bush rubber* | *Mitragyna ciliate* | 40 | 100 | 21 | 52.5 | 19 | 47.5 |
| 9 | *Ububa/Berlinia* | *Berlinia grandiflora* | 38 | 95.0 | 40 | 100 | 17 | 42.5 |
| 10 | *Ojokwa/iroko tree* | *Milicia excels* | 38 | 95.0 | 38 | 95.0 | 15 | 37.5 |
| 11 | *Akaan/kola tree* | *Garcinia heekel* | 36 | 90.0 | 26 | 65.0 | 14 | 35.0 |
| 12 | *Aku/Eveuss* | *Klainedoxa gabonensis* | 11 | 27.5 | 7 | 17.5 | 4 | 10.0 |
| 13 | *Uder/Ethiopian tree* | *Xylopia aethiopica* | 23 | 57.5 | 26 | 65.0 | 21 | 52.5 |
| 14 | *Gwaiva/Guava tree* | *Psidium guajava* | 1 | 2.5 | 4 | 10.0 | 9 | 22.5 |
| 15 | Ironwood/ironwood wattle | *Acacia* excels | 39 | 97.5 | 34 | 85.0 | 29 | 72.5 |
| 16 | *Saghai/silkcotton tree* | *Ceiba petandra* | 17 | 42.5 | 30 | 75.0 | 22 | 55.0 |
| 17 | *Abo/African nutmeg tree* | *Pycanthus angolensis* | 4 | 10.0 | 25 | 62.5 | 14 | 35.0 |
| 18 | *Obobiobo/tallow tree* | *Klainedoxa gabonensis* | 1 | 2.5 | 4 | 10.0 | 11 | 27.5 |
| 19 | *Abo/Abo* | *Coelocaryon preusii* | 7 | 17.5 | 3 | 7.5 | 3 | 7.5 |
| 20 | *Aboshi/Camwood* | *Baphia nitida* | 2 | 5.0 | 13 | 32.5 | 2 | 5.0 |
| 21 | *Ugba/Oilbean tree* | *Petadethra macrophylla* | 22 | 55.0 | 11 | 27.5 | 23 | 57.5 |
| 22 | *Craib/Boko* | *Pterocarpus osun* | 2 | 5.0 | 1 | 2.5 | - | - |
| 23 | *Isinkpi/pheasant berry* | *Margaritaria discoidea* | 1 | 2.5 | 1 | 2.5 | 1 | 2.5 |
| 24 | *Okpolota/okpolota* | *Spondianthus preussii* | 3 | 7.5 | 1 | 2.5 | - | - |
| 25 | *Kuru/red ironwood tree* | *Lophira alata* | 34 | 85.0 | 32 | 80.0 | 4 | 10.0 |
| 26 | *Apopo/English African walnut* | *Lovoa trichilioides* | 4 | 10.0 | 5 | 12.5 | 22 | 55.0 |
| 27 | *Baa/abura* | *Hallea ledermannii* | 3 | 7.5 | 4 | 10.0 | 3 | 7.5 |
| 28 | *Alagba/Red mahogany* | *Khaya ivorensis* | 27 | 67.5 | 24 | 60.0 | 36 | 90.0 |
| 29 | *Fo/mahogany* | *Carapa procera* | 36 | 90.0 | 7 | 17.5 | 35 | 87.5 |
| 30 | *Ren/Sasswood tree* | *Erythrophluem ivorenses* | 4 | 10.0 | 15 | 37.5 | 1 | 2.5 |

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Out of the several wood species in the South-South region, only a few species were available in the timber markets studied. In a similar study done by Awe *et al*, (2019), 96% of timber sellers complained that there has been fluctuation and decline in the availability of the timber species traded. Prominent among the reasons was over-exploitation. This confirms FAO (2010), estimates, that Nigeria loses about 3.7% of its forest area per year. Increased utilization of a wide number of species, especially Lesser-Used Species (LUS) may help prevent going for the few traditional high-value species. The properties and uses of LUS are unknown to consumers; most of them are reluctant to purchase them. The rate of the growing scarcity of desirable and high-value species calls for substitution with LUS (Ernest, 2015).

From table 1, *Rhizophora racemosa* (100%), *Symphonia globulifera* (100%), *Mitragyna ciliate* (100%), *Brachystegia eurycoma* (97.5%), *Terminalia ivorensis* (97.5%), *Milicia excelsa* (95.0%), and *Berlinia grandiflora* (95.0%) had high responses rate and assumed to be species that are mostly prioritized in Marine Base timber market. *Symphonia globulifera* (100%), *Mitragyna ciliate* (100%), *Berlinia grandiflora* (100%), *Milicia excelsa* (95.0%), and *Brachystegia eurycoma* (87.5%) recorded high response and assumed to be wood species that are highly prioritized for roofing in Illoabuch timber market. In the Igwuruta timber market, *Symphonia globulifera* (87.5%), *Rhizophora racemosa* (70.5%), *Mitragyna ciliate* (70.5%) was available and highly prioritized for roofing. *Klainedoxa gabonensis*, *Ceiba petandra*, *Lovoa trichilioides, Petadethra macrophylla, Xylopia aethiopica,* was at the bottom of the ranking of wood species available all the timber markets studied. Although these species were available; but were not easily obtained by the timber brokers for sale in the markets. It was also discovered that preference for certain timber species in the market due to their high quality, strength, and durability has resulted in the over-exploitation of such species. Hence, such species are now scarce and not readily available in the market. These species are regarded as endangered species because of the quick decrease in their availability in the timber markets (Awe, *et al*, 2019). The trend of availability of the species on the markets can be attributed to the knowledge of their use and how easily they can be obtained by dealers. With the many wood species and different timbers available, choosing timber for roofing is not an easy task as it seems to be, and selecting the right material is a very important factor when building houses (Adebara *et al*., 2014).

Plate 2: Available wood species in the timber markets studied.

**Attributes that Influence Wood Species Selection by Plank Sellers and Onsite Carpenters**

Results from the analysis indicate that all the eleven attributes that were put up for consideration, influenced the choice of the wood species available in the timber markets. Table 4.2 indicates the attributes influencing timber plank Sellers and onsite carpenters Choice of Wood Species for Roofing in the study areas.

**Table 4.2: Attributes Influencing Plank Sellers Choice of Wood Speciesfor Roofing**

| Attributes | MARINE BASE Frequency (n=40) | Percentage (%) | ILOABUCHI Frequency (n=40) | Percentage (%) | IGWURUTA Frequency (n=40) | Percentage (%) |
|---|---|---|---|---|---|---|
| Customer Demand | 39 | 97.5 | 40 | 100 | 40 | 100 |
| Color | 32 | 80.0 | 29 | 72.5 | 33 | 82.5 |
| Sources | 20 | 50.0 | 20 | 50.0 | 21 | 52.5 |
| Finish quality | 39 | 97.5 | 38 | 95.0 | 39 | 97.5 |
| Cost | 18 | 45.0 | 14 | 35.0 | 22 | 55.0 |
| Building standards | 36 | 90.0 | 38 | 95.0 | 38 | 95.0 |
| Local council regulation | 9 | 22.5 | 5 | 12.5 | 9 | 22.5 |
| Transportation cost | 32 | 80.0 | 35 | 87.5 | 31 | 77.5 |
| Ease of Design | 33 | 82.5 | 36 | 90.0 | 34 | 85.0 |
| Uniqueness | 34 | 85.0 | 36 | 90.0 | 35 | 87.5 |
| Durability | 40 | 100 | 40 | 100 | 40 | 100 |

**4.3: Attributes Influencing On-Site Carpenters Choice of Wood Species for Roofing**

| Items | FLAT Frequency (n=15) | Percentage (%) | BUNGALOW Frequency (n=15) | Percentage (%) | DUPLEX Frequency (n=15) | Percentage (%) |
|---|---|---|---|---|---|---|
| **Customer demand** | 14 | | | | 15 | |
| Yes | 1 | 93.3 | 15 | 100.0 | - | 100.0 |
| No | 4 | 6.7 | - | - | | - |
| **Color** | 11 | | | | 3 | |
| No | | 26.7 | 5 | 33.3 | 12 | 20.0 |
| Yes | 7 | 73.3 | 9 | 60.0 | | 80.0 |
| **Sources** | 8 | | | | 7 | |
| Yes | - | 46.7 | 7 | 46.7 | 8 | 46.7 |
| No | 15 | 53.3 | 8 | 53.3 | | 53.3 |
| **Finish quality** | | | | | - | |
| No | 8 | - | - | - | 15 | - |
| Yes | 7 | 100.0 | 15 | 100.0 | | 100.0 |
| **Cost** | | | | | 5 | |
| No | 3 | 53.3 | 10 | 66.7 | 10 | 33.3 |
| Yes | 12 | 46.7 | 4 | 26.7 | | 66.7 |
| **Building standards** | | | | | 1 | 37.5 |
| No | 4 | 20.0 | 2 | 13.3 | 14 | 6.7 |
| Yes | 11 | 80.0 | 13 | 86.7 | | 93.3 |
| **Local council reg.** | | | | | 5 | |
| No | 4 | 26.7 | 3 | 20.0 | 10 | 33.3 |
| Yes | 11 | 73.3 | 12 | 80.0 | | 66.7 |
| **Transportation cost** | | | | | 5 | |
| No | | 26.7 | 3 | 20.0 | 10 | 33.3 |
| Yes | | 73.3 | 12 | 80.0 | | 66.7 |
| **Ease of design** | 5 | | | | | |
| No | 10 | 33.3 | 4 | 26.7 | 4 | 26.7 |
| Yes | | 66.7 | 11 | 73.3 | 11 | 73.3 |
| **Uniqueness** | | | | | | |
| No | 3 | 20.0 | 2 | 13.3 | | 13.3 |
| Yes | | 80.0 | 13 | 86.7 | 2 | 86.7 |
| **Durability** | 12 | | | | 13 | |
| Yes | | 100 | 15 | 100.0 | | 100.0 |
| No | 15 | - | - | - | 15 | - |

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Customer demand rated (97.5%) in Marine base timber market, (100%) in Iloabuchi and Igwuruta. Durability recorded (100%) in the three timber markets. Durability was rated as the most influential attribute, while local council regulation was the least influential attribute with; (22.5%) in Marine base and Igwuruta timber markets, and (12.5%) in Iloabuchi timber market. Also, the eleven (11) attributes were influential towards the selection of a particular wood species for roofing by the onsite carpenters in the study area (construction sites in Marine base, Illabuchi, and Igwuruta). Finish quality and durability were the most influential attributes with (100%), while source (46.7%) from which the wood species are gotten was the least influential attribute. This confirms a similar finding by Goldstein, (1999) that for ages, the utilization of wood for roof construction has been worldwide limited to wood species that are of high class in durability with relatively high resistance and strength with ease of joining. Wood as a building material is used because of its durability and other mechanical and physical properties (Paluš *et al.,* 2012). Colour, quality, cost price, building standard, transportation cost, ease of design and uniqueness, were the other attributes that influenced the plank sellers and onsite carpenters in the study areas. Traditional marketing practices, lack of guidance on selection for a reason, familiar species, and the danger involved, can all contribute to the reluctance to use a wide variety of timbers, particularly the lesser-used species (Ayarkwa, 1998). Making informed and responsible choices when selecting and purchasing wood for use is one of the most important things one needs to do, to get value for the money spent. Preferences are typical for consumer markets. They influence what consumers would buy and relate to the material used for product production, its quality, appearance, and functionality (Paluš *et al*., 2012). Durability was ranked as the most influential factor amongst all the factors. A probable interpretation is due to knowledge of the maintenance incurred on inferior species when used for certain purposes. The ranking order of the factors seems to indicate consumers' preparedness to spend more money and get value in the long run. Color, cost, building standard, transportation cost, ease of design, and uniqueness which are all very important factors for the specification and selection of timber species for roofing production faired considerably influential from the study. A reason for the cost being fairly influential could be as a result of the relatively cheaper (20-40% cheaper) illegal chain-saw lumber supplied to the markets (Oteng-Amoako *et al*., 2008). This cheaper cost of domestic illegal lumber does not motivate producers of legal lumber to sell on the domestic market (Oteng-Amoako *et al*., 2008).

Plate 3: Ongoing roof truss construction of a duplex in Marine Base and bungalow in Igwuruta

**CONCLUSION AND RECOMMENDATION**

The local lumber industries in Nigeria have for quite a while experienced significant difficulties that have exposed the area to serious pressing factor in regards to crude material inaccessibility and a struggle for efficient utilization of the limited accessible timber. Local consumers out of ignorance and scarcity wind up utilizing inferior timber for superior jobs and vice versa. The study concludes that there are a decent number of timber species that can be used for roofing in Port Harcourt, apart from those generally known and are constrained. Durability, quality, and customer demand were the most influential attributes for the selection and prioritization of the species utilized for roofing in the study area. Source and local council regulation were the least influential attributes. Color, cost, building standard, transportation cost, ease of design, and uniqueness; were all fairly influential attributes. This study presumes that there is a recent fad in the utilization of wood species for roofing in Port

Harcourt, Nigeria. The sustainable harvesting and utilization of these highly prioritized species which have been affirmed to be available and durable, will decrease relentless rooftop disappointments, guarantee the preservation of human wellbeing and furthermore lessen tension on the overexploited of Commonly Used Species (CUS) in Port Harcourt.

In view of the discoveries of this study, it is hence basic that further exploration ought to be done on dimensions, mean/average cost, and selling price of the wood species used for roofing in the study area. Further examinations by the pertinent foundation ought to be led on the durability and strength properties of the lesser-known and lesser used wood species, and the data made accessible to purchasers. To boost confidence in the use of wood for roofing, consistent quality of wood ought to be guaranteed through proper quality control and product verification by the Standards Organization of Nigeria (SON). Innovation to enhance forest management should be used to trace, track and certify timber as it grows to enhance supply chains and sustainability. Manuals, design guidelines, and codes of practice that could guarantee the appropriate utilization of these species ought to be made accessible to forestall flawed rooftop support development. Government should set up framework of policies and activities that will uphold the development of lumber enterprises; this would improve the performance of the trade, viability, business openings, and employment opportunities in the study area.

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