

FACTORS INFLUENCING THE CHOICE OF TIMBER FOR FURNITURE AND JOINERY PRODUCTION IN GHANA

Ernest Boampong

Department of Interior Architecture and Furniture Production, Kumasi Polytechnic, GHANA
Email: ernest.boampong@kpoly.edu.gh

Bernard Effah*

Department of Interior Architecture and Furniture Production, Kumasi Polytechnic, GHANA
Email: bernardeffah@gmail.com

Kwaku Antwi

PhD Student, Department of Construction and Wood Technology Education,
University of Education-Winneba, Kumasi, GHANA
Email: antwikwaku10@gmail.com

Jack Nti Asamoah

Department of Civil, Engineering, Kumasi Polytechnic, GHANA
Email: jaccephas@gmail.com

Alfred Boadi Asante

Department of Interior Architecture and Furniture Production, Kumasi Polytechnic, GHANA
Email: abasantegh@yahoo.co.uk

ABSTRACT

The local timber industry in Ghana has for some time now experienced major challenges that have subjected the sector to severe pressure regarding raw material unavailability and a struggle for efficient use of the limited available timber. This study investigated the availability of timber species and their sizes in two local timber markets and the factors that influence their selection for furniture and joinery production. A cross-sectional survey study which used questionnaire, observation and photography was employed. Random Systematic sampling methods was used to select a realised sample of 306 respondents from an infinite population comprising of timber processors, timber sellers and consumers from the study sites. From the study, out of thirty-two species that were outlined, twenty-two of them were found to be available on the markets. Durability, appearance, quality and processability were the most influential factors for the specification and selection of the species for furniture and joinery production. Affordability, area of usage and informed decision were the least influential factors. Seven common sawn lumber sizes and the actual sizes on display at the markets showed that thickness sizes were less by 5mm for four sizes. The width sizes for all the observed pieces were less by 5-20mm for all the seven sizes. It was concluded that the trend of availability of the species on the markets for furniture and joinery production is attributed to the knowledge on the utilization of the species and the easiness to obtain by the dealers while most wood users buy lumber without checking if the sizes are actual as indicated. There is therefore the need to increase utilization of a wide number of species, especially lesser-used species (LUS) to help prevent creaming for the few traditional high value species.

Keywords: Furniture, joinery, lumber sizes, lesser-used species, timber species.

INTRODUCTION

Wood has played a very important role in the life of man for centuries as a building material. It is known that the earliest humans used wood to make shelters, cook food, construct tools,

and make weapons (Rowell, 2005). Wood has remained an important substance throughout history because of its unique and useful properties as well as its versatility (Rowell, 2005). Although there are many tree species in the world especially in the tropics, Ghana has considerable wealth in tropical hardwood timber resources and has been noted for the supply of forest timber and wood to the rest of the world. Forests play a crucial role in the socioeconomic wellbeing of the people of Ghana (Osei-Tutu *et al.*, 2010). Ghana's timber industry contributes 4.0% of GDP and happens to be the third largest foreign exchange earner for the country (Sutton and Kpentey, 2012).

Ghana is located on the west coast of Africa with a land area of 23.9 million hectares and an estimated population of 24.3 million people (United Nations Population Division, 2010). Ghana's forest resources which stood at 8 million hectares in the early 1920s have reduced to an estimated 1.8 million hectares as at November 2010 (Forestry Commission of Ghana, 2010). The country's forest resources are fast declining in size and productivity partly due to illegal logging practices, over utilization of traditional timber species, unregulated farming practices and illegal mining activities which has affected Ghana's export of timber products (KMA, 2013). The decrease of the annual allowable cut (AAC) as well as encouraging diversification of species used by the local industry is some of the strategies to offset pressure on the county's forest (Owusu and Damnyag, 2008). There are nearly seven hundred different tree species in Ghana (TEDB, 1994). Approximately 420 of these tree species attain timber size and therefore are of potential economic value (Hall and Swaine 1981). Almost 126 of them occur in sufficient volumes to be considered exploitable as raw material base for the timber industry (Ghartey, 1989). According to Oteng-Amoako *et al.* (2008), export of timber revolves around some twenty species and in 2007 seven of these species contributed about 80% of volume and 70% of value of total timber export. As predicted by Ayarkwa (1998) the present state of Ghana's forest has resulted in the adoption of more strict control on timber exploitation, which is has affected both the furniture and the construction industries. Falling volumes of timber in Ghana, coupled with rise in illegal lumbering, has compelled the former net timber exporter to import timber to augment demands of the industry (Quartey, 2012).

Despite wood being the most abundant biodegradable and renewable material available, there are good reasons to maximize its utilization in a sustainable way (Nielsen *et al.*, 2002). In Ghana, timber and other wood products on the local wood markets are obtained from sawn mills as 'factory rejects', 'fall-downs' and residues of inferior qualities (Oteng-Amoako *et al.*, 2008, Ametsistsi *et al.*, 2009). Similarly, the sector is dominated by the informal sector, which accounts for 53% of local supply of timber and also employs about 100,000 people (Sutton and Kpentey, 2012). The formal forest sector employs about 120,000 people, including about 50,000 in the wood-products industry (Blaser *et al.*, 2011). About 30,000 small-scale carpenter firms employ an estimated 200,000 people, and there are about 5,000 woodcarvers and 1,500 canoe carvers (Blaser *et al.*, 2011), with illegal chainsaw milling operations providing jobs for about 130,000 Ghanaians and livelihood support for about 650,000 people (Marfo, 2010).

The total volume of sawmill lumber available for domestic use is only 152,660 m³ per year, while the demand of the domestic end-users is about 384,730 m³ (Ametsistsi *et al.*, 2009). The local timber market relies heavily on illegal chainsaw milling operations accounting for 84% of domestic timber (about 497,000 m³) and an additional 260,000 m³ of timber from same operations exported to neighboring countries (Marfo, 2010). Difficulty in getting the adequate amount of raw material inputs and species of wood has been the main obstacle of local wood products manufactures (Ametsistsi *et al.*, 2009). The formal timber industry has

traditionally concentrated on exports to the neglect of the local market (Blaser *et al.*, 2011). One challenge of the industry is the low recovery rate, leading to waste and the loss of almost 70% of the raw material base (Sutton and Kpentey, 2012). The biggest sources of local demand for wood are the furniture and construction industries, which account for 75% and 24%, respectively, of the market (Sutton and Kpentey, 2012).

After processing, timber meant for the local market is handled by lumber brokers to the local wood markets for consumers to purchase. Changing consumer tastes and species availability is influencing the design and manufacture of hardwood products (Bumgardner *et al.*, 2007). Timber has many uses and which type of timber should be used for right purpose is important to know because if timber used in construction comes out to be of low quality then one may need replacement again and again (Adebara *et al.*, 2014). Timber is naturally hygroscopic and varies in properties between and with-in species (Hoadley, 2000). It is therefore imperative for whoever is going to use any timber product to make the right choice based on reliable information to meet the design requirements of the selected species. Most dealers in the Ghana wood industry and users have relied mainly on a traditional knowledge based on experience of use of the various species but with little or no information on their properties. Most of the species are also not being put to wider utilization because of inadequate data on the physical and technological properties that relates to the utilization of the species (Effah and Osei, 2014). Proper utilization of a particular wood species must be based on both basic and processing properties. There seems to be a general lack of guidance in Ghana on selection for a purpose from among the many timbers with promising characteristics (Ayarkwa, 1998). Also there is limited knowledge about the properties of a large proportion of timber-grade wood species in Ghana (Effah *et al.*, 2013).

Although the Forestry Commission of Ghana has recommended the appropriate use of Ghanaian timber species (Ametsistsi *et al.*, 2009), as to the availability of these species on the local timber market is another issue. Also as to what form the bases for the choice of a particular species for use by timber brokers and users is uncertain. Timber must give satisfaction if it is to hold its markets. A better understanding of consumer preferences for underutilized and established commercial species will assist wood products manufacturers as they make species decisions (Bumgardner *et al.*, 2007). Technical issues of lumber sizes necessary to do a particular job satisfactorily are very important factors to the cost and uses of most construction lumber. Timber is also the single most important raw material in the furniture industry and as such it is important for the industry to know the customers' conceptions of wood as a furniture material and to better understand what the success factors for wood furniture are (Paluš *et al.*, 2012). Selection of a specific tree species depends on one or a combination of factors such as strength, cost, availability, experience and policy considerations (Zziwa *et al.*, 2006).

The local timber industry in Ghana has for some time now experienced major challenges that have subjected the sector to severe pressure regarding raw material unavailability and a struggle for efficient use of the limited available timber. This situation has come about as a result of the decline of Ghana's timber resource making timber difficult to come by and very expensive on the local timber market. Local consumers out of unawareness and scarcity end up using inferior timber for superior jobs and vice versa. This study therefore seeks to investigate the availability of timber species and their sizes in two local timber markets and the factors that influence their selection for furniture and joinery production in Ghana.

METHODOLOGY

Study Areas

The study was conducted at two local timber markets in Kumasi and its environs in the Ashanti region of Ghana. Precisely, the Sokoban wood market located at Sokoban on the outskirts of the Kumasi Metropolis and the Ahwiaa timber market in the Kwabre District. The Sokoban Wood Village is a conglomerated wood industry made up of micro, small, and medium-scale firms which produces all kinds of wood products ranging from household furniture to office furniture (Attuquayefio and Abdulai, 2013). The Ahwiaa timber market on the other hand is at the heart of Ahwiaa, a small town located on the main Kumasi-Mampong highway, about 14 kilometers north of Kumasi in the Kwabre District of Ashanti region. These two timber markets are very important centers for wood products and two of the main wood markets in the country. The markets are run by lumber brokers, who obtained their wood stocks from sawmills and chainsaw operators. The main activities are sales of lumber and secondary and tertiary processing of lumber. The timber markets are communities that house lumber brokers, carpenters and other woodworkers, with economic activities ranging from the sale of food, wood and wood products as well as accessories for wood work and financial institutions.

Methods

In order to achieve the objective of the study, a cross-sectional survey design which sought to portray an accurate profile of persons, events and situations (Robson, 2002) was employed. The survey strategy is usually associated with the deductive research approach and mostly used to answer who, what, where, how much and how many questions (Saunders *et al.*, 2009). A set of questionnaire was developed as brief but provided valuable information to capture the required information on the subject under consideration. The questionnaire was categorized into three sections. Section A contained one categorization variable and 32 timber species for furniture and joinery production. The section required the respondents to indicate the available species at the timber markets by responding to Yes or No to the species. Section B elicited information on the factors that influence the selection of the species with a five point Likert scale of less influence to high influence. The result was scored using Likert scale of summated rating. The criterion mean of 3.0 was derived by adding all the weighted points and divide them by 5. That is; $1 + 2 + 3 + 4 + 5 = 15$; $15/5 = 3.0$. A factor was considered influential if the mean was equal to or greater than 3.0 and non-influential when the mean score was less than 3.0. Section C contained information on 7 standard sizes as against the actual sizes of the pieces of timber on the markets. The researchers thus measured the width and thickness of the pieces available. The species considered were both established and underutilized domestic woods classified by the Forestry Commission of Ghana.

Several techniques were used to improve the quality of data collected. Random Systematic sampling methods was used to select a realized sample of 306 respondents from an infinite population comprising of timber processors, timber sellers and consumers from both study sites. Participant observation and desktop study were used to buttress the information generated from the questionnaire. Photography was used to capture important scenes of the study and to strengthen evidence of important events. The data obtained from all the sources were evaluated using content analysis, descriptive statistics and graphs.

RESULTS AND DISCUSSION

From the analysis, it was observed that the respondents from the two timber markets were 138 (44.7%) timber processors, 102 (33%) timber sellers and 69 (22.3%) customers or consumers who formed the 309 final samples.

Timber Species available on the markets

Results from the questionnaire, observations and photography proved that out of the thirty-two species that were outlined in the questionnaire, twenty-two of them were found to be available on the markets. This was arrived at from the species that obtained fifty percent and above for 'Yes' response to the species. Table 1 indicates the species and their utilization as recommended Oteng-Amoako (2006) and Ametsistsi *et al.* (2009).

Table 1: Timber Species on the two local timber markets and their recommended utilization

No.	Local Name	Botanical Name	Utilization (Oteng-Amoako, 2006; Ametsistsi <i>et al.</i> 2009)
1	African Mahogany	<i>Khaya ivorensis</i>	Boat construction, cabinet works, carvings, doors, frames, furniture, joinery, flooring, etc.
2	Edinam	<i>Entandrophragma angolense</i>	Cabinet works, boat construction, doors, flooring, furniture, joinery, panelling, etc.
3	Sapele	<i>Entandrophragma cylindricum</i>	Block board, carvings, boat construction, doors, fittings, frames, furniture, cabinet works, joinery, veneer, etc.
4	Emire	<i>Terminalia ivorensis</i>	Flooring, frames, furniture, joinery, mouldings, weather boards, shingles, doors, etc.
5	Wawa	<i>Triplochiton scleroxylon</i>	Block board, furniture – utility, plywood, toys, woodware, mouldings, cabinet works, etc.
6	Ceiba	<i>Ceiba pentandra</i>	Boxes, food containers, veneer for plywood, mouldings, etc.
7	Otie	<i>Pycnanthus angolensis</i>	Boxes, furniture, plywood, , boat construction, frames, weather board, canoe, etc.
8	Dahoma	<i>Piptadenia africana</i>	Garden furniture, marine defence, mining timbers, truck bodies, sleepers, joinery, etc.
9	Essia	<i>Petersia africana</i>	Carpentry, construction – utility, sleepers, deckings, truck bodies, etc.
10	Teak	<i>Tectona grandis</i>	Boat construction, cabinet works, flooring, frames, garden furniture, etc.
11	Avodire	<i>Turreanthus africanus</i>	Fittings, furniture, veneer, plywood, mouldings, panellings, etc.
12	Ofram	<i>Terminalia superba</i>	Block board, furniture, plywood, joinery, claddings, veneer, etc.
13	Odum	<i>Milicia excelsa</i>	Boat construction, cabinet works, flooring, frames, garden furniture, joinery, etc.

14	Danta	<i>Nesogordonia papaverifera</i>	Bench tops, boat components, cabinet works, joinery, frames, decorative furniture, etc.
15	Denya	<i>Cylicodiscus gabunensis</i>	Bridges, construction – heavy, flooring – heavy duty, truck bodies, boat building, etc.
16	Kusia	<i>Nauclea diderrichii</i>	Boat construction, flooring, panelling, bridges, sleepers, vehicle and truck bodies, etc.
17	Mansonia	<i>Mansonia altissima</i>	Cabinet works, flooring, joinery, veneer, claddings, high value furniture, etc.
18	Kyenkyen	<i>Antiaris toxicaria</i>	Boxes, carvings, plywood, toys, veneer, handicrafts, claddings, mouldings, etc.
19	Esa	<i>Celtis mildbraedii</i>	Boxes, pallets, handicrafts, core veneer, etc.
20	Asanfena	<i>Aningeria spp.</i>	Trim, veneer, panelling, frames, joinery, furniture, luxury cabinet works, etc.
21	Fotie	<i>Hannoa klaineana</i>	Match boxes, containers, common furniture, handicrafts, packing cases, etc.
22	Hyedua	<i>Guibourtia ehie</i>	Cabinet works, carvings, fittings, flooring, joinery, frames, veneer, etc.

From the many timber species available in Ghana, only few species were found on the market for possible utilization. This confirms the assertion that the usage of timber in Ghana is highly selective in nature and dominated by a small number of preferred timbers (Ayarkwa, 1998). Increased utilization of a wide number of species, especially lesser-used species (LUS) may help prevent creaming for the few traditional high value species. Apparently because the properties and uses of LUS are unknown to consumers, most of them are reluctant to purchase them. The rate of growing scarcity of desirable and high value species is necessitating substitution of the high value species for LUS. Seven of the species in Table 1 (Kyenkyen, Ceiba, Esa, Denya, Hyedua, Essia and Otie) are LUS under promotion for their possible adoption as they were found in commercial quantities in Ghana's forest reserves and have not been subjected to any serious levels of exploitation (ITTO, 2002). All wood products are subject to substitution, especially framing materials, windows and doors, mouldings and casework, cladding, furniture, pallets and packaging (Paluš *et al.*, 2012).

From figure 1, Mahogany (95.1%), Wawa (94.2%), Ofram (93.2%) and Asanfena (92.2%) had high response rate and assumed to be species that are mostly patronized. All the three categories of respondents seem to have knowledge on these species as they are popular and their utilization well known. Essia (59.2%), Fotie (56.9%), Odum (54%) and Avodire (53.5%) were at the bottom of the ranking of the species available. Although these species were available, some of them like Odum and Avodire were not easily obtained by the lumber brokers to be sold on the markets. However their presence can be attributed to their primary nature and the knowledge on the utilization of the species as well as the purpose for which the species are purchased. In the middle range were Danta (85.4%), Emire (84.5%), Sapele (83.5%), Denya (81.6%), Mansonia (79.6%), Dahoma (77.7%), Chenchen (76.7%), Edinam (75.7%), Otie (68%), Esa (67%), Hyedua (63.1%), Ceiba (63.1%) and Teak (61.2%) all received good responses of their availability.

The trend of availability of the species on the markets can be attributed to the knowledge on the utilization of the species and the easiness to obtain by the dealers. With the many wood species and different timbers available, selecting timber is not an easy task as it seems to be and selecting the right material is a very important factor (Adebara *et al.*, 2014). Wood species and users usually request for only the traditional species which has resulted in over-utilization of the preferred species (Ayarkwa, 1998). Consumer preferences are permanently changing because of product innovations and changing life style of consumers (Paluš *et al.*, 2012) and as prices of these traditional timber increase, and quality and quantities decline, manufacturers and producers have little option other than to pay attention to the lesser-known species that were previously ignored if they are to remain in business (Effah *et al.*, 2013). The use of non-traditional tree species is also a positive move towards sustainable utilization of forests since it provides an avenue for increasing the diversity and volume of prime timbers for utilization (Zziwa *et al.*, 2006). Unfortunately, at present only about 7% of trees in the tropical forests of Ghana are being exploited (ITTO, 2002).

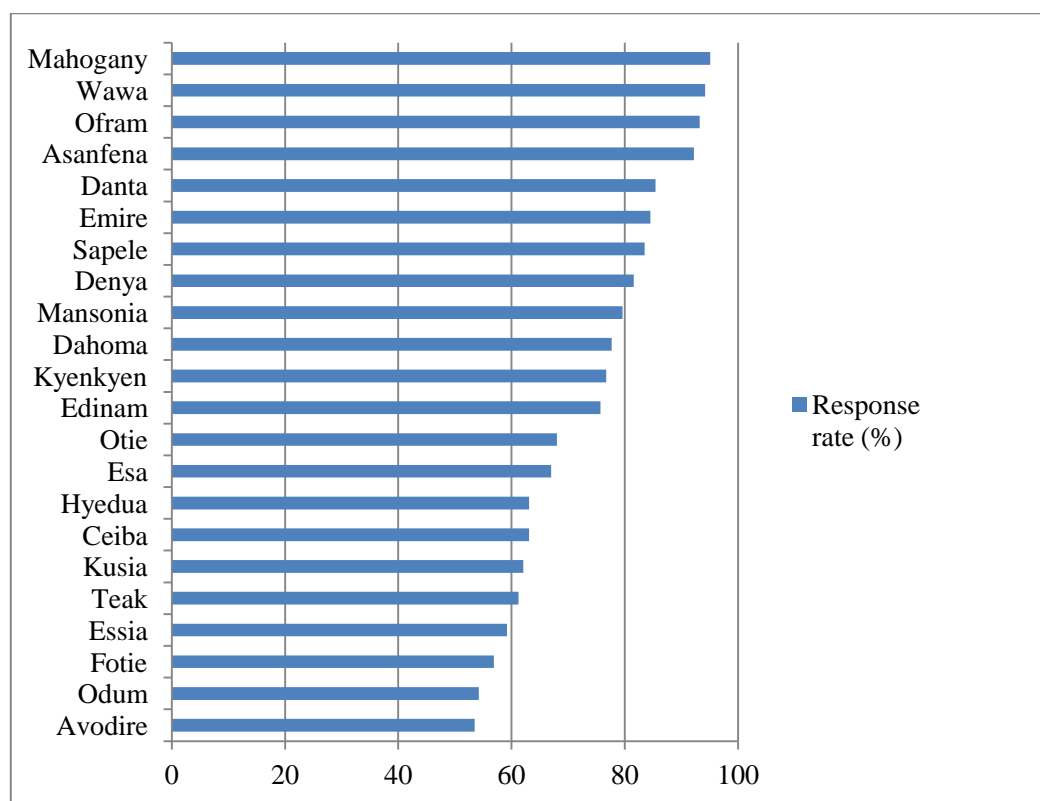


Figure 1: Timber Species on the two local timber markets (response rate %)

Factors that influence Species selection

Results from the analysis indicate that all the twelve factors that were put up for consideration with regards to their influence to the selection of the species, all of them were influential towards the selection of a particular species for usage. However, durability, appearance, quality and processability were the most influential in that order. Affordability, area of usage and informed decision were the least influential factors. Type of product, expert advice, suitability, sustainability and availability were the other influential factors. Figure 2 depict mean ratings of factors that influence the selection of timber for furniture and joinery products at the two timber markets. Wood as building material will be used because of its durability and other mechanical and physical properties (Paluš *et al.*, 2012).

The reluctance to use a great variety of timbers, especially the lesser-used species, may be attributed to several factors among which are: traditional marketing practice, lack of guidance on selection for a purpose, familiar species and risk involved (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). Although all the factors were of significant importance in the specification and selection of the timber species, factors like appearance, price and availability were all influential as the case of Zziwa *et al.* (2009). Durability was ranked as the most influential factor amongst all the factors. A probable interpretation is due to knowledge on the maintenance incurred on inferior species when used for certain purposes. Ranking order of the factors seems to indicate consumers' preparedness to spend more money and get value in the long run. Another reason for the price being last could be the relatively cheaper (20-40% cheaper) illegal chain-saw lumber supplied to the markets (Oteng-Amoako *et al.*, 2008). This cheaper price of domestic illegal lumber does not motivate producers of legal lumber to sell on the domestic market (Oteng-Amoako *et al.*, 2008). Type of product, expert advice, suitability, sustainability, availability, area of usage and informed decision which are all very important factors for the specification and selection of timber species for furniture and joinery production faired considerably influential from the study.

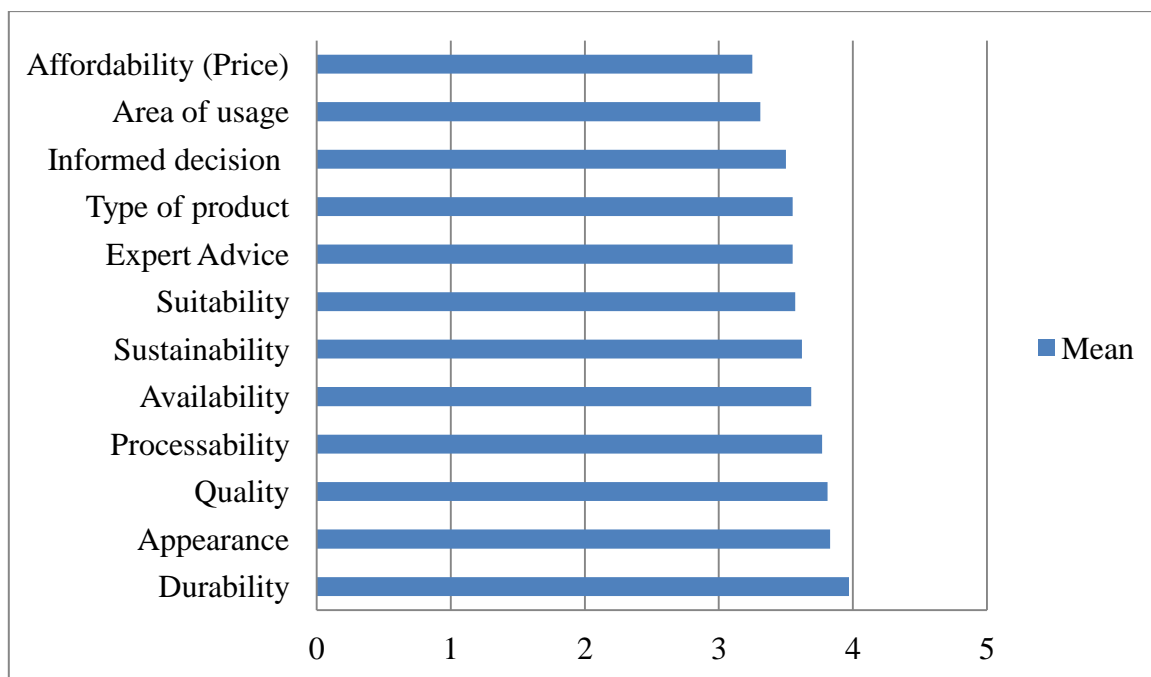


Figure 2: Mean ratings of factors that influence selection of timber for furniture and joinery products

Sizes of lumber at the two timber markets

Table 2 is the result of seven common sawn lumber sizes and the actual sizes on display at the markets. It was observed that thickness sizes were less by 5mm for four sizes. The remaining three thickness sizes met the standard size. The width sizes for all the observed pieces were less by 5-20mm for all the seven sizes. This reduction undermines quality control and the grading standards for which most of the lumber sellers and consumers are not aware of.

Table 2: Sizes of lumber at the two timber markets

No.	Standard sizes (mm)		Realized sizes (mm)	
	Thickness	Width	Thickness	Width
1	50	50	45	45
2	50	75	45	70
3	50	100	45	90
4	50	150	45	145
5	25	25	25	25
6	25	50	25	50
7	25	300	25	280

As prescribed by Adebara *et al.* (2014), one must be well informed regarding timber types and forms before purchasing timber material for construction. A probable interpretation of the reduction in sizes of some of the pieces is because timber is now scarce in the forest and they have reduced the sizes to get more wood to sell. Nonetheless, the species and grade compositions of timber must match demand and be physically compatible with end product requirements and markets which was not the case from the observations of the study. Another potential reason for the reduced sizes could be the lack of technical skills and obsolete machines. Apparently, for efficient and easy identification, the sawn lumber was arranged based on species, sizes and purposes. Figure 3 depicts some lumber selling stands whiles figure 4 shows some wooden items on sale display.



Figure 3: Lumber selling stands (a) Sokoban timber market (b) production shop – Sokoban (c) Ahwiaa timber market



Figure 4: Some wooden items on sale display

Wood products and sawn timber lumber that were found on the markets varied in design, composition and quality. It was observed that preference for particular products and species depended on a number of factors like financial capacity and taste of individuals and this was in line with the study by Ametsistsi *et al.* (2009).

CONCLUSIONS

The local timber industry in Ghana has for some time now experienced major challenges that have subjected the sector to severe pressure regarding raw material unavailability and a struggle for efficient use of the limited available timber. This situation has come about as a result of the decline of Ghana's timber resource making timber difficult to come by and very expensive on the local timber market. Local consumers out of unawareness and scarcity end up using inferior timber for superior jobs and vice versa. This study investigated the availability of timber species and their sizes in two local timber markets and the factors that influence their selection for furniture and joinery production.

The study shows that from the many timber species available in Ghana, only few species were found on the market for possible utilization. From the study, out of thirty-two species that were outlined, twenty-two of them were found to be available on the markets. There is therefore the need to increase utilization of a wide number of species, especially lesser-used species (LUS) to help prevent creaming for the few traditional high value species. Durability, appearance, quality and processability were the most influential factors for the specification and selection of the species. Affordability, area of usage and informed decision were the least influential factors. Type of product, expert advice, suitability, sustainability and availability were all fairly influential factors for specification and selection of the species. Seven common sawn lumber sizes and the actual sizes on display at the markets showed that thickness sizes were less by 5mm for four sizes. The remaining three thickness sizes met the standard sizes. The width sizes for all the observed pieces were less by 5-20mm for all the seven sizes. It was concluded that the trend of availability of the species on the markets is attributed to the knowledge on the utilization of the species and the easiness to obtain by the dealers while most wood users buy lumber without checking if the sizes are actual as indicated.

REFERENCES

Adebara, S.A., Hassan, H., Shittu, M.B. & Anifowose, M.A. (2014) Quality and Utilization of Timber Species for Building Construction in Minna, Nigeria. *The International Journal of Engineering and Science*, 3 (5): 46-50.

- Ametsistsi, G.K.D., Kyereh, B., Duah-Gyamfi, A. & Agyeman, V.K. (2009) Quality control and Standardization of Ghanaian Wood Products. Identify local market requirements for timber and wood Products and priority areas for standards and grading rules development. ITTO Project PD 318/04 Rev. 2. (I) (Activity 2.2).
- Attuquayefio, K.D. & Abdulai, A.R. (2013) Environmental and Social Management Plan (ESMP): Construction of access roads with kerbs and drains at Sokoban wood village. Kumasi Metropolitan Assembly, Ghana.
- Ayarkwa, J. (1998) New marketable Ghanaian timber Species for furniture and construction. *GHANAIAN TIMBERS*. Wood News Jul-Sep 98; 13-18.
- Blaser, J., Sarre, A., Poore, D. & Johnson, S. (2011) Status of Tropical Forest Management 2011. ITTO Technical Series No 38. International Tropical Timber Organization, Yokohama, Japan.
- Bumgardner, M., Nicholls, D. & Donovan, G. (2007) Effects of Species information and Furniture price on consumer preferences for selected woods. *Wood and Fiber Science*, 39(1), 71-81.
- Effah, B. & Osei, J.K. (2014) Development of Kiln-Drying Schedules for two lesser-known timber species in Ghana. *Journal of Science and Technology*, 6 (1): 67-76.
- Effah, B., Osei, J.K. & Antwi, K. (2013) Examining the physical properties and within tree variability in the physical properties of two lesser-known timber species in Ghana. *International Journal of Science and Technology*, 3 (8): 328-332.
- Forestry Commission, Ghana (2010) Report on Export of Wood Products (Timber Industry Development Division).
- Ghartey, K.K. (1989) Results of the Ghana Forest Inventory project. UK Overseas Development Administration / Ghana Forestry Department. Proceedings Ghana Forest Inventory Project Seminar. Accra, Ghana.
- Hall, J.B. & Swaine, M.D. (1981) Distribution and ecology of vascular plants in a tropical rain forest: Forest vegetation in Ghana. *Geobotany 1*. Junk, The Hague.
- Hoadley, R.B. (2000) *Understanding wood: A Craftsman's Guide to Wood Technology*. The Taunton Press, Newtown, Connecticut, USA.
- ITTO (2002) Technological profiles of selected species – Ghana. ITTO PD 179/91 document.
- KMA (2013) Investment Opportunity in Kumasi, Ghana bamboo cultivation and processing. The Kumasi City Investment Promotion Unit, Kumasi Metropolitan Assembly, Ghana.
- Marfo, E. (2010) Chainsaw Milling in Ghana: Context, Drivers and Impacts. Tropenbos International, Wageningen, the Netherlands.
- Nielsen et al. (2002) Utilisation of Wood Waste-Challenges for the sector. 14th Annual Life after waste Conference, Waste MINZ, Rotorua 6-8 November 2002.
- Osei-Tutu et al. (2010) Hidden forestry revealed: Characteristics, constraints and opportunities for small and medium forest enterprises in Ghana. IIED Small and Medium Forest Enterprise Series No. 27. Tropenbos International and International Institute for Environment and Development, London, UK.
- Oteng-Amoako et al. (2008) Timber Industry Restructuring Group Final Report. Voluntary Partnership Agreement.
- Oteng-Amoako, A.A. (2006) *100 Tropical African Timber Trees from Ghana*. Tree Description & Wood Identification with Notes on Distribution, Ecology, Silviculture, Ethnobotany & Wood Uses. Graphic Packaging; Accra, Ghana.
- Owusu, F.W. & Damnyag, L. (2008) Report on Wood market trends, inclination and developmental potentials in Ghana. Forestry Research Institute of Ghana.
- Paluš, H., Mařová, H. & Kaputa, V. (2012) Consumer Preferences for Joinery Products and Furniture in Slovakia and Poland. *ACTA FACULTATIS XYLOLOGIAE* 54(2): 123-132.
- Quartey, L. (2012) *Ghana considers timber imports as industry declines*. The Africa Report

www.theafricareport.com/WestAfrica/ghanaconsiderstimmerimportsasindustrydeclines.html

Robson, C. (2002) *Real World Research* (2nd ed). Blackwell, Oxford.

Rowell, R.M. (2005) *Handbook of wood chemistry and wood composites*. CRC Press, 2000
N.W. Corporate Blvd., Boca Raton, Florida USA.

Saunders, M., Lewis, P. & Thornhill, A. (2009) *Research Methods for Business Students* (5th
ed). Pearson Education Ltd., England.

Sutton, J. & Kpentey, B. (2012) *An Enterprise Map of Ghana*. International Growth Centre.
London Publishing Partnership. London; United Kingdom.
www.londonpublishingpartnership.co.uk

TEDB (1994) Timber Export Development Board. *The Tropical Timbers of Ghana*. Ghana
Forestry Commission. Accra, Ghana.

United Nations Population Division (2010) *World population prospects: the 2008 revision*.

<http://esa.un.org/unpp/p2k0data.asp>

Zziwa, A., Bukenya, M., Sseremba, O.E. & Kyeyune, R.K. (2006) Non-traditional tree
species used in the furniture industry in Masaka District, Central Uganda. *Uganda
Journal of Agricultural Sciences*, 12(1): 57-66.