

# The Level of Utilization of Secondary Timber Species among Furniture Producers

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## ABSTRACT

**Background and Purpose:** Inadequate supply of wood raw material is one of the major obstacles for the global furniture industry's growth. Several secondary timbers/Lesser-Utilized-Species (LUS) that could substitute the scarce traditional timbers for furniture production exist in tropical forests. However, the industry continuously faces persistent timber shortages. The extent to which manufacturers utilize LUS as alternatives is unclear, which this study sought to ascertain.

**Materials and Methods:** Data were collected from 300 Timber Firms from Ghana primarily through questionnaires using the stratified random sampling technique.

**Results:** Continuous decline and non-availability of preferred traditional timbers and competition from imported furniture were the main challenges confronting the furniture industry. Data obtained indicated that most manufacturers (85%) hardly use any LUS; 44% of these mentioned lack of information on their properties and prospective uses and 32% attributed it to non-availability on the domestic timber markets. However, 22% of these producers rely on traditionally 'well-known' timbers (e.g. mixed red wood, *Guarea cedrata* and *Tectona grandis*) owing to their strength properties, 20% due to their strength and durability and 14% because of their strength and aesthetic properties. Many LUS (with prospects for furniture-making) available in great quantities in many tropical forests could substitute the over-dependent timbers. However, information on their properties and uses are hardly available to local producers, which affects their popularity among timber suppliers and manufacturers.

**Conclusion:** To improve on the level of utilization of secondary timbers, wood workers must be supplied with comprehensive information about their properties and economic values. This will contribute to reducing pressure on the primary timbers, ensuring consistent supply of timber and keeping the sector operational.

**Keywords:** Furniture industry, joinery production, office furniture, primary timber, timber market, wood technical data

## INTRODUCTION

Production activities of the wooden furniture industries continuously get hindered by the decline in the supply of raw materials [1]. Purnomo *et al.* [2] and Zhou *et al.* [3] explained that increasing scarcity of preferred (especially the traditional/primary) timber species limits the output and growth of the timber companies globally. For instance, supply of *Hevea brasiliensis* (rubberwood), a major timber for furniture production in Malaysia, decreased from 489,378 m<sup>3</sup> in 2001 to 91,605 m<sup>3</sup> in 2008 due to overexploitation [4]. Consequently, Sarawak, a leading furniture producer contributed less than

0.5% of Malaysia's furniture export [1]. Hashim [5] reported that sustainability of Thailand's furniture industry continues to face serious risk because deforestation has reduced the country's forest cover from 53% to 28% of the total land area between 1961 and 1998. A further reduction to 24% was anticipated by 2010. Currently, wooden furniture is giving way to the metal type in Taiwan, one of the world's largest furniture producing countries, due primarily to wood raw material shortage [5]. The impacts of timber shortage on furniture industries in these countries are not different from those experienced in other parts of the world. Nutassey *et al.* [6] noted that many

companies in Accra and Kumasi have folded up because the traditional timbers for furniture are not available, while a few are very expensive to acquire.

Adupong [7] reported that about 78% of wooden furniture on the national market is imported from Asia, Italy and South Africa partly due to a reduction in the processing capacities of the local industries from timber shortage. Importation of wooden furniture increased by about 400% between 2005 and 2011 [6]. This has led to a decline in the contribution of the wood industry to the national economy. For instance, Attah [8] reported that the nation's timber industry's contribution to Gross Domestic Product (GDP) dropped from 4.1% in 2006 to 3.7% in 2010. The decline was attributed to poor performance of the industry on the export market due to operational challenges such as reduced supply of wood raw material.

Timber importation is one attempt at solving the challenge of inadequate raw material supply. In 2012, 66% of wood used for furniture production by Vietnam was imported from the USA [9]. Hansen *et al.* [10] mentioned that logging ban placed by the Chinese Government on natural forests due to shortage of domestic timber supply has resulted in a surge in the amount of timber imported into the country, which is estimated at 70% of China's total timber consumption. Similarly, Ghana imports timber from neighboring countries including Cameroon to augment the local supply [11]. However, continuous importation of wood increases the cost of operation and furniture products, which subsequently slows the growth of the local industries [12]. Hansen *et al.* [10] observed that China's continuous dependence on imported timber is a source of industry insecurity. Donovan and Nicholls [13] and Smith *et al.* [14] mentioned that the introduction of Lesser Utilized timber Species (LUS) with known properties on the market is one of the best strategies that would widen the raw material base and ensure continuous supply of timber resources for furniture production. LUS are available in great quantities in many sustainably managed tropical forests and are likely to obtain legality assurance certificate for exploitation. The cost of secondary timber species is generally low due to their abundance. For instance, while *Loxopterygium sagotii*, a popular traditional species for furniture in Guyana was sold for about \$250/Bm, *Hymenolobium flavum*, a LUS with similar properties and utilization potential as *L. sagotii* was sold for \$180/Bm. In the USA, previously underutilized species such as *Alnus rubra* Bong. are making substantial contributions to the growth of the furniture sub-sector [15]. Manufacturers in Malaysia have accepted alternatives such as *Dipterocarpus confertus* v. Sloot, *Pseudolachnostylis maprounaefolia* Pax, *Shorea* spp. and *Koompassia malaccensis* Maingay ex Benth., which have similar properties as rubberwood [4]. In Ghana, several LUS (e.g. *Klainedoxa gabonensis* Pierre ex Engl., *Celtis* spp., *Borassus aethiopicum* Mart., *Strombosia glaucescens* Engl., *Pycnanthus angolensis* (Welw.) Warb., *Canarium schweinfurthii* Engl. and *Azadirachta indica* A. Juss.) that have the potential to substitute the scarce traditional timbers for furniture production have been investigated [16-18]. However, there is still high uncertainty about the survival of the industry due largely to persistent wood shortage [19-21]. It is therefore unclear the extent to which manufacturers utilize LUS as alternatives to the dwindling primary timbers. This work sought to ascertain among manufacturers the level of utilization of LUS (including *Klainedoxa gabonensis*, which occurs widely in East and West

African countries, has great amount of biomass and superior physico-mechanical properties) for furniture production and to identify the current challenges associated with their utilization by the furniture industry and their solution so as to ensure reliable timber supply.

## MATERIALS AND METHODS

### Study Area

The study was conducted in selected 300 furniture manufacturing companies randomly sampled [from a total of 550 active companies in Accra and Kumasi (Ghana), registered with Furniture and Wood Products Association of Ghana (FAWAG)] and interviewed between October 2014 and February 2015 since most of these firms which produce furniture and joinery products are concentrated here [22]. Kumasi lies in the moist semi-deciduous forest zone (60°35' - 60°40' N, 001°30' - 001°35' W), is Ghana's largest wood product manufacturing District [23, 24] and is dominated by small to medium-scale firms which produces bedroom, office, living room and kitchen furniture. Accra is located on latitude 5°33'N and longitude 0°15'W [25] and hosts many of the large-scale furniture companies in Ghana [6]. These firms largely depend on timber markets in Kumasi and other forested areas in Ghana (e.g. Koforidua, Oda, Sunyani etc.) for raw materials [22].

### Sampling Technique

Data were collected from the FAWAG Secretariat at Kumasi about the active Furniture Production Firms in the country. These have been stratified into Small-, Medium- and Large-scale companies based on staff strength, capacity of logs processed as well as the machinery and technology employed. Large companies included those with more than 80 workers, advanced technology/machinery and efficient processing techniques with a capacity of over 20,000 m<sup>3</sup> of wood Per annum while medium-size had 60-80 workers, used simple technology involving hand tools and few automated machines with a processing capacity of 5,000–20,000 m<sup>3</sup> of wood Per annum. Small-scale furniture firms had 10 - 60 workers, used only simple hand tools and processed about 5,000 m<sup>3</sup> of wood or less Per annum. The number of companies (n) sampled from each stratum was determined by Slovin's formula [26]:

$$n = \frac{N}{1 + Ne^2}$$

where: N = total number of companies in each stratum; e = margin of error (0.05).

### Data Collection and Analysis

Data were collected from respondents through questionnaires. Personal observations were made to confirm responses to the question on the furniture products manufactured. Furniture producers provided information on the types of products they manufacture, their choice of timber species and the use of LUS in their operations. Statistical Package for Social Scientists (SPSS) and Microsoft Excel were used to analyze the data and are presented in Figures and Tables.

## RESULTS

### Size of Firm

Table 1 shows that majority of the firms in both Accra and Kumasi were small-scale (70%) while the least were large-scale (5%). More small-scale firms (56%) were observed in Kumasi than Accra (14%), while large scale-firms were greater in Accra (3%) than Kumasi (2%).

**TABLE 1.** Respondents sampled from the various categories of firms in Accra and Kumasi

Location of firm	Category of firm (%)			Total
	Small	Medium	Large	
Accra	14	12	3	29
Kumasi	56	13	2	71
Total	70	25	5	100

### Furniture Products Manufactured by Firms

Most of the firms (33%) manufactured office chairs, tables as well as bedroom furniture. Living room, dining furniture, bedroom furniture and others (e.g. garden benches and kitchen stools) were produced by about 1% of the firms. About 40% of the companies indicated that their choice of products depended only on market availability, 27% mentioned profitability and market availability, while 1% cited profitability and other reasons such as vocation.

### Choice of Markets for Sale of Furniture Products

Figure 1 shows that 93% of the manufacturing companies sold their products on the local market and 7% on the international market (UK, Germany, Italy, USA). About 92% of those who sold their products on the domestic market explained that their choice was due to their inability to meet international demand (Figure 2).

### Timber Materials Used for Furniture Production

#### Choice of Wood Species

Timber species such as mixed red wood (e.g. *Cedrella odorata* L., *Entandrophragma* spp., *Khaya* spp., *Azelia Africana* Sm. ex Pers.), *Aningeria robusta* (A.Chev.) Aubrév. & Pellegr.

(*asanfena*), *Guarea cedrata* (A. Chev.) Pellegrin. (*guarea*) and *Tectona grandis* L. f. (*teak*) were used for furniture production by majority of the manufacturers (32%) (Table 2); 22% of these firms indicated that their choice of wood species was based on the timbers' strength, 20% attributed it to strength and durability and 14% due to strength and aesthetics (Table 3).

### Utilization of LUS for Furniture Manufacturing

Only 15% of the manufacturers use LUS (e.g. *Celtis* spp., *Magnifera indica* L. and *A. indica*) for furniture production (Figure 3). The others (i.e. 85%) rely on only the primary timbers. Specifically, none of the respondents use *K. gabonensis* in their operations. For those who do not use any LUS for production, 32% attributed this to market unavailability, while 44% indicated lack of information about the properties and uses of LUS as challenges that hinder their utilization (Table 4).

### Sources of Timber Materials

Timber markets; contractors served as the major suppliers of wood for most manufacturers (26%), followed by timber markets (23%), timber markets; sawmills (21%), timber contractors (18%), sawmills (8%) and then sawmills; timber contractors (4%).

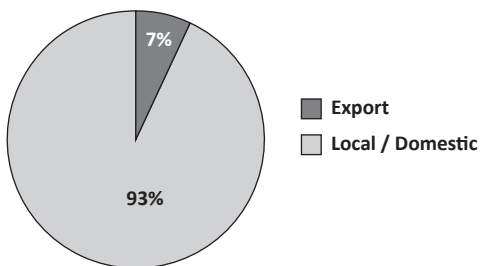
### Challenges Faced by Firms in Furniture Manufacturing

For the major challenges faced by the companies, 31% mentioned non-availability of preferred wood, while 19% stated non-availability of preferred wood and competition from imported furniture (Table 5).

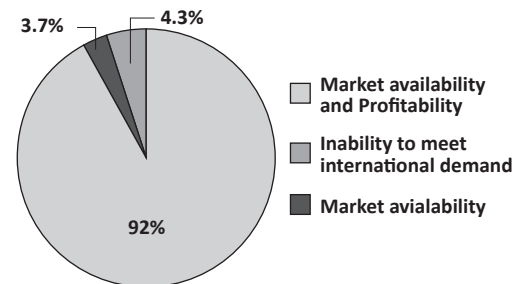
## DISCUSSION

### Size of Firms

The Ghanaian wooden furniture industry is steadily declining in performance, productivity and profits due to lack of raw materials, skilled labour, competition brought about by trade liberalization and high operational costs [27]. These challenges are more pronounced among the large scale companies [28]. According to Söderbom *et al.* [29], many Ghanaian large-scale firms have shut down due to increasing costs of operations. A few of those remaining have reduced their production capacities drastically due to raw material shortage. It was therefore not surprising to find more small- (70%) and medium-scale (25%) furniture firms than the large



**FIGURE 1.** Choice of market for the sale of furniture products by the manufacturing firms



**FIGURE 2.** Reasons for manufacturers' choice of market for furniture products

**TABLE 2.** Timber species used by firms for furniture production

Timber species	Respondents/Firms (%)
Mixed red wood; <i>A. robusta</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	32
<i>G. cedrata</i> ; <i>T. grandis</i>	11
Mixed red wood; <i>A. robusta</i> ; <i>Milicia excelsa</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	9
<i>Piptadeniastrum africanum</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	5
Mixed red wood; <i>A. robusta</i> ; <i>M. excelsa</i>	5
Mixed red wood; <i>A. robusta</i> ; <i>D. ogea</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	4
Mixed red wood; <i>A. robusta</i> ; <i>Mansonia altissima</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	3
<i>A. robusta</i> ; <i>G. cedrata</i> ; <i>T. Grandis</i>	2
Mixed red wood; <i>A. robusta</i>	2
<i>M. excelsa</i> ; <i>P. africanum</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	2
<i>M. altissima</i> ; <i>D. ogea</i> ; <i>G. cedrata</i> ; <i>T. Grandis</i>	2
<i>M. excelsa</i> ; <i>Celtis</i> spp.; <i>P. africanum</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. excelsa</i> ; <i>M. altissima</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>Celtis</i> spp.; <i>P. africanum</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. excelsa</i> ; <i>Celtis</i> spp.; <i>G. cedrata</i> ; <i>T. grandis</i>	1
<i>A. robusta</i> ; <i>M. excelsa</i> ; <i>P. africanum</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. excelsa</i> ; <i>Celtis</i> spp.; <i>P. africanum</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>D. ogea</i> ; <i>P. africanum</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>M. excelsa</i> ; <i>P. africanum</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. altissima</i> ; <i>D. ogea</i>	1
<i>A. robusta</i> ; <i>P. africanum</i> ; <i>G. cedrata</i> ; <i>T. Grandis</i>	1
<i>A. robusta</i> ; <i>M. excelsa</i> ; <i>D. ogea</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. excelsa</i> ; <i>D. ogea</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>P. africanum</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. excelsa</i> ; <i>P. africanum</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. altissima</i> ; <i>D. ogea</i> ; <i>G. cedrata</i> ; <i>T. Grandis</i>	1
<i>Celtis</i> spp.; <i>P. africanum</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. excelsa</i> ; <i>D. ogea</i> ; <i>P. africanum</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. excelsa</i> ; <i>P. africanum</i> ,	1
<i>A. robusta</i> ; <i>M. excelsa</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
<i>M. excelsa</i> ; <i>M. altissima</i> ; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>M. excelsa</i> ; <i>D. ogea</i>	1
Mixed red wood; <i>A. robusta</i> ; <i>D. ogea</i> ; <i>P. africanum</i>	1
Mixed red wood; <i>M. excelsa</i> ; <i>Celtis</i> spp.; <i>G. cedrata</i> ; <i>T. grandis</i>	1
Total	100

type (5%). Small- and Medium-scale Enterprises (SMEs) are recognized as catalysts for sustainable development of many countries [30, 31]. They provide about 50% of all jobs in Nigeria [32] and make up about 70% of all industrial establishments and 90% of all businesses in Ghana. According to Oppong et

al. [33], Ghanaian SMEs employ 60% of the labour force, contribute about 22% to the GDP and support the development of indigenous entrepreneurship. Ranabijoy [34] observed that a major bottleneck to the survival of small-, medium- and large-scale industries in the forestry sub-sector is the limited supply

of timber materials. Policies aimed at boosting innovation and increasing the availability of raw materials would promote the competitiveness and growth of these firms [35]. Zziwa *et al.* [36] explained that in order to increase the raw material base for furniture product manufacturing, an increase in the use of LUS to supplement the supply of primary timbers need encouraged. This, according to Ssseremba *et al.* [37], would preserve firms, keep the sector operational and prevent job losses.

**TABLE 3.** Reasons for choice of timber used for furniture manufacturing

Reasons	Respondents /Firms (%)
Strength	22
Strength; durability	20
Strength; aesthetics	14
Durability	8
Strength; aesthetics; consumers' choice	6
Strength; consumers' choice	6
Strength; durability; aesthetics	6
Consumers' choice	3
Durability; consumers' choice	3
Strength; durability; consumers' choice	2
Strength; durability; others (good carving properties)	1
Durability; consumers' choice; others (good carving properties)	1
Strength; consumers' choice; others(good carving properties)	1
Durability; others (good carving properties)	1
Strength; durability; consumers' choice; others (good carving properties)	1
Strength; aesthetics; others (good carving properties)	1
Strength; others (good carving properties)	2
Strength; durability; aesthetics; consumers' choice	1
Durability; aesthetics; other (good carving properties)	1
Total	100

### Furniture Products Manufactured by Firms

The study revealed that most of the manufacturers (33%) engaged in the production of office chairs, tables as well as bedroom furniture. Centre for Industrial Studies [38] observed a faster growth in the office trade on the European market. Ponder [39] explained that the emergence of new businesses and expansion of existing ones have led to the growth in trade of office chairs and tables. Ha [40] and Kazemifar and Khodadadeh [41] also noted that every individual spends about a third of their lives in bed for relaxation and privacy. As a result, most families rank bedroom furniture as the most important product to be purchased for the home. Consequently, Drayse [42] and Kingsway Furniture Co. Ltd. [43] observed that office and bedroom furniture were the main commodities traded on

**TABLE 4.** Reasons for low level of utilization of LUS among furniture manufacturers

Reasons	Respondents/Firms (%)
LUS unknown; lack of technical data on the properties and uses of LUS	44
Unavailability of LUS on the market	32
Unavailability of LUS on the market; lack of technical data on the properties and uses of LUS	8
LUS unknown; unavailability of LUS on the market	5
LUS unknown	5
Lack of technical data on the properties and uses of LUS	4
LUS unknown; unavailability of LUS on the market; lack of technical data on the properties and uses of LUS	1
None of the options	1
Total	100

**TABLE 5.** Challenges faced by firms in furniture manufacturing

Challenges facing firms	Respondents/Firms (%)
Non-availability of preferred wood	31
Non-availability of preferred wood; frequent power outage	31
Non-availability of preferred wood; competition from imported furniture	19
Non-availability of preferred wood; high cost of operation	8
Competition from imported furniture	4
Competition from imported furniture; frequent power outage	3
Non-availability of preferred wood; competition from imported furniture; frequent power outage	2
Frequent power outage	2
Total	100

the global furniture market. Flow control magazine [44] noted that the household and office furniture sectors accounted for about two-thirds of the furniture sector's revenue in USA over the last decade. The high availability of market for office chairs, tables and bedroom furniture could explain the frequency of their production among manufacturers. The high rate of production also implies that large amount of wood would be needed by the office and bedroom furniture manufacturers.

### Choice of Markets for Sale of Furniture Products

Most of the firms (93%) sold their products on the domestic market; 92% of them attributed this to inability to meet international demand. According to Oppong *et al.* [33], inadequate financial resources, lack of export marketing strategies and inability to meet international demands/standards are responsible for the reliance of the furniture

industry on the local market for sale of products. Ward and Gilbert [45] explained that firms choose to sell their products on the local market because export marketing requires more time, greater financial resources and greater ability to withstand far wider and more intense competition. As a result, about 73% of middle-market firms in North America currently sell their products on the domestic market [46]. However, Julian [47] observed that the international market helps local industries to grow fast, improve their innovation, credibility and competitiveness by enhancing their operating capabilities. Biggs [48] mentioned that due to the relatively small size of domestic markets, firms looking to expand their businesses must take advantage of the export markets. Thus, the growth of the Ghanaian furniture sector could be enhanced when more firms are supported to produce furniture in quantities that meet international demand. However, this will partly be dependent on continuous supply of timber resources [49]. With decreasing quantities of popular timbers for furniture, producers could rely on secondary timber species to augment supply and promote the competitiveness of the sector.

### Timber Materials Used for Furniture Production Choice of Wood Species

Timber is the single most important raw material in the furniture industry [50]. Adebara *et al.* [49] noted that certain products require specific timber species. Therefore, Ayarkwa [51] asserted that timber users in Ghana are very selective in their choice of wood, such that furniture products are usually made from a small number of preferred timbers. It was observed from this study that mixed red wood (e.g. *Cedrella odorata*, *Entandrophragma* spp., *Khaya* spp., *Afzelia africana*), *A. robusta*, *G. cedrata* and *T. grandis* were the timber species used by majority of the manufacturers (32%) due to their strength, durability and aesthetics. In a study to determine the factors influencing the choice of timber for furniture and joinery production in Ghana, Dadzie *et al.* [52] and Boamong *et al.* [50] similarly found that among a list of 22 wood species, only few including mixed red wood, *G. cedrata* and *T. grandis* were mostly patronized by furniture manufacturers. Trevallion and Strazzari [53], Zziwa *et al.* [36], Louppe [54], Binggeli [55], Derkyi *et al.* [56], Govorčin *et al.* [57] and Chernyh *et al.* [58] confirmed that factors such as strength, cost, durability, beauty and availability influenced the choice of timber for furniture. This accounts for the high patronage of mixed red wood, *A. robusta*, *G. cedrata* and *T. grandis* among manufacturers. Consumers preferred to spend more money to purchase products made from strong and durable timbers that would reduce maintenance and replacement cost [50]. Tropical timber species with great strength and good aesthetic properties such as *Khaya anthoteca*, *Pericopsis elata*, *Simarouba versicolor* and *E. cylindricum* are therefore common on the Italian furniture market [59]. Thus, in seeking alternatives for the over-dependent primary timbers, secondary timber species that are strong, durable and aesthetically good could gain acceptance by furniture manufacturers. For instance, *K. gabonensis* is a naturally durable and strong timber with attractive grain pattern; it is abundant in most tropical forests and has prospects for furniture-making [60]. However, it has no information in trade statistics. Based on its characteristics, it could contribute to satisfying the raw material needs of the furniture industry.

### Utilization of LUS for Furniture Manufacturing

Acaqh and Whyte [61] explained that the volume of high-valued commercial timbers used for furniture production has reduced drastically over the years. The remaining amount of wood in the forests faces stiff competition from all the other wood-related sectors. Oteng-Amoako *et al.* [60] found that LUS could serve as substitutes to and reduce the pressure on these commercial timbers. Boamong *et al.* [50] noted that several LUS whose properties make them suitable for furniture are in large quantities in the tropical forests. However, this study showed that only 15% of manufacturers use LUS such as *Celtis* spp., *M. indica* and *A. indica* for furniture production. Sseremba *et al.* [37] found *M. indica* among several other secondary timbers used for furniture-making in Uganda. It was further observed that none of the respondents had ever used *K. gabonensis* in their operations. Manufacturers indicated unavailability of secondary timbers on the market and lack of information regarding their properties and uses as some of the hindrances to their utilization. Smith [62] found that utilization of timber by wood product manufacturers depends on accessibility on the market and availability of comprehensive technical data on its properties. Similarly, Ayarkwa [51] and Effah and Osei [63] mentioned that dissemination of research results among wood workers about new timber species that could serve the same purpose as their already utilized counterparts would enhance their utilization. Sseremba *et al.* [37] explained that accessibility of data regarding the characteristics and uses of LUS such as *M. indica* and *Artocarpus heterophyllus* improved their acceptance and utilization by Ugandan furniture manufacturers. It could be understood from the results that the level of utilization of LUS, the likely alternatives for furniture-making, is low among manufacturers because information on their characteristics and uses are not readily available. To increase the utilization of secondary timber species for wood products, adequate information about their abundance, properties and uses must be made available to manufacturers [64].

### Sources of Timber Materials for Furniture Production

Raw materials supplied to furniture manufacturers are obtained through a network of buyers who purchase timber from both private and public forest landowners [65]. About 26% of the respondents sourced wood from timber markets and contractors (loggers). Nketiah and Wieman [66] and Marfo [67] explained that wood procured from these two sources are comparatively cheaper than those sold by sawmills. Therefore, many furniture manufacturing firms prefer to buy lumber from the former [50]. Since firms do not use secondary timber species due to market unavailability, it could be stated that timber contractors and operators do not supply LUS to furniture manufacturers. Boyes and Melvin [68] mentioned that the level of supply of raw materials for any production process depends on demand for those materials by producers. In Northern India, although many secondary timber species that could be used for housing construction existed in great numbers in the forests, timber providers did not risk bringing them on the market due to their low demand among users [69]. Therefore, the failure by timber contractors and operators to supply LUS on the market may be due to low demand for the species. Venn and Whittaker [70] also mentioned that most timber sellers are unaware of the properties and the prospective uses of a lot of the LUS in the forests as well as profits that might be obtained from their



sales. This leads to total neglect of the non-traditional timbers in the timber trade. Providers of timber for furniture production do not make available LUS to manufacturers due likely to a lack of understanding of their quality and profitability [71]. Thus, in encouraging the use of secondary timbers for furniture and other wooden products, information on the characteristics, uses and profitability of LUS should also be made available to wood suppliers.

### Challenges Faced by Furniture Manufacturers

According to Center for Industrial Studies (CSIL) [72], about US\$376 billion was obtained on the global market from the production of furniture in 2010. Ngui *et al.* [73] explained that furniture has greater monetary value than other wood-based products such that furniture manufacturing is an ideal option for countries that seek to earn more from the timber-processing industry. Nonetheless, furniture industries face serious challenges that have led to the collapse of many [6]. Nutassey *et al.* [6] explained that the number of industries in Ghana's tertiary wood sub-sector declined by over 60% between 1990 and 1999. Norini *et al.* [74] estimated that only 26% of the total furniture firms in Sarawak State in Malaysia remained active as of 2009 due to myriad of problems such as decline in quantities of raw materials and rising costs of operations.

Respondents mentioned that non-availability of preferred wood raw material and competitions from imported furniture (due partly to poor design and quality of the domestic types) were among the challenges confronting the furniture industry. Similarly, Adupong [7] observed in a survey commissioned by Wood Workers Association of Ghana-Western Region (WWAG-WR) that decreasing quantities of primary timbers hindered the activities of furniture-making firms. Respondents from that survey explained that the volumes of timbers had declined drastically over the years. The few amounts remaining were difficult and expensive to acquire partly because sawmills that had large forest concessions were export-oriented and did not provide for the local market. Local manufacturers were therefore unable to meet customers' increasing demand for furniture and have resorted to their importation to supplement local production [75, 76]. This situation has led to stunted growth of the local industry, while rendering many manufacturers jobless [77]. The challenges associated with the drastic decline in timber supply could be

reduced by encouraging the use of secondary timber species to widen the raw material base for the sector [75]. However, the present study has shown that manufacturers hardly use LUS primarily due to market unavailability and lack of technical information about them. Thus, to increase the use of secondary timber resources by the wood industry, wood suppliers, product manufacturers and end users must be fed with reliable and sufficiently detailed information about the characteristics and uses of the large amount of neglected timber species in the forests. This will help meet the raw material requirement of the industry, while reducing pressure on the current commercial timber species.

### CONCLUSION

Wood strength, durability and aesthetics were the major factors for the selection of timber for furniture-making due to reduced future maintenance and replacement cost of products. Thus, with decreasing quantities of the conventional timbers, many of the secondary timbers with comparable strength, beauty and durability (e.g. *K. gabonensis*) could substitute the traditional timbers to ensure regular wood supply. However, most manufacturers rely on only the well-known timbers (e.g. mixed red wood, *G. cedrata* and teak) and hardly use the secondary timber species due to market unavailability and lack of information about their characteristics and uses. This has led to pressure on the demand for and exploitation of few primary timbers. Thus, the furniture industry's ability to meet future demand for wood products is unsustainable, which requires adequate efforts for the promotion and utilization of the secondary timbers (or LUS). To increase the level of utilization of the secondary timber species to ensure consistent wood supply for the furniture industry, adequate information about their abundance, properties and uses must be made available to wood workers.

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