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Utilization of Lesser-Used Timber Species in Clustered Furniture Industries of Ethiopia

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ABSTRACT

Demand for all forest products has been increasing in Ethiopia, due to population, economic growth, and the rise in the construction sector. In the past, about 85% of this demand has been covered by indigenous timber species which are now endangered and protected from harvest. As an alternative, there are potential lesser-used timber species in the country that can be utilized to narrow down the gap between supply and demand. This study aims to describe the utilization practices of timber species and identify factors affecting the utilization of lesser-used timber species in furniture industries. The study was conducted in four (4) purposively selected towns based on their Wood business transaction and resource availability. Both quantitative and qualitative data were collected using semi-structured questionnaires. A binary logit model was employed to estimate factors influencing the utilization of lesser-used timber species for industrial application. The results show that the majority of wood furniture industries still depend on pit sawed valuable indigenous timber species of the country. The result indicated that *Cordia africana* is the main type of timber species preferred to be utilized in the majority of furniture industries. It also indicated that there is a negative perception towards lesser-used timber species, less access to appropriate information, and skill training on wood processing. Therefore, the study implicates the need to intervene in changing perceptions toward these species and build the technical capacity of the wood industries through skill training.

INTRODUCTION

In Ethiopia, given the accelerated economic growth, urbanization, and increasing population the demand for all wood products has been increasing and highly exceeding the supply (Lemenih, M., and Kassa, H., 2014; Gemechu, K., & Getachew, D., 2020). According to MEFCC (2017), Ethiopia consumed roughly 124 million cubic meters of wood and wood products in 2013, and this increased by about 27% and will reach an annual consumption of 158 million cubic meters by 2033. So, the forestry sector must supply this increasing demand with higher quality domestic wood and wood products to meet the requirements of the construction sector and furniture industries (Adebara et al, 2014). In Ethiopia, about 85% of the wood demand has been covered by limited commercially important indigenous timber species such as *Juniperus procera, Hagenia abyssinica, Cordia afrcana, Podocarpus falcatus, Olea europaea,* and *Pouteria adolfi-friedericii*. Nowadays these species were becoming endangered and they were gazetted not to be harvested from the forests of the country (Gemechu, K., et al., 2018).

On the other hand, Ethiopia possesses one of the largest and most diverse plants genetic and wildlife resources in the world (Asefa, M., et al, 2020). The country has over 300 tree species of which a few are found on the market and used for construction and industrial purpose (EFCC, 2020). Even though most of these species have the potential to substitute the scarce and valuable timber species of the country they are less known and considered less utilized timber species for

furniture and structural purposes (Gemechu, K., et al., 2018). Therefore, many furniture industries continue to highly depend on limited indigenous timber species and imported woods (Getachew, D., et al., 2020). To solve this problem, the major timber characteristics and utilization methods of lesser-known timber species have been studied at Forest Products Innovation Research and Training Center.

Even though the potential of these species as lumber and suitability for furniture making and construction have been investigated, they are not been yet well promoted and utilized in furniture and construction industries (Getachew, D., et al., 2012). Boampong, E., et al., (2015) mentioned that the promotion of Lesser Utilized timber Species (LUS) on the market is one of the best approaches that would improve the level of utilization of these species and ensure a continuous supply of timber resources for furniture production. Improving the utilization of these species will also decrease pressure on the limited indigenous timber species and import lumber against hard currency (Gemechu, K., et al., 2018).

Therefore, this study aims to determine the level of utilization of lesser-known timber species for furniture production and identify the current challenges associated with their utilization by the furniture industry and their solution to ensure reliable timber supply.

MATERIALS AND METHODS

Study Area

The study was conducted in four major selected towns of Ethiopia namely Addis Ababa, Hawassa, Jima, and Bahir Dar. The towns were purposively selected based on their level of business activity, the abundance of the timber trade, and furniture workshops around the area. For instance, according to a report from CSA Addis Ababa alone accounts for 21% of furniture factories found in the entire country.

Sampling Technique and Size

The study employed furniture industries divided into groups, or clusters, in selected towns, using the cluster sampling method. The population of the study in each town was estimated with the consultation of the Sub-city administration in each city. The number of the clustered industries determined in each town by the Yemane formula at the 8% precession level (Yamane, 1967):

$$n = \frac{N}{1+N(e)^2}$$

Where:

N = total number of companies in each stratum;

e = margin of error (0.08).

After determining the number of clustered industries in each town all observations in the selected clusters are included in the sample. Accordingly, 197 furniture industries are determined and included in the study.

Data Collection

Data were collected from wood industries through questionnaires and Personal observations. Semi-structured questionnaires were used, for collecting both quantitative and qualitative data from selected wood furniture factories. During data collection managers or owners, technical managers, or technical employees are requested to answer the questionnaires. The survey covers the type and volume of annual wood used, types of their end products, sources of the wood, challenges in terms of wood resource supply, how they are intending to use less known wood species as a solution, the products they produce from less utilized timber species, demand of material produced from LUS and the annual processing capacity of each firm, problems encountered during wood processing, factors affecting the utilization of lesser-known timber species for different industrial applications, the information gaps exist regarding the species, and the like were gathered.

Data Analysis

The collected data are coded, categorized, encoded into a computer separately, and managed before being analyzed. SPSS and Stata Software are used to analyze the encoded data. Descriptive statistics like summation, average, percentage, and other tests of significance are calculated. Qualitative data obtained from different categories of the respondents are also summarized. Results are presented in the form of texts, tables, and charts.

In this study, the binary logistic model was employed to identify the most hypothesized explanatory variables which influence the utilization of LUS. In this case, the model was employed to see the relative influence of different variables related to industry characteristics, well-known timber availability and utilization, access to

the market, skill training, and information on LUS utilization and its intensity for furniture production. Before running the model, all the hypothesized explanatory variables were checked for the existence of multicollinearity problems. The existence of multicollinearity was checked using contingency coefficients as all variables are categorical/dummy variables. The contingency coefficient result indicates that the data have no serious problem of multicollinearity.

RESULTS AND DISCUSSION

Industries Timber supply

The survey results indicated that the main source of timber supply for most of the small-scale wood industries in Ethiopia is pit sawed lumber mainly from the natural forests. Few industries have access to timber from their sawmills and some from other sawmills through brokers. Except for Hawassa town, most of the industry respondents (57.4%) express the supply source of timber is not reliable to their current wood demand. This is because currently it is very difficult to access timber from the forest and the market easily. This result is similar to the report by Getahun, Z., et al., (2014) that the indigenous timber species of Ethiopia are indiscriminately and increasingly exploited, and what is remaining is found mostly in unusable sizes and inaccessible areas. Due to this harvesting and transporting of these endangered valuable timber species are now banned by the government of Ethiopia.

64.5% of the industries in all surveyed towns indicated that there is a lumber shortage in the timber market. Most of the respondents (87.8%) in the industries claim that the demand for lumber in the market is increasing in the last five years. This is due to the construction boom all over the major towns in the country, the limitation of sawmillers, deforestation, technological, and legal issues. Except for Bahir Dar town, the majority of the industries in other towns responded that the lumber in the market is not fulfilling the need for their furniture manufacturing.

Timber Utilization practices in wood industries

The result shows that industries utilize both indigenous and exotic timber species. *Cordia africana* (Wanza), Imported Pines (locally called Australian lumber), *Juniperus procera*, and *Cupressus lusitanica* (locally known as Shashemene) are the top four species utilized in furniture industries. From the survey result, it is revealed that *Cordia africana* is the main type of timber species (86.3%) preferred to be utilized in furniture industries (Table-1). This indicated that most of the industries (92.9%) are still using or depend upon well-known valuable timber species for their furniture production across all the towns. The respondents in the furniture industries indicated that their preference for this species for furniture making is due to its high quality, good texture, strength, durability, and customer preferences. This resulted in the over-exploitation of this species and other valuable timber species from the natural forest of the country. Other species such as *Grevillea robusta*, *Croton macrostachyus* in rare cases different *Eucalyptus* lumber are among the major types of species found in furniture industries for possible utilization. Some high-value timber species such as *Hagenia abyssinica* and*Olea europaea* which had been commonly used in the past were limited and not used commonly at present in furniture industries (Table 1). From the survey result, it was seen that 41.5% of the lumber utilization in furniture industries is mainly in solid form.

Table 1. Types of timber species utilized in different firms

Scientific name	Local name	Respondents/ Firms	Percentage (%)
Cupressuslusitanica	Yeferenjthid	63	32.0
Different imported Pines	Australian lumber	72	36.5
Podocarpus falcatus	Zigba	36	18.3
Cordia africana	Wanza	170	86.3
Ekebergia capensis	Sombo	3	1.5
Grevillea robusta	Gravilia	39	19.8
Hagenia abyssinica	Koso	6	3.0
Olea europaea	Woira	5	2.5

Juniperus procera	Yeabeshathid	71	36.0
Croton macrostachyus, Eucalyptus spp., *Trichiladergena* and others	Bisana, Bahirzaf, Luya	81	41.1
Total		**197**	**100**

Source: Own survey (2021)

Alternate uses of Less Utilized timber Species (LUS)

Most of the respondents (75%) in furniture industries are aware of other alternative species for furniture production (Table 2). The majority of industries (58%) argue that alternative timber species are available on the market at their locality. However, the survey result shows that majority of the industries (56%) are not yet using these species as alternative timber species. But the majority of the respondents of the industries in all towns have the plan to use these species in the future.

Table 2. Information on less-utilized timber species

No.	About lesser-used timber species	Respondents reply			
		Yes	Percentage (%)	No	Percentage (%)
1	Awareness about LUS	148	75	49	25
2	Availability of LUS on the market	114	58	83	42
3	Information about properties of LUS	76	39	121	61
4	Usage of LUS	87	44	110	56
5	Interest to use LUS	138	70	59	30
6	Perception towards LUS	97	49	100	51
7	Training on wood utilization	73	37	124	63

Source: Own survey (2021)

Most of the respondents in the surveyed industries (61%) do not get enough information regarding the wood property of less used timber species (LUS). Similarly, most of the industries (63%) do not have access to training in lumber processing which could support improving their skill in furniture production (Table 2). But few industries in Addis Ababa and Bahir Dar, have access to training on wood furniture processing. The result shows that on average about half (51%) of the respondents in the surveyed towns have a negative perception of lesser used timber species (LUS) for furniture production. Exceptionally majority of respondents in Jima town (82.4%) have a positive perception towards lesser used timber species for their furniture production. However, the majority of the industry respondents have a negative perception; the majority (62.9%) of them likes to buy furniture made from less-utilized species if they were a consumer.

To validate the result of the expectation index, further probing was done to assess the perception of the quality of lesser-used timber species in comparison with well-known timber species. The respondents ranked lesser used timber species as Fair, Good, Bad, and Very good respectively in comparison with well-known timber species. This rank is based on its texture, properties, density, and workability.

Table 3. Comparison of lesser used timber species with well-known timber species (WKT)

No.	Observations of LUS in comparison with WKTS	Respondents	Percentage (%)
1	Very good	42	21.3
2	Good	51	25.9
3	Fair	53	27
4	Bad	45	22.8
5	I don't know	6	3
	Total	197	100

Source: Own survey (2021)

Utilization of Imported Lumber

Most of the industries (76.7%) utilize imported lumber for furniture production due to limitations in the supply and quality of locally produced timber species. This is in line with the report of the International tropical timber organization (ITTO, 2016) that Ethiopia is the largest East African importer of wood products. The survey result indicated that the utilization of imported lumber is high in Bahir Dar, Addis Ababa, and Hawassa respectively but few industries utilize imported lumber from Jima town. This might be due to the availability of other alternative timber species with better properties around Jima town. During the survey, it was observed that *Trichiladergena*, *Ekebergia capensis*, *Croton macrostachyus*, etc were being utilized. The majority of respondents (59.6%) in the industries who utilize imported lumber perceive that the quality of the lumber is high in comparison with locally produced lumber.

Determinants of LUS Timber Utilization in the Industries

Different factors enlisted and measured, are expected to influence the Utilization of LUS. These are partly related to industry characteristics such as Industry experience, technical know-how, adequate machine, capital, the market for end products, skill training, information, availability of LUS timber resources, availability and utilization of well-known timber species, and perception of LUS utilization. According to the survey results, the availability and utilization of well-known timber species, availability of LUS on the market, information about LUS, perception towards LUS, and access to skill training have shown significant associations with the utilization of lesser used timber species.

The chi^2 result shows that The Availability of well-known timber species on the market is significantly associated with the utilization of LUS at less than one percent probability level. The availability of LUS on the market is expected to affect the utilization of the species. The chi^2 result shows that it significantly affects at a one percent probability level. Access to skill training is another variable regarding wood processing that is expected to affect the utilization of LUS. This could improve the skill of furniture workers to use any alternative timber species, which is locally available and accessible by the industry. Hence, the chi^2 result shows that access to skill training regarding timber processing has a significant relation with the utilization of LUS at a one percent probability level. Access to appropriate information about the property of LUS could improve the utilization of LUS timber species.

The chi^2 result shows that access to information has an association with utilization of LUS at less than a five percent probability level. This result is consistent with the finding of Gemechu, K., et al., (2018) who found that information properties, availability, and suitability for furniture production on less utilized timber species affect furniture producers to utilize these species. The final variable expected to have an association with the utilization of LUS is the perception of the species. It is expected that negative perception towards LUS could affect species utilization as the common reputation is that LUS has no quality for furniture purposes. The chi^2 result shows that perception towards LUS with its utilization is significant at less than one percent probability level. The summary results of variables expected to influence utilization of LUS presented below in Table 4.

Table 4. Summary results of variables expected to influence utilization of LUS

Variables		Industry category				Total		Chi2
		Non-users		Users				
		F	%	F	%	F	%	
Experience	1-5 yrs.	50	57.47	60	54.55	110	55.84	
	6-10 yrs.	21	24.14	26	23.64	47	23.86	
	> 10 yrs.	16	18.39	24	21.82	40	20.30	0.3606
Technical know-how	Yes	31	35.63	43	39.09	74	37.56	
	No	56	64.37	67	60.91	123	62.44	0.2478
Adequate Machine	Yes	43	49.43	65	59.09	108	54.82	
	No	44	50.57	45	40.91	89	45.18	1.8324

Access to Market	Yes	54	62.07	71	64.55	125	63.45	
	No	33	37.93	39	35.45	72	36.55	0.1285
Adequate Capital	Yes	58	66.67	77	70.00	135	68.53	
	No	29	33.33	33	30.00	62	31.47	0.2503
Access to Training	Yes	23	26.44	50	45.45	73	37.06	
	No	64	73.56	60	54.55	124	62.94	7.5327***
Access to Information	Yes	26	29.89	50	45.45	76	38.58	
	No	61	70.11	60	54.55	121	61.42	4.9697**
Perception towards LUS	Positive	24	27.59	73	66.36	97	49.24	
	Negative	63	72.41	37	33.64	100	50.76	29.2257***
Availability and utilization of WKTS	Yes	76	87.36	107	97.27	183	92.89	
	No	11	12.64	3	2.73	14	7.11	7.2362***
Availability of LUS	Yes	27	31.03	87	79.09	114	57.87	
	No	60	68.97	23	20.91	83	42.13	46.0149***

*** and ** is less or equal to 1% and 5% probability level, respectively

Results of Binary Logistic Regression Model

Using lesser-used timber species as a dependent variable, whereby a value '1' is assigned to users of the LUS group and '0', otherwise. Using ten explanatory variables for utilization of LUS, the maximum likelihood estimation procedure employed to estimate the model. The parameter estimates and the effects of independent variables on the probability of utilization of LUS are analyzed and presented. The measurement of the goodness of fit of the model shows that the model fits the data well. According to the rule of thumb pseudo R^2 ranging from 0.2 to 0.4 indicates an excellent model fit. The Pseudo R^2 (0.2909) shows that in accepted range of data fitness to the model. The value of the Pearson Chi-square test (0.4031) shows that the overall goodness of fit of the model exceeds rejected probability level.

The logit model results were used to study factors influencing the utilization of LUS in the industries. The results of the Logistic regression model estimate indicate that out of the 10 explanatory variables included, four variables namely; access to skill training, perception towards LUS, availability of LUS on the market, and utilization of well-known timber species are found to have a significant influence on the probability of utilization of LUS in the industries. As the model results show, the remaining six explanatory variables have no significant influence on the probability of utilization of LUS in the industries. The significant explanatory variables, which have effects on the utilization of LUS in the industries are discussed below (Table 5).

Table 5. Factors influencing utilization of LUS in the Industries

Variables	**Coefficient**	**Standard error**	**Marginal effect**	**Z-value**	**P-value**	**95% Conf. Interval**
Constant	9.788	1.877	-	5.21	0	6.109-13.468
Adequate machine	0.474	0.420	0.116	1.130	0.259	-.349-1.298
Accesstoskilltraining	0.839	0.406	0.205	2.060	0.039	.043-1.635
Accesstoinformation	0.344	0.382	0.084	0.900	0.367	-.405-1.094
Availability on the market	2.107	0.375	0.514	5.620	0.000	1.372-2.842
Accesstomarket	0.029	0.436	0.007	0.070	0.947	-0.826-0.884
Technical knowhow	0.302	0.391	0.074	0.770	0.440	-.465-1.069
Perception towards LUS	-1.299	0.376	-0.317	-3.460	0.001	-2.035- 0.563
Utilization WKT species	-1.412	0.813	-0.345	-1.740	0.083	-3.001- 0.182
Adequate capital	0.087	0.497	0.021	0.180	0.861	-.888-1.062
Experience	0.012	0.233	0.003	0.050	0.961	-.446-0.469

Log-likelihood = -95.871 LR chi2(10) = 78.67
Prob > chi2 = 0.000 Pseudo R2 = 0.291
***, **, *= significant at <1%, <5% &<10% probability level respectively

Access to skill training: The model result shows that access to skill training in lumber processing is positively related to the utilization of LUS at less than a five percent probability level. The possible reason for this is as industries' access to the training will improve lumber processing of alternative timber species. Thus, the marginal effect results show that as furniture producers have access to skill training the probability of utilization of LUS increases by 20.5% more than those who do not have access to skill training, keeping other factors constant (Table 5).

Perception towards LUS: As expected, perception is negatively related to the utilization of LUS for furniture industries. The coefficient of this variable is negatively related to the utilization of LUS for furniture production at less than one percent probability level. The logit model showed that a furniture producer who perceived less utilized timber species are good for furniture production is more likely to use less utilized timber species than a furniture producer who does not perceive less utilized timber species good for furniture. Hence, the result further shows as furniture producers negatively perceive LUS, the probability of LUS utilization for furniture production decreases by 31.7% compared to those who have a positive perception of LUS, holding other factors constant (Table 5).

Availability of LUS on the market: The availability of lesser used timber species on the local market helps the industries to access and utilize these species for furniture production. The result of the logit model showed that the availability of less utilized timber species has a positive and significant influence at less than 1% significance level on the use of fewer timber species for furniture production. According to the result, As the availability of LUS on the market for furniture production, the probability of the utilization of LUS for furniture production increases by 51.4%, keeping other factors constant (Table 5).

The findings of this study agree with the previous studies conducted in different countries which had a positive and significant effect on the use of less utilized timber species available in the market as a predictor variable for to use of less utilized timber species for furniture production (Ewudzie et al., 2018). The failure of timber operators to supply LUS on the market due to market unavailability affect furniture manufacturers using LUS as a raw material (Antwi-Boasiako and Boadu, 2016).

Availability and utilization of well-known timber species: The result of the logit model shows that the availability and utilization of well-known timber species are negatively related to the utilization of LUS at less than a ten percent probability level. It is understood that different types of well-known valuable timber species are commonly preferred and used for various furniture production in furniture industries.

With the availability and utilization of well-known timber species for furniture production, the probability of utilization of LUS for furniture production decreases by 34.5%, holding other factors constant (Table 5). This implies that furniture producers who use well-known timber species are less likely to use less utilized timber species than furniture producers who use less well-known timber species.

CONCLUSION

The study has revealed that most manufacturers still depend upon limited valuable well-known timber species. The results indicated that the widely used timber specie in the furniture industry is Cordia *africana*. The Majority of respondents said that they prefer well-known timber species to that lesser-known or LU timber species. This is due to a lack of adequate machines, lack of market for their end products, and unavailability of the LUS on the market. Lack of adequate information on their property and negative perception towards the species for furniture making. This has led to overexploitation of valuable well-known timber species and dependence on imported timber species.

It is therefore recommended that; adequate effort is needed to promote the best alternative timber species and the way of their utilization in furniture industries. People should utilize products made with lesser-used timber species as an alternative to the well-known timber (WKT) species

to save our forest. Furthermore, it should be alerted that products made with lesser-known species will not be seen as inferior (low-grade). Most LUS are hardwood species and they may also require special tools and machines to work with, therefore these tools should be made available for the better processing of lesser used timber species.

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