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Determinants For Industrial Uses Of Highland Bamboo In Selected Cities In Ethiopia

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Abstract: Bamboo is an alternative construction material to substitute the declining supply of wood raw material in the construction sector and this study aimed to identify determinants for industrial uses of highland bamboo. The study was done in Injibara town and Addis Ababa city in Ethiopia; a snowballing sampling technique was used and both quantitative and qualitative data were collected from primary and secondary sources. Econometrics analysis showed that determinants such as working capital, lack of demand, lack of sufficient technologies, challenges in supply of bamboo, and training availability were significantly influenced the industrial uses of highland bamboo culms at 5% significance level.

Keywords: Highland bamboo, Determinants,

1 Introduction

With the rapid development of the global economy and constant increase in population, the overall demand for wood and wood-based composites is rising, while the available wood supply will decrease due to the global biomass demands for the green energy generation (Chaowana, 2013). Bamboo is versatile, fast growing and ecologicaly useful construction material which have a potential to substitute wood in many application. Rural people of Ethiopia largely depend on raw bamboo culms for different construction, furniture and income generating purposes (Getachew Desalegn1* and Wubalem Tadesse, 2014). Ethiopia has an estimated one million hectares of natural bamboo forest, the largest in the African continent. Despite the versatile resource base and advanced bamboo utilization at a global scale, its great potential to enhance socio-economic and ecological development remains unrealized in Ethiopia (Zenebe Mekonnen et al., 2014). There exists very limited local market for bamboo handicrafts processed manually and exists only a few specialized enterprises that produce bamboo furniture and sell with high price. Poor processing and low value addition occurs, though there are about 500 furniture producers in the country out of which 58 in the capital city Addis Ababa (Getachew Desalegn1* and Wubalem Tadesse, 2014).

In adequate technologies and database on bamboo management, processing, manufacturing, marketing, culms characterization and rational utilization are among the major challenges. Therefore, this study mainly aimed to identify the determinants for industrial uses of highland bamboo in cottage bamboo furniture industries.

2 Methodology

Description of the Study Areas

The study was done in Injibara and Addis Ababa.

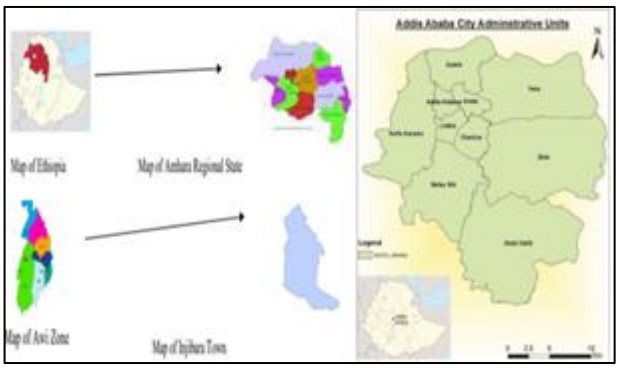

Figure 1: The map of Addis Ababa and Injibara cities Sources (Yetnayet, 2012) and (Zewditu, 2017)

Injibara

Injibara is a town in Ethiopia. Injibara is located at 10°57′N 36°56′E, and at an elevation of 2560 meters above sea level, which is the potential area for Yushania alpina bamboo species. The average annual rainfall is 1750 mm while the average monthly temperature ranges from 17°C to 27°C (Wikipedia, 2017). In this area, there are many cottages bamboo industries that are settled along the roadside of Addis Ababa to Bahir dar and they are consuming the available bamboo resources in the areas.

Addis Ababa

Addis Ababa is the capital city of Ethiopia. Geographically, Addis Ababa lies at an altitude of 7,546 feet (2,300 meters) and is a grassland biome, located at 9°1′48″N38°44′24″E or 9.03000°N 38.74000°E Coordinates: 9°1′48″N38°44′24″E or 9.03000°N 38.74000°E. The annual temperature of the city is 15.9 degrees Celsius (60.7°F) and it provided with on balance 1089 mm (42.9 in) of rainfall per year (Wikipedia, 2015). Bamboo processing and marketing in Addis Ababa, which is the capital of Ethiopia, is proliferating in recent years.

Most commercial processing takes place in urban areas with the largest concentration in Addis Ababa.

Sample Data and Sampling Procedure

A snowball sampling technique was used because the bamboo industry is not yet registered as an independent sector; there was no information about the address of bamboo industries. Then the available sixty cottage bamboo furniture industries were used for data collection for the study.

Data Collection Methods

Primary data collection

Interview survey has done to gather information about the determinants for industrial use of bamboo in cottage bamboo furniture industries and socio-economic parameters.

Secondary data collection

These types of data were collected from Central Statics Agency (CSA) and International Network for Bamboo and Rattan (INBAR) data bank in Addis Ababa and differently related literature such as textbooks, manuals, journals, and reports were reviewed.

Data Analysis Methods

2.1.1 Econometric analysis

Multiple linear regression Analysis:

This study has aimed to identify factors that affect the industrial uses of Yushania alpina bamboo culm in cottage scale bamboo furniture industries. Multiple regression analysis allows to explicitly control for many observed factors that simultaneously affect the dependent variable (Wooldridge, 2013). The method of ordinary least squares is easily applied to estimate the multiple regression model. Each slope estimate measures the partial effect of the corresponding independent variables on the dependent variable, holding all other independent variables fixed. R2 is the proportion of the sample variation in the dependent variable explained by the independent variables, and it serves as a goodness-of-fit. measure. Multiple linear regression analysis model specification for the study:

$$Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\beta_7X_7+\beta_8X_8+\beta_8X_8+U_t \quad \ldots\ldots(3.1)$$

This study was fit into the multiple regression model (with k = 9) by defining a dependent variable (Y), the amount of Yushania alpina bamboo culm used in cottage scale bamboo furniture industry per year, and nine factors that affecting the dependent variable (X_1-X_9) listed below the equation 3.1.

Y = the amount of culms of Yushania alpina bamboo used in cottage scale bamboo furniture industry per year.

β_1- β_9 is slope parameters
β_0 = Constant intercept
X_1 = Total capital
X_2 = No Employers
X_3 = Challenges of supply
X_4 = Lack of sufficient technology
X_5 = Lack of skilled personnel
X_6 = Lack of demand
X_7 = Availability of training
X_8 = Lack of access to loan and incentives
X_9 = Location of industry
U_t = Error term

3 Result and Discussion

Socio-Economic Characteristics of Respondents

A total of 62 questionnaires were distributed and collected back making the response rate of 100%. From these, 60(96%) questionnaires from cottage were used for econometric analysis. Out of the 62 respondents 52(83.8%) of them were males and the remaining 10 (16.1%) were females and the average age of respondents was 30.2years. The distribution of education level of respondents told that 6(9.6%) respondents were from primary school, 25(40.3%) were from secondary school, 9(14.5%) were from preparatory school, 20(32.2%) were from college diploma and 2(3.2%) were master's degree holders. According to interviews made to know the experiences, responsibilities, and roles of respondents in their industries, 30 (48.4% of) respondents had work experience of 1 up to 5 years, 22 (35.5% of) respondents had experience of between 6 to 10years and 10 (16.1% of) respondents had more than 10 years experiences

Factors Determining Industrial Uses of Highland Bamboo

The proposed variables were statistically tested using an econometric model to identify and isolate relevant factors and the results from the econometric model were presented in which the relative influence of each of the explanatory variables identified to affect industrial uses of highland bamboo culm in the cottage scale bamboo furniture industry.

Table 1. An estimate of determinants for industrial uses of highland bamboo

Variable	Cof	SE	Z	P>Z
K	0.515	.008	4.506	000
No.Empl	-.009	29.090	-.102	919
CHS	-0.204	295.768	4.353	.036
LST	-0.222	307.951	-2.147	.027
LQPr	-0.092	249.934	-2.281	.245
LD	-0.234	298.992	-1.176	.017
TAv	-0.163	266.069	-2.471	.050
LI	0.027	350.136	-2.008	.813

F=18.621, Adjusted R Square=67%, P>Z=0.00

Interpretation of model results

Most of the variables were significant to tell the effect of factors on industrial uses of highland bamboo culm in bamboo furniture industries (Table 4.2.). From eight explanatory variables, five variables were significant at less than 5% significance level. These were total capital of industry, lack of sufficient technologies, and lack of demand, training availability and challenge in supply of bamboo. Lack of sufficient technologies (LST): The result of this variable was in line with the expectation. Lack of sufficient technologies

significantly and negatively affected the industrial uses of highland bamboo (P<0.01). The model result indicated that industrial use of bamboo culm was decreased with a coefficient of 307.951 if there is lack of sufficient technologies. This means those industries with few technologies about the processing and handling of highland bamboo had used less amount of bamboo culms (Table 4.2.). This result is in line with a recent study concluded that bamboo utilization in Ethiopia has been limited due to its scarce technologies (Omer & Gemechu, 2018).

Lack of demand (LD):
After controlling the effect of other variables, the effect of lack of demand affected significantly and negatively the industrial uses of highland bamboo culm at 5% significance level. The model result indicated that the industrial use of highland bamboo decreased with the coefficient of 298.992 if there is lack of demand in the industry. This result is in parallel with the finding of Muhammed Unais etal., 2017, institutions in Kerala showed the reduced demand for bamboo products were challenges that have recorded in the bamboo industry in Kerala.

Capital (K): keeping the effect of other variables, the capital of the industry has a positive and significant effect on industrial uses of highland bamboo cum in the cottage scale bamboo furniture industry. The industry with higher capital was associated with better industrial uses of highland bamboo cum. The model result indicated that the industrial use of bamboo increased with a coefficient of 0.008 if the cottage scale bamboo industries have enough capital to mobilize the production. This result is in alignment with the result of the study by Shyam Paudel, INBAR coordinator found that a lack of working capital is one key barrier constrained bamboo sector development in Ethiopia (Shyam Paudel, 2011).

Challenges of Supply of Bamboo (CHS):
After all other variables keep constant; the challenge in the supply of bamboo has significantly and negatively affected the industrial uses of highland bamboo culm in the cottage bamboo furniture industry at 5% significance level. The model result indicated that the industrial uses of bamboo culm decreased with a coefficient of 295.768 if there is a challenge in the supply of bamboo (Table 4.2.). This result is in alignment with a recent study in India concluded that low volumes of bamboo supply considered as bamboo industries transformational challenges (Baksy, 2013).

Training availability (TAv): Keeping the effect of other variables, the availability of training expected to have a positive significant effect on industrial use of highland bamboo cum. But the result of this study told us the availability of training have a significant and negative effect on the industrial use of highland bamboo cum. The model result indicated that the industrial uses of highland bamboo culm decreased with a coefficient of 266.069 if the workers have the opportunity to get training. This result is related to the study explained that improvements in efficiency can be realized through a number of different means, including technological innovations, learning effects, and capacity effects, among others and led to reducing resource consumption (Jeffrey B et al.,).
Lack of access to loan and incentives: Unfortunately, there were no industries found that have access to loan and incentives and it was meaningless to include this variable in the model. But, the responses of the whole respondents showed that lack of access to loan and incentives were the main barriers significantly and negatively affected industrial use of highland bamboo cum. This result is in alignment with the result of a study by INBAR coordinator found that lack of economic incentives to promote rural communities to value bamboo as a useful commodity is one key barrier constrained bamboo sector development in Ethiopia (Paudel, 2011). Factors include lack of qualified personnel and locations of industry were not have significant effect on industrial use of highland bamboo in cottage bamboo furniture industries at 5% significance level (Table 1).

4 Conclusions

This study indicated that determinants such as working capital, lack of demand, lack of sufficient technologies, challenges in supply and training availability were significantly influenced the industrial uses of highland bamboo culms. Thus, the isolation and optimization of these determinants help to improve industrial uses of highland bamboo. At the same time, the cottage furniture industries situated in Addis Ababa have processed more bamboo culms than those located in Injibara city and this explained the effect of the location of industry mainly infrastructure and accessibilities of facilities and training on the industrial uses of bamboo culms. Furthermore, based on this survey, there was no organized marketing system even for customary bamboo products. Much bamboo remains unused, in rural areas such as Injibara where transportation is a constraint. Most of cottage industries are financially weak and found it difficult to upgrade their production and marketing. The obstacles for industrial use highland bamboo should be solved through integrated work from government, NGO, and research institutions. Further research on advanced utilization of highland bamboo is needed to exploit this untapped resource. Therefore, considering these issues the government and responsible bodies should put their crucial attention to build the capacities of bamboo industries and to develop the sector through implementing and promoting the right policies and adoption of the latest technologies related to bamboo processing.

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Proceedings

1. Effective Lumber Seasoning Technologies and Uses of Pinus patula ssp tecunumanii Tree Species Grown at Bonga, Ethiopia
2. Getachew Desalegn, Gemechu Kaba, Anteneh Tesfaye, Saifu Amanuel, Tsegaye Wubshet, Tesfanesh Ababu
3. Wood Technology Research Center
4. Seasoning Characteristics and Potential Uses of Gmelina arborea Lumber Tree Species Grown at Bonga
5. Getachew Desalegn, Anteneh Tesfaye, Gemechu Kaba, Saifu Amanuel
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Educational background

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1981	1985	Beijing Forestry University	Bachelor in Forestry Economics & Management
1985	1987	Beijing Forestry University	Master in Forestry Economics & Management
1996	1999	Beijing Forestry University	Ph.D. in Forestry Economics & Management

Research projects

From	To	Title of Project	Position	Project Description
2007	2010	Research on the resource of the woody oil plant and exploitation mechanism in China	Project chief	National Natural Science Foundation of China(NSFC) financed project
2011	2013	Study on the operation mechanism and the promotion pattern of biomass solid forming fuel project in Beijing rural areas	Project chief	Ministry of personnel and social security: The scientific and technological activities for the selected students studying abroad

2013	2015	Research on global renewable energy development prospect	Project chief	The project funded by the climate department of National development and reform commission
2013	2015	Study on commercial application model of biomass pellet fuel replacing fossil fuel	Project chief	Funded by UNDP China
2015	2017	Study on farmers' income increase and forestry development model in huairou water conservation	Project chief	Funded by Beijing beilin advanced eco-environmental technology research institute co. LTD
2018	2019	Forging strategies for sustainable development in Zhouqu County of Gansu province	Project chief	Funded by UNDP China

Publications

Year	Publication
2018	Fiscal decentralization and environmental pollution -- from the perspective of new structural economics, Journal of financial research, 2018(03), 50-70
2018	Evaluation on the carbon footprint and economic cost of power generation enterprises from the perspective of resource value stream, Journal of industrial technology economics, 2018 Vol. 37 (12)
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2018	Forest biomass energy resource potential estimation and change trend in China, Journal of world forestry research, 2018.11.3
2017	Review and revelation of research on the raw material supply of foreign biomass energy, Exploration of economic problems, 2017(06)
2017	Environmental value measurement and potential economic impact analysis of biomass energy projects, Technology management research, 2017(11)
2017	National Mangrove Restoration Project in Malaysia. Journal of Environment and Earth Science, Vol. 7, No. 11: 119-125
2016	Spatial and temporal pattern evolution of the forestry total factor productivity in China, Statistics and decision making,2016(08)
2016	Study on the consumption of carbon emissions from residents - take Henan province as an example, Resources and environment In dry area, 2016(06)