Unlocking the Potential of Bamboo Entrepreneurs: Characteristics, Innovations, and Economic Performance in Tanzania's Southern Highlands

Lyimo, P.J.[1]*, J.S. Japhet[2], G.E. Kaaya[2], F.M. Ntenga[2], K. Masaka[3], G. Mbeyale[4] and S. Nyefwe[5]

[1]Department of Ecosystems and Conservation, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3010, Chuo Kikuu, Morogoro, Tanzania.
[2]Bamboo and Rattan Association of Tanzania (BARATA), P.O. Box 3100, Morogoro, Tanzania.
[3]Department of Forest and Environmental Economics, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3011, Chuo Kikuu, Morogoro, Tanzania.
[4]Department of Forest Resources Assessment and Management, College of Forestry, Wildlife and Tourism, Sokoine University of Agriculture, P.O. Box 3013, Chuo Kikuu, Morogoro, Tanzania.
[5]Nelson Mandela African Institution of Science and Technology (NM-AIST), P.O. Box 447, Arusha, Tanzania

*Corresponding author e-mail: *paulo.lyimo@sua.ac.tz*

Abstract

This study focuses on bamboo entrepreneurship in Tanzania's Southern Highlands, where bamboo is a significant non-timber forest product (NTFP) offering employment opportunities in raw material collection, processing, and marketing. Bamboo possesses unique mechanical and chemical qualities that attract various enterprises, leading to eco-innovations that improve eco-efficiency and contribute to the circular economy. Despite its global significance, bamboo resources in Tanzania have received limited research attention, and the potential for innovation remains underrecognized. Thus, the study aimed to explore the characteristics, performance, and innovation propensity of bamboo entrepreneurs in the region and identify factors influencing their innovativeness. Using systematic random sampling with proportional allocation, households involved in bamboo value chains were selected for the study. Findings from the study indicated that traditional knowledge and individual ideas were the primary sources of innovation, contributing 42.27% and 30.28%, respectively. Local competitors played a significant role as well, contributing 10% to the innovation process, while other sources such as the internet, mass media, and expert advice had minimal influence (each less than 10%). Furthermore, the study highlighted that the location of raw material supply significantly impacted the economic performance of bamboo entrepreneurs. Factors such as short distance (79.63%), cost-effectiveness (75.93%), and large culm size (37.04%) were crucial considerations in this regard. Additionally, aesthetic appeal (34.0%) and adherence to tradition (33.33%) were found to be relevant factors influencing their innovativeness. In conclusion, bamboo resources hold immense potential for elevating living standards and contributing to the achievement of sustainable development goals in Tanzania's Southern Highlands.

Keywords: Bamboo; entrepreneurs; innovation; performance

Introduction

Bamboos are important members of forest ecosystems from sea level to alpine Mountains (Zhang *et al.,* 2020). Bamboos belong to the family Poaceae (Gramineae) and of the subfamily, Bambusoideae normally occur in both primary and secondary forests and are considered fast-growing, and high-yielding renewable resources if managed properly (Asari and Suratman, 2010; Judziewicz and Clark, 2007). Bamboo is a common term for a large number of giant grasses that include many

different species and varieties throughout the world (Yuming *et al.,* 2004). Bamboos have many uses worldwide from building to paper materials (Singh, 2008). They often have a tree-like habit and can be characterized as having woody, usually hollow culms, complex rhizome and branch systems (Bystriakova *et al.,* 2004; Emamverdian *et al.,* 2020; Htwe and Si, 2015; Lobovikov *et al.,* 2007; van Dam *et al.,* 2018). Bamboo is widely found in tropical, subtropical, and mild temperate zones of the world (Kaur, 2018), it can adapt to any extreme climatic and soil conditions (Kuehl *et al.,* 2011). There are about 90 genera and about 1200 species of bamboo found in the world (Hossain et al., 2015) of which about 13 genera and 40 species have been recognized in Africa. Bamboo forests distribute mainly in East Africa; Tanzania, Kenya, Zambia, Ghana, Ethiopia, Uganda, Mozambique, and Madagascar (Ahmad *et al.,* 2021).

In Tanzania bamboo is naturally occurring on low altitude areas and in montane forests (Lyimo *et al.,* 2019). A total of 1,025,033 hectares of bamboo forests, in both lowland and highland regions that receive adequate rainfall, are found in Tanzania, according to Lyimo *et al.* (2019). *Yushania alpina, Oreobambos buchewaldii, Hickelia Africana,* and *Oxytenanthera abyssinica* are examples of natural species, while *Dendrocalamus strictus, Dendrocalamus nutans, Bambusa vulgaris, Bambusa multiplex, Bambusa nutans, Bambusa bambos,* and Bambusa species are examples of introduced species. Bamboo occurred to all vegetation types and land uses. Woodlands (66%) have the largest percentage of occurrence, followed by cultivated land (12%) and forests (10%) (Magafu, 2020).

Bamboo has become an important resource to replace wood which act as major substitute resource for wood and facilitate protection of forest and environment (Zhang *et al.,* 2022). Compared to timber, bamboo can have even higher potential due to its fast growth and adaptability to a wider agroclimatic range including degraded landscapes (Kuehl *et al.,* 2011). Its fast growth directly correlates with its enhanced ability to capture and sequester atmospheric carbon and consequently mitigate climate change, while simultaneously providing livelihood resources to local communities (Endalamaw and Dietrich, 2020). Throughout the world, 2.5 billion people rely on bamboo for their livelihood and survival (Lobovikov *et al.,* 2007; Phimmachanh *et al.,* 2015; Hogarth and Belcher, 2013; Lou *et al.,* 2010; Singh, 2008). Additionally, today's bamboos play a considerable role in human life, and they cover a wide range of human needs from environmental protection to use as home appliances (Emamverdian *et al.,* 2020).

Recently, there are increasing uses of bamboo mainly due to the evolution of industries and technology that make it possible to manufacture different new forms of bamboo products (Daphney and Shu-Yi, 2019). A very tall bamboo scaffolding against oriental skyscrapers serves as evidence of how bamboo is employed in support structures as well as crafts that range from extremely traditional to completely industrialized products. Moreover, bamboo is used for energy, food, and paper (Nirala *et al.,* 2017).

Bamboo continues to play a crucial role in rural development, providing a mechanism for poverty alleviation and livelihood security (Tripath, 2008). Its unique qualities have attracted attention from various industries, leading to the emergence of bamboo enterprises and entrepreneurs. Just like other entrepreneurs, bamboo entrepreneurs possess certain common characteristics (Tan, 2008). Leveraging bamboo entrepreneurship becomes essential for uplifting the socio-economic status of underprivileged communities in the country. Bamboo craft makers skillfully design various bamboo structures using simple, locally prepared tools. It is estimated that around 3.3 million farming families are involved in the bamboo sub-sector either as producers or users of bamboo-based products (Pant, 2006).

Developing and supporting cottage industries based on bamboo have tremendous potential in providing much-needed cash income to locals and contributing significantly to their household economy (Poudyal, 1992; Karki *et al.,* 1995; Sherchan *et al.,* 1996). Furthermore, these efforts can make substantial contributions to the regional and national economy. However,

despite its importance, bamboo resources remain less investigated, and information on characteristics, performance, and innovation propensity of bamboo entrepreneurs is limited. To bridge this information gap, this study was conducted in the southern highlands of Tanzania to generate valid insights into the bamboo entrepreneurs in the region. By exploring the factors influencing their innovativeness and understanding their unique characteristics, policymakers and stakeholders can foster an environment that maximizes the potential of bamboo entrepreneurship in contributing to the socio-economic development of the area.

Materials and Methods

Study area

The study was conducted in Tanzania's Southern Highlands, specifically focusing on the primary regions of Iringa, Njombe, and Mbeya (Fig. 1). According to Mbululo and Nyihirani, (2012), the Southern Highlands of Tanzania, situated between the latitudes of 6°S and 12°S and the longitudes of 29°E and 38°E, represent the coldest zone in the country. Average temperatures there range from 13°C to 19°C, and mean annual rainfall ranges from 823mm to 2850mm.

The Southern Highlands of Tanzania boast abundant vegetation, including savannas, woodlands, grasslands, and forests. Within this region, namely Mbeya, Iringa, and Njombe, lies the primary source of bamboo shoots used in communal activities and beverages (Kaale, 2022). These three regions collectively cover 165,030 hectares and play a vital role in determining the bamboo coverage in Tanzania's southern highlands (Lyimo *et al.,* 2019). The native bamboo species found in this area include Yushania alpina, Oreobambos buchewaldii, Hickelia africana, and Oxytenanthera braunii (Lyimo *et al.,* 2019).

The people of the Southern Highlands heavily rely on bamboo for various economic activities, both historically and in the present day. This versatile resource is utilized in the production of paper and handicrafts, home furnishings, water pipes, storage containers, snacks, and beverages like bamboo juice, as well as other essential household items (Kaale, 2022).

Overall, rich bamboo resources in the Southern Highlands contribute significantly to the region's economic activities, supporting the livelihoods of rural and ethnic communities. By harnessing the potential of bamboo in various sectors, the Southern Highlands sustainably benefit from this valuable natural resource.

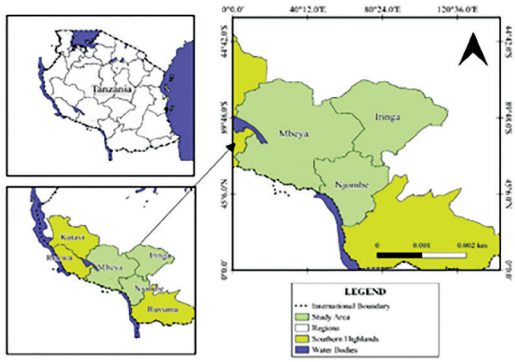

Figure 1: Study area in Iringa, Njombe, and Mbeya regions of Tanzania

Source: Author 2023

Research Design

In this study, the research design involved the selection of households and bamboo entrepreneurs actively engaged in bamboo operations within the study area. To achieve this, a selection frame was created with the assistance of village elders, which served as a comprehensive list of potential participants. The sampling technique employed was systematic random sampling with proportional allocation. In this method, the first unit of the sample was randomly chosen from the selection frame, and subsequent units were selected systematically based on a predetermined interval. This approach ensured a representative and unbiased sample, allowing for meaningful insights into the characteristics and innovation dynamics of bamboo entrepreneurs in the study area (Singh and Masuka, 2014).

Data collection

The study utilized a mixed-methods approach, incorporating surveys, focus groups, key informant interviews, and household surveys to collect primary data. The research was conducted in the three southern highlands

regions of Tanzania (Iringa, Mbeya, and Njombe) during June to July 2022.

For examining socioeconomic characteristics, household surveys were conducted, gathering information on the age of bamboo producers, marital status, and income details. Focus group discussions (FGDs) were held at bamboo businesses to gain insights into their management styles and dynamics. Staff members were interviewed to understand their involvement in managing bamboo resources and the current "production to consumption" systems of bamboo enterprises.

Key informants, including village leaders and enterprise owners, were involved in the household survey. The questionnaire approach was used to collect demographic information and assess bamboo enterprise performance of the respondents. The survey also explored the reasons behind their innovations and household income from bamboo activities. Additionally, other natural capital and non-natural activities, as well as other bamboo businesses conducted by individual producers, were identified to evaluate the economic potential of the bamboo crop in sustaining local livelihoods. Both categorical and numerical data were collected through the household survey. By employing this comprehensive research approach, the study aimed to gain a holistic understanding of bamboo entrepreneurship in the region, exploring various dimensions such as socioeconomic characteristics, innovation factors, and economic potential. The combination of qualitative and quantitative data collection methods allowed for a more robust analysis and nuanced insights into the role of bamboo in supporting the livelihoods of the people in Tanzania's southern highlands.

Data analysis

The data analysis process commenced with data cleansing and filtering, ensuring the data's accuracy and reliability. Data visualization was then performed as the initial step in the analysis, allowing for a comprehensive understanding of the dataset's patterns and trends. Careful consideration was given to the type of data available and the study's objectives while selecting the appropriate analytical approach.

For this study, descriptive statistics emerged as the primary analytical method. It was employed to examine the characteristics, performance, innovation propensity, and factors influencing innovativeness among the bamboo entrepreneurs. RStudio analysis tool and Microsoft Excel were utilized for conducting the analysis, enabling robust and efficient data processing.

The findings were presented in the form of tables, graphs, diagrams, and percentages, providing clear and concise representations of the results. Through these visualizations, the study's insights were effectively communicated, offering valuable information about the dynamics of bamboo entrepreneurship in the region. Data visualization and descriptive statistics ensured a comprehensive analysis of the data, contributing to a deeper understanding of the characteristics and innovation dynamics of bamboo entrepreneurs in Tanzania's Southern Highlands.

Results and Discussion

Characteristics

Socio- economic and demographic status of the respondents

A total of 270 respondents, including 93 women and 177 men, who owned various bamboo businesses, were interviewed during this study. The number of women interviewed were quite small compared to men and this is because bamboo harvesting is dominated by men. According to Aswandi and Kholibrina (2021), bamboo processing and marketing is carried out by both men and women, although men still dominate.

Despite having large number of male bamboo entrepreneurs and enterprises owner to about 177 males also 93 women in the study area have full participation in bamboo- based activities. This signify that traditional business have been providing upgrading means for women in male dominated society.

According to the findings, the most enthusiastic individuals in the research region were the ones who engaged in bamboo activities the most Table 1 below. 25 bamboo entrepreneurs were over 60 years old, 142 bamboo entrepreneurs were between 36 and 60 years old, and 103 bamboo entrepreneurs were

between the ages of 18 and 35 make a total of 270 respondent as it shown in table 1 below. Also, educational status of 270 respondents and marital status shown in Table 1 below.

Southern Highlands of Tanzania. About 50% of the bamboo entrepreneurs in the study area were found operating the business since last 20 years and more. Family employees are family

Table 1: Socio-economic and demographic characteristics of the respondents

Parameter	Category	Frequencies	Percentage
Sex			
Male	177	65.56	
	Female	93	34.44
Age	18-35	103	38.15
	36-60	142	52.59
	Above 60	25	9.26
Education level	Primary	173	64.07
	Secondary	77	28.52
	Tertiary	19	7.04
	Informal education	1	0.37
Marital status	Married	174	80.56
	Single	30	13.89
	Widowed	12	5.56
Land ownership	General land	3	5.77
	Private	49	94.23
Family members	Less than 4	106	49.07
	5 to 8	104	48.15
	More than 9	6	2.78

Further, study reveals that the literacy percentage of bamboo entrepreneurs in the study area was 99.63%, Table 1 above show that 64.07% of bamboo entrepreneurs are qualified with primary education, 28.52% had secondary education as well as 7.04% had tertiary education while the rest 0.37% had informal education. Whereas, results showing greater percentage for literacy of bamboo entrepreneurs (87%) from Nepal (Kattel *et al.,* 2007), good indicator for educated people investing in bamboo enterpreneurship. Hence, it is brilliant choice for the educational underprivilege people in the study area to invest in bamboo-based activities to improve their living standard.

Employment profile of bamboo enterprises

Figure 2 shows employment profile reflecting the characteristics of the bamboo enterprises in the three selected regions of the

members who work in the company since it is a family business, intern employees are there to work for less than one year, and permanent employees are bamboo entrepreneurs who have been there for more than five years. In Njombe and Iringa, where the majority of bamboo businesses were family-owned, the number of family employees was fairly high. Permanent employees in the Njombe region show that bamboo businesses are one of the key economic activities carried out in the area. Additionally, bamboo entrepreneurship is not the primary source of income for temporary employees.are quite high in Njombe region than iringa and mbeya as in njombe bamboo

Bamboo had received high social and economic values for their role in the lives of community and performance of different bamboo enterprises in the study area. It was found that not a single enterprises had one-

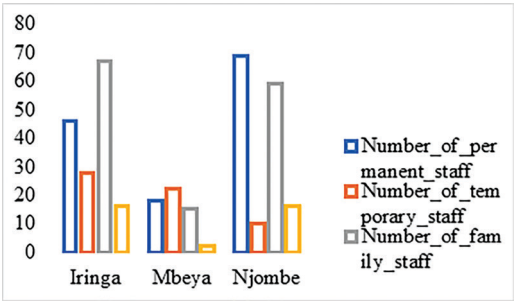

Figure 2: Employment profile of bamboo enterprises in the three selected regions

man entrepreneurship, rather, high percentage of employees belong to their own family, with each enterprise having in average less than four (<4) family staff approximately to (49.07%) of the total staff (Table 1). Kattel *et al.* (2007), reported that bamboo-based enterprises in the area of Nepal are family-owned activities since 100% of employees comes from family, with each family having in average three members in the business.

Innovation

Identified innovation

Local knowledge is the primary source of innovation for bamboo entrepreneurs because the majority of bamboo entrepreneurs inherit knowledge on how to conduct bamboo businesses like the manufacture of bamboo juice. One's own idea is the second most common source of innovation for bamboo entrepreneurs, as seen in Table 2 below. Local knowledge having high frequency of 134 followed by one's own idea with frequency of 96 and other ource of innovation as shown in Table 2 below.

Sources of innovation

Frequency results displaying the key sources of innovation which are among the factors influencing the bamboo enterprises performance and innovation prosperity were depicted by Figure 3.

Thus, innovativeness of an enterprises depends on availability of knowledge and its appropriate selection and application. Similarly, for bamboo enterprises in study area that are typically characterized by a limited knowledge base, poorly established communication networks, and the absence of research and development units, the need for external knowledge is quite substantial. Indigenous knowledge was main source of innovation due to traditional uses of bamboo which are direct related to processing skills. Followed by one's own ideas due to creativity towards market potentials (Fig. 3) above.

Table 2: Shows identified innovation

Source of innovation	Frequency
Foreign competitor	2
Research and Dissemination	2
Expert advice	7
Handouts and literatures	10
Internet	14
Mass media	20
Local competitor	32
Own idea	96
Local knowledge	134

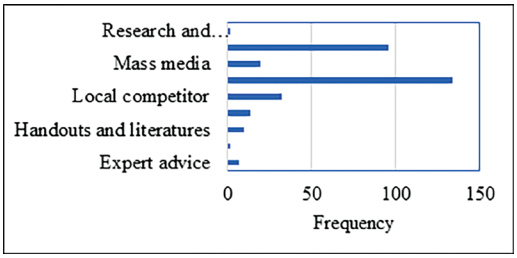

Figure 3: Key sources of innovation

According to Endalamaw and Darr (2020) discussion for bamboo entrepreneurs in Ethiopia shows that main source of innovation was indigenous knowledge, furniture catalogues, customer information, trial and error, and copying from wood furniture enterprises which increase absorptive capacity and accelerate endogenous technological. The results shows that bamboo material carry huge potential that affect the innovation of the enterprise as the sources of great opportunities. Moreover, studies show that external knowledge utilization equally depends on the capability of enterprise to properly select and adopt knowledge to their own institutional environment (Endamalaw and Darr, 2020)

Economic Performance of Bamboo enterprises

The finding shows that most of the bamboo entrepreneurs decided site for raw materials based on several consideration but major short distance factor, about 80% of bamboo entrepreneurs choose site for raw material based on distance that is favorable and economic advantageous to the business. The followed factor was cheapness of raw material as 76% of bamboo entrepreneurs choose raw material site based on cheapness Table 3.

This reveal raw material is the main factor for business and have significant contribution to the performance of bamboo enterprises as well as major factor for innovativeness. Study by Hieph (2021) reveals that location and price of bamboo material have effect on enterprises economy and innovation as the supply of bamboo material greatly impacts the production strategy of bamboo enterprises.

The choice of raw material location had effect on the performance of enterprises. Different reasons were mentioned as factors influencing the performance of bamboo enterprises and their percentage contribution analyzed. (Table 2). It was observed that short distance is major factor for raw material location due to its greater percentage, followed by cheapness with respect to raw material location.

The figure below demonstrates factors bamboo entrepreneurs considers in locating site for raw materials as the major source of innovation and performance of the business.

Table 2: Reasons for raw material location

Factor(s)	N	Freq.	(%)
Short distance	54	43	79.63
Cheap	54	41	75.93
Durable bamboo	54	20	37.04
Big culm size	54	29	53.7
Good aesthetics	54	18	33.33
Just by tradition	54	18	33.33

Freq.=Frequency; %=Percentage

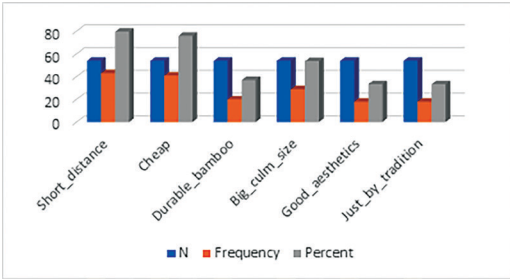

Figure 4: Reasons for raw material location as preferred by entrepreneurs

Conclussion and recommendation

The fact that most bamboo businesses in Tanzania's southern highlands are family-run shows how valuable and important bamboo resources are to the life of the people in the area. Additionally, indigenous knowledge and one's own ideas were identified to be the primary sources of innovation for bamboo entrepreneurs and businesses in the research location. Since innovation plays a significant role in bamboo businesses, more research-based education on the value addition of bamboo products is highly recommended in order to enhance and strengthen bamboo enterprises' economic performance.

Additionally, bamboo resources have great potential for improving both human well-being and the environment, as highlighted by (Zhang *et al.,* 2022). This is because bamboo can be used in place of wood to help protect forests and the environment. To maximize profits through highly creative goods and services, it is crucial to invest in establishing an environment that bamboo businesses can operate in. Sustainable development goals (SDGs) such as eradicating poverty, promoting life on land, combating climate change, and investing in industrial innovation and infrastructure are all supported by bamboo resources.

Conflict of Interests

All authors declare that they have no conflict of interest regarding the content and publication of this manuscript.

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