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BEEKEEPING PRACTICES, HONEY PRODUCTION, AND THEIR ECONOMIC IMPACT ON BEE FARMERS IN MBADURA COMMUNITY, BENUE STATE, NIGERIA

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Abstract

Beekeeping, a vital agricultural and ecological activity, holds significant potential for economic development and biodiversity conservation. However, the predominance of traditional methods may limit its full economic and ecological potential. This study examines beekeeping practices in Mbadura Community Benue State, Nigeria, focused on beekeeper distribution, methods employed, honey production, and associated challenges. A purposive sampling design was used to identify 36 beekeepers, assessing hive types, honey yield, and constraints through a semi structured questionnaire. Findings reveal that 55% of beekeepers use traditional wooden hives, with no adoption of modern hive types such as Langstroth or Kenya Top Bar hives. The average honey yield per hive was 30 liters, generating an estimated ₦150,000 ($99.80) per hive. Despite its economic potential, beekeeping in Mbadura faces significant barriers, including limited modern training (only 8% trained), restricted market access, habitat degradation, and pest infestations. Addressing these challenges through targeted interventions, such as training programs, market infrastructure development, and sustainable land management, can enhance productivity, profitability, and sustainability. Promoting modern beekeeping techniques will strengthen its role as a key driver of rural economic development and biodiversity conservation.

Keywords: Apis mellifera adansonii, Beekeeping, Biodiversity Conservation, Honey Production, Pollination, Sustainable Livelihoods, Traditional Practices

INTRODUCTION

Bees, belonging to the Order *Hymenoptera*, Suborder *Apocrita*, Superfamily *Apoidae*, and Clade *Anthophila*, are a monophyletic lineage (Masiga *et al*., 2014). With approximately over 20,000 known species distributed across seven recognized biological families, bees are vital components of terrestrial ecosystems. (Danforth *et al.*,2019). Six of these families *Apidae*, *Megachilidae*, *Melitidae*, *Andrenidae*, *Colletidae*, and *Halictidae* are found in Africa, inhabiting diverse environments wherever insect-pollinated flowering plants exist, excluding Antarctic (Ollerton.,2017).

In Nigeria, honey is primarily produced by *Apis mellifera adansonii*, a close genetic relative of *A. m. scutellata*, commonly referred to as "African killer bees" (Akinwade *et al*., 2013). These West African bees, while known for their aggressive behavior, demonstrate notable resistance

to several bee pests and diseases (Ramos-Cuellar *et al*., 2022). Honeybees, as principal pollinators of flowering plants, play a pivotal role in sustaining biodiversity and ensuring food security through enhanced crop production.

Beekeeping, a sustainable and accessible economic activity, requires minimal technical expertise, making it viable for individuals across all demographics. Honey production, however, is influenced by various factors, including the skill level of beekeepers, climate conditions, vegetation, and the species of bees utilized. As a recognized means of wealth creation, beekeeping holds significant potential for addressing poverty, particularly in rural communities (Agbidye and Hyamber, 2018).

Despite the economic and ecological benefits of beekeeping, its sustainability and productivity in Kwande Local Government Area (LGA), Nigeria, are constrained by several challenges. These include the absence of comprehensive data on the number of beekeepers, their practices, and the economic contributions to their activities. This data gap hinders the development of targeted interventions to enhance beekeeping practices and maximize their benefits. The study focused on Mbadura Community in Kwande LGA, a prominent hub for bee farming in Benue State. The objectives of the research were to ascertain the number of beekeepers in the community and identify the beekeeping methods employed. determine the quantity of honey produced by each beekeeper and the income generated from beekeeping activities.

MATERIALS AND METHODS

Study area

The study was conducted in the Mbadura Council Ward of Kwande Local Government Area (LGA) in Benue State, Nigeria, a region recognized for its significant beekeeping activities. The target population comprised all identified beekeepers within the ward. Kwande LGA is located between latitudes 6°0'80.10" N and longitude 9°47'2" E, at an elevation of 86.02 meters above sea level (Amagu *et al*.,2023) .It is bordered by Vandeikya LGA to the west, Ushongo LGA to the north, and Katsina-Ala LGA to the northwest. To the south, Kwande shares a boundary with Cross River State, and to the southeast, with the Republic of Cameroon. To the east, it is bordered by Takum LGA in Taraba State (NPC, 2006).

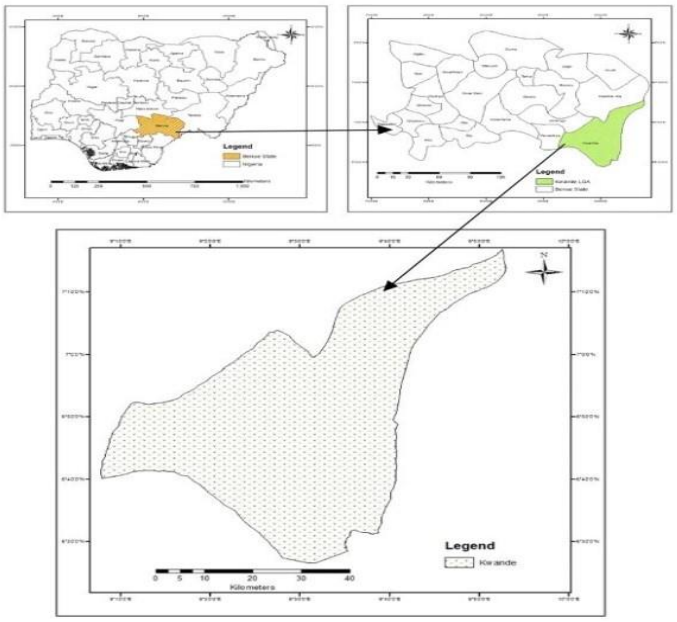

Figure 1: Map of Nigeria showing the Study area

Source: Amagu *et al.*, 2023

Kwande LGA experiences a unimodal rainy season from April to October, receiving an annual rainfall of approximately 1,500–1,750 mm, followed by a dry season from November to March (Nyiatagher *et al*., 2019). The mean annual temperature ranges from 31°C to 38°C. The region's mountainous terrain and proximity to the Cameroonian mountain range create a relatively cool climate, making it an attractive destination for traders and investors. The area is endowed with numerous large streams, such as Amile u Tamen and Amile u Kiliki, which provide adequate water resources for agricultural and industrial activities. Its vegetation is characteristic of the Guinea Savanna biome, dominated by giant annual and perennial grasses interspersed with tree species such as red mortar wood (*Pterocarpus erinaceus*), locust bean plant (*Parkia biglobosa*), mahogany (*Khaya senegalensis*), red ironwood (*Lophira alata*), shea butter plant (*Vitellaria paradoxa*), and black plum (*Vitex doniana*) (FAO, 2020)

Data Collection

A total of 36 beekeepers engaged in varying scales of beekeeping activities were identified as the study population. The study employed a purposive sampling design to identify and administer semi structured questionnaire to beekeepers engaged in varying scales of beekeeping activities. Purposive sampling was chosen because it allows for the intentional selection of

respondents with relevant experience in beekeeping, ensuring that data collected would be both informative and representative of the study's objectives. The questionnaire comprised a combination of open-ended and closed-ended questions. Closed-ended questions were designed to capture quantitative data, such as the number of hives owned by each beekeeper. In contrast, open-ended questions sought to gather detailed qualitative information regarding beekeeping methods, challenges encountered, and perceptions of beekeeping activities in the region. Face-to-face administration of the questionnaires facilitated better engagement and ensured clarity in responses. Prior to data collection, the questionnaire underwent pre-testing with a small sample of beekeepers in a neighbouring area. This pilot phase allowed for refinement of the questions to enhance clarity, reliability, and validity of the instrument.

Data Analysis

Data was analysed using descriptive statistics

Results And Discussion

Table 1 shows the socio-economic dynamics of beekeepers in Mbadura, Chi-square test **(**$\chi 2$=4.28, p=0.639**)** shows the association between education level and years of experience in beekeeping**.** The lack of statistical significance **(**$p > 0.05$**)** suggests that formal education does not significantly influence the duration of experience in beekeeping**.**

Table 1: Socio-Economic Characteristics of Beekeepers in Mbadura

Characteristic	Category	Frequency (n=36)	Percentage (%)
Gender	Male	34	94.4
	Female	2	5.6
Age Group (Years)	20 – 30	4	11.1
	31 – 40	8	22.2
	41 – 50	12	33.3
	51 and above	**12**	**33.3**
Education Level	No formal education	4	11.1
	Primary education	10	27.8
	Secondary education	14	38.9
	Tertiary education	8	22.2
Primary Occupation	Beekeeping only	10	27.8
	Farming + Beekeeping	20	55.6
	Other	6	16.7
Years of Experience	1 – 5 years	4	11.1
	6 – 10 years	10	27.8
	11 years and above	22	61.1

Figure 1 shows that among the 36 beekeepers identified, 25% (9 individuals) manage a single hive, while 33% (12 individuals) operate two hives. Another 25% (9 individuals) own two or more hives. Notably, 17% (6 individuals) practice a combination of hive beekeeping and wild bee harvesting. Spearman's Rank Correlation Coefficient **(**rs=0.592**)** indicates a moderate to strong positive relationship between years of experience and number of hives owned. The p-value (0.00014) is much smaller than 0.05, confirming that the correlation is statistically significant This suggests that as beekeepers gain more experience, they tend to manage more hives**.** However, the correlation is not perfect (rs=1.0), which means **other factors beyond experience influence hive ownership.**

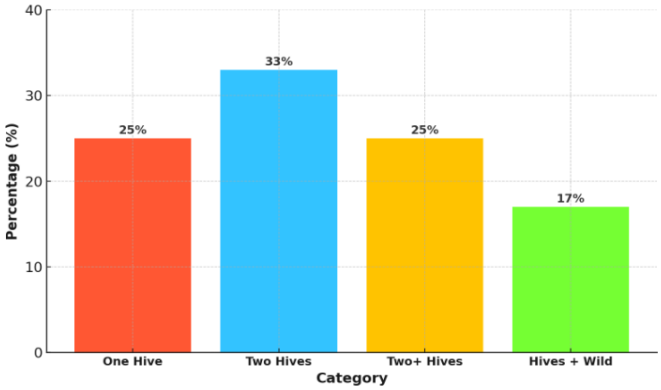

Figure 1: Distribution of Beekeepers in Mbadura

Types of Hives Used

The types of hives employed by beekeepers in Mbadura are presented in Table 2. Traditional wooden hives are the most used, accounting for 55% (20 individuals) of the total. Repurposed plastic hives are utilized by 28% (10 individuals), while 17% (6 individuals) rely on tree trunks. Notably, none of the beekeepers reported using modern hive types such as Langstroth or Kenya Top Bar hives. These results suggest a reliance on traditional and locally available materials for hive construction.

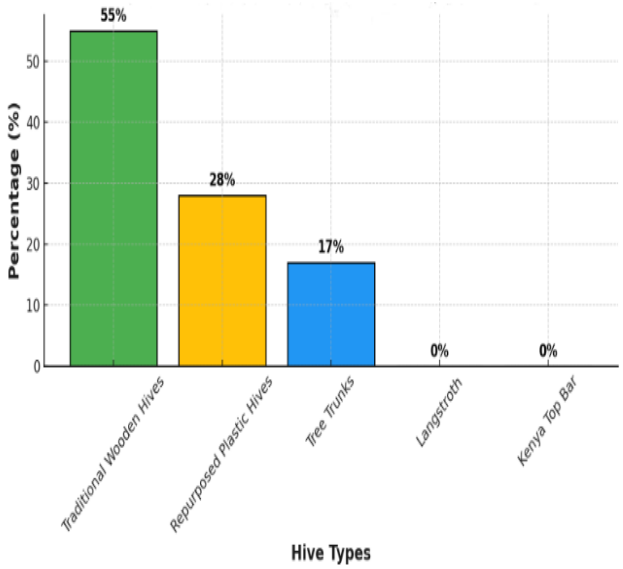

Figure 2: Types of Hives Used by Beekeepers in Mbadura

Table 2 indicates that all the beekeepers in Mbadura exclusively utilize baiting materials made from honeycombs. None of the respondents reported using cow dung or lemon grass as baiting materials.

Table 2: Baiting Materials Used by Beekeepers in Mbadura

Baiting Material	Frequency	Percentage (%)
Made from Honeycombs	36	100
Cow Dung	0	0
Lemon Grass	0	0

Table 3 shows the distribution of hive placements among the 36 beekeepers in Mbadura. The majority (69%, n=25) place their hives under temporary sheds in forested areas. Additionally, 17% (n=6) place their hives on trees, while 14% (n=5) place them under tree shades. No hives were reported to be placed in other locations.

Table 3: Placement of Hives in the Study Area

Placement of Hives	Frequency	Percentage (%)
On Trees	6	17
Under Tree Shades	5	14
Under Temporary Sheds in Forested Areas	25	69
Others	0	0
Total	**36**	**100**

Table 4 shows the distribution of beekeepers in Mbadura who have received training on modern beekeeping practices. Out of 36 beepers, 3 (8%) have received training, while 33 (92%) have not.

Table 4: Training on Modern Beekeeping Practice in Mbadura

Response	Frequency	(%)
YES	3	8
NO	33	92
TOTAL	36	100

Table 5 shows the distribution of reasons for practicing beekeeping among the 36 beekeepers in Mbadura. It indicates that 3% (1) of beekeepers practice beekeeping as a hobby, 27% (10) due to inheritance, and 70% (25) as a means of livelihood.

Table 5: Reasons for Practicing Beekeeping among Beekeepers in Mbadura

Reason	Frequency (n)	Percentage (%)
Hobby	1	3
Inheritance	10	27
Means of Livelihood	25	70
Total	**36**	**100**

Table 6 shows the average honey yield per hive and the corresponding revenue generated in the study area. The findings reveal an average yield of 30 liters per hive. At a market price of ₦5000 per liter, the total revenue generated per hive is ₦150,000.

Table 6 : Honey Production and Economic Impact in the Study Area

Parameter	Value
Average Honey Yield per Hive	30 liters
Price per Liter of Honey	₦5000
Total Revenue per Hive	₦150,000

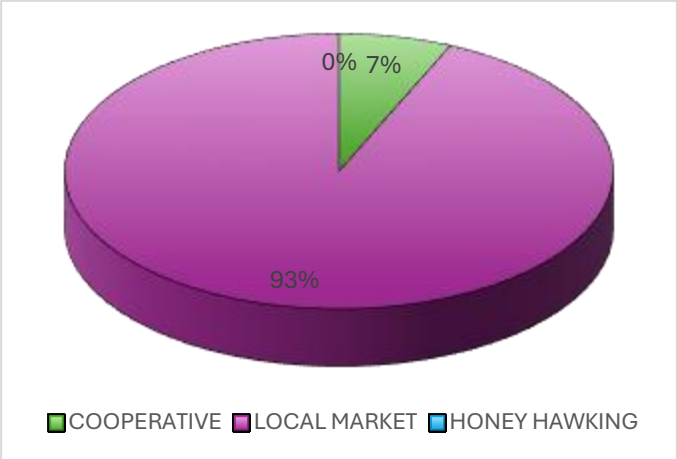

Figure 3: Marketing Channels for Honey in the Study Area

Table 7 highlights the key challenges faced by beekeepers in the study area. The most frequently reported challenge is the lack of modern beekeeping practice training, accounting for 54% of responses. Other notable challenges include market access (16%), habitat loss (14%), and pests (14%).

Table 7: Challenges Faced by Beekeepers in Mbadura

Challenge	Frequency	(%)
Habitat Loss	5	14
Pests	5	14
Market Access	6	16
Lack Of Modern Bee Practice Trainings	20	54

Discussion

This study highlights several critical aspects of beekeeping practices in Mbadura, Kwande LGA, shedding light on the current practices and identifying areas for potential improvement. The data reveals a predominant reliance on traditional beekeeping methods, especially the use of traditional wooden hives. Specifically, 55% of beekeepers use traditional wooden hives, 28% use repurposed plastic hives, and 17% utilize tree trunks. The absence of modern beekeeping

techniques such as Langstroth and Kenya Top Bar hives suggests a significant gap in technological adoption, likely driven by limited awareness and accessibility. While traditional hives are functional, their inefficiencies in honey yield and colony management highlight the need for intervention. These findings align with previous studies in Kenya, where limited access to modern beekeeping technologies has constrained productivity (Siminyu *et al*., 2024). However, unlike regions where training programs have improved modern hive adoption, Mbadura beekeepers remain largely uninformed about such advancements, indicating an urgent need for targeted capacity-building initiatives.

Training in modern beekeeping practices is essential to improving productivity and sustainability within the sector. The study found that only 3% of beekeepers have received formal training in modern beekeeping methods, suggesting that a significant knowledge gap exists. The observed knowledge gap in beekeeping practices can be framed within the human capital theory, which posits those investments in education and skills development lead to improved productivity (Tan., 2014). The fact that only 3% of beekeepers have received formal training suggests a lack of human capital investment in this sector, potentially explaining the persistence of traditional methods. Similar studies in Ethiopia have demonstrated that structured training programs significantly enhance the adoption of modern hives and improve honey yields (Affognon *et al*., 2015). This suggests that the situation in Mbadura is not merely a matter of technological availability but also one of knowledge transfer.

Furthermore, the diffusion of innovation theory (Rogers, 2003) provides an additional lens to interpret these findings. According to this model, the adoption of new technologies depends on awareness, perceived benefits, and social influence. The low adoption of modern hives in Mbadura indicates that beekeepers may either lack exposure to the benefits of modern methods or perceive traditional hives as more cost-effective despite their inefficiencies. This is particularly relevant in low-resource settings were financial constraints and risk aversion shape decision-making. Future interventions should not only introduce modern hives but also demonstrate their economic benefits through farmer-led pilot programs, thereby fostering gradual adoption.

The economic analysis reveals that beekeeping holds significant revenue potential in Mbadura, with an estimated income of ₦150,000 per hive at a price of ₦5,000 per liter. However, reliance on traditional hives means that beekeepers may not be maximizing their earning potential. Comparative studies in Ethiopia and Indonesia have shown that modern hive adoption can increase honey yield (Wakjira *et al*., 2021), suggesting that Mbadura beekeepers are operating below optimal capacity.

Beyond production, market structure plays a crucial role in determining profitability. The study reveals **t**hat 83% of honey is sold locally**,** while only 17% reaches cooperative networks**.** This heavy dependence on local markets exposes beekeepers to price fluctuations and potential oversaturation. By contrast, research in Nepal shows that cooperative membership can increase farmer incomes by providing access to higher-value urban and export markets (Dhakal and Mueser 2023). Expanding cooperative participation in Mbadura could mitigate market limitations and enhance bargaining power, enabling beekeepers to command better prices.

The challenges identified habitat loss, pests, and limited training extend beyond economic concerns to broader ecological consequences. Beekeeping is intrinsically linked to biodiversity conservation, as bees play a pivotal role in pollination. The decline of natural forage areas due to habitat destruction threatens not only honey production but also agricultural productivity in the region**.** This aligns with global concerns over pollinator decline and its impact on food security (Uwingabire and Gallai 2024). Sustainable land management practices, such as agroforestry and reforestation initiatives, could simultaneously support beekeeping while enhancing ecosystem resilience.

Additionally, the findings of this study highlight the critical role of beekeeping in biodiversity conservation and ecosystem services. Bees are vital pollinators, and their decline due to habitat loss or other factors can have far-reaching implications for agriculture and natural ecosystems. Therefore, promoting sustainable beekeeping practices not only benefits beekeepers economically but also contribute to broader environmental and conservation goals.

Conclusion and Recommendations

The findings reveal a predominantly traditional approach to beekeeping in Mbadura, Kwande LGA, with significant challenges including limited adoption of

modern techniques, lack of training, and constrained market access. While beekeeping offers substantial economic potential, with an average revenue of ₦150,000 per hive, its full benefits remain unrealized due to the reliance on traditional methods and challenges such as habitat loss and pests.

Targeted interventions, including training on modern beekeeping practices, improved market infrastructure, and sustainable land management, are essential for enhancing productivity and profitability. Additionally, the role of beekeeping in biodiversity conservation accentuates its importance beyond economic benefits, aligning with broader environmental and ecological objectives. These findings call for strategic policy and support programs to unlock the full potential of beekeeping in rural communities.

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