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Research Article
(Araştırma Makalesi)

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Economics analysis of the use of modern and traditional methods in honey production among farmers in Enugu State Nigeria

Nijerya, Enugu Eyaletindeki çiftçiler arasında bal üretiminde modern ve geleneksel yöntemlerin kullanımının ekonomik analizi

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ABSTRACT

Objective: The objective of this study was to examine the cost and returns on the use of traditional and modern methods of honey production and barriers faced by farmers.

Material and Methods: Primary data was collected from 100 beekeepers using both purposive and random selection techniques. Data was analysed using descriptive statistics and cost and return analysis.

Results: The modern methods of apiculture had a higher honey yield (105.4 litres) than the traditional method (52.3 litres). Also, modern methods had a higher gross margin (₦123,434.54) and benefit-cost ratio (2.99) than traditional methods, with a gross margin of ₦73,055.46 and a benefit-cost ratio of 2.99. The major constraints faced in apiculture include pests, hive theft and vandalism, changing climatic conditions, lack of equipment, and lack of capital.

Conclusion: The modern method of beekeeping was more profitable and the best technique to use in honey production. This study recommends sensitization and training on modern apiculture, the provision of modern equipment, and credit facilities to beekeepers to enable them to adopt the modern method.

ÖZ

Amaç: Bu çalışmanın amacı, geleneksel ve modern bal üretim yöntemlerinin kullanımının maliyet ve getirilerini ve çiftçilerin karşılaştığı engelleri incelemektir.

Materyal ve Yöntem: Hem gayeli hem de rastgele seçim teknikleri kullanılarak 100 arıcıdan birincil veriler toplanmıştır. Veriler, tanımlayıcı istatistikler ve maliyet ve getiri analizi kullanılarak analiz edilmiştir.

Araştırma Bulguları: Modern arıcılık yöntemleri, geleneksel yönteme (52,3 litre) göre daha yüksek bal verimine (105.4 litre) sahiptir. Ayrıca, modern yöntemlerin brüt kâr (₦123,434.54) ve fayda-maliyet oranı (2,99), geleneksel yöntemlerin brüt kârından (74,055,46) ve fayda-maliyet oranından (2,98) daha yüksektir. Arıcılıkta karşılaşılan başlıca arasında zararlılar, kovan hırsızlığı ve vandalizm, değişen iklim koşulları, ekipman eksikliği ve sermaye eksikliği sayılabilir.

Sonuç: Modern arıcılık yöntemi daha kârlı ve bal üretiminde kullanılacak en iyi tekniktir. Bu çalışma, modern arıcılık konusunda eğitim verilmesini, modern ekipman temini ve çiftçilerin modern yöntemi benimseyebilmeleri için kredi kolaylıkları sağlanmasını önermektedir.

INTRODUCTION

Beekeeping (apiculture), a branch of agriculture that involves the commercial management of bee swarms, is an important sector of agriculture that received little attention in the past. Apiculture requires small land; it is cost-friendly and easy to start as it has low operating costs as compared to other ventures (Verma et al., 2018; Otim et al., 2019). Beekeeping plays a critical role in sustaining the environment, maintaining biodiversity, and economic and social sustainability (Akinmulewo et al., 2017; Vrabcová & Hájek, 2020). It serves as a source of foreign exchange through export (Yeserah et al., 2019) and directly and indirectly provides jobs in both rural and urban areas (DeGrandi-Hoffman et al., 2019).

However, honeybees are well known for their economic value, particularly in the pollination of vegetables, fruits, and seed crops across the world (Akinade, 2019). Thus, beekeeping directly influences crop productivity and can increase productivity by 24% globally (Vrabcová & Hájek, 2020). The products of honeybees include honey, royal jelly, pollen, propolis, beeswax and bee venom (Verma et al., 2018; Popovska et al., 2021). Honey is a valuable part of a healthy diet and lifestyle, especially in this modern day of health challenges. Honey as a product of bees, has been scientifically proven beneficial in the treatment of disorders such as diabetes, asthma, high blood pressure, snakebite, and throat sores (Amssalu, 2002; Demirkaya & Sagdicoglu Celep, 2022). It is also used in the beauty industry, where it aids in the healing of wounds and ulcers.

Over the years, beekeeping has been practised under the traditional method. The traditional approach is based on the use of log hives, gourds, mud pots, and baskets, which cannot be opened for examination, and honey can only be gathered by chasing the bees with smoke. The management approach and tools used in traditional beekeeping differ from those used in modern beekeeping. The modern approach, on the other hand, employs replaceable tops or frames. Bees are encouraged to build combs in this style of bee management, which allows beekeepers to monitor the functioning of existing colonies (Oyerinde & Ande, 2006). Modern beekeeping provides consistent sources of honey and allows small-scale farmers to maintain and regulate bee colonies. It also provides for more skilled and efficient management, as well as greater yields and consistent delivery of bee products to the market (FAO, 2011). Traditional beekeeping, on the other hand, is technically viable and needs less expertise, yet colonies are destroyed in the pursuit of honey. Traditional beekeeping management does not sustain the hive system since immature bees are killed in the process during harvesting; also, the honey produced from the traditional method remains impure and, most of the time, unfit for human consumption (Oyerinde & Ande, 2006).

Beekeeping as an agribusiness venture requires the most productive, profitable, and environmentally friendly management practices (Gurung, 2005). Modern beekeeping practice is environmentally friendly and has to be encouraged when compared with the traditional practice. It is reported that commercial beekeepers in developed countries practice the modern beekeeping method. This is because the modern method allows farmers to harvest about 40 litres of honey on average per hive (Abdullahi et al., 2014). The reverse is the case in most sub-Saharan African countries. According to Holeta Bee Research Center (2004), a modern beehive box has the capacity to produce about 20-30 kg of honey per colony in a year when compared with 5-10 kg of honey per colony per year for the traditional beehive. Modern beekeeping has many advantages, such as it is easy to understand, produces high-quality honey, and improves honey yield production and productivity (Asmiro et al., 2017).

The major problem of beekeeping is associated with the traditional method of honey harvesting. This is because the honey is usually harvested with smoke and fire, and this does not sustain the hive system. It destroys a large number of bees and sometimes leads to bush burning (Gurung, 2005; Oyerinde & Ande, 2006). Furthermore, beekeeping provides beekeepers with sustainable values and uses, but there are many existing problems that vary depending on the environments in which they are located (Edessa, 2002). Identification of these problems would enhance better decision-making and productivity. Although studies were conducted on the economics of beekeeping, Gezahegne (2001) identified cultural practices, changes in climatic factors, socio-economic and ecological factors, as well as the behavior of bees as the problems

associated with beekeeping. Akinade (2019) studied the barriers and prospects of apiculture; he identified theft and environmental influence as the major problems associated with beekeeping. Ajao and Oladimeji (2015) looked at the production, structure, and barriers of traditional beekeeping and hunting activities. Their results showed that the loss of large trees is another important problem in beekeeping as bees nesting in smaller trees are prone to predators and vandalism. The current study revisits the economics of apiculture and adds to the existing knowledge by using current data to compare the profitability of the use of modern and traditional methods of beekeeping.

The need for sustainable and environmentally friendly apiculture, especially in developing countries including Nigeria, motivates this research. Sustainable and environmentally friendly apiculture is possible when the profit associated with the modern production method is known. Therefore, this study contributes to knowledge by comparing the profitability of modern and traditional methods to better inform apiculturists on the need for modern methods of apiculture. This study, in particular, described the socioeconomic characteristics of bee keepers, identified existing beekeeping practices, examined the cost and return of traditional and modern beekeeping practices, and identified the constraints to modern and traditional apiculture practices. This would serve as empirical evidence for policymakers and apiculture researchers on modern beekeeping.

MATERIALS and METHODS

Study area

The study was conducted in the Igbo-Etiti Local Government Area (LGA) of Enugu State, Nigeria due to the significant level of commercial beekeeping activities in the LGA. It has an area of 325 km^2. It is situated in the dry Savanna climate belt of Enugu State and has coordinates of 6040'N and 7022'E on the map of Nigeria. Igbo-Etiti LGA is made up of twelve (12) towns/communities with moderately rolling plains and upland hills. The communities are: Ohodo, Ozalla, Ekwegbe, Umunna, Ohebe dim, Umunko, Diogbe, Ukehe, Ikolo, Aku, Idume, and Ochima. It is bounded in the west by Uzouwani LGA; in the south by Udi LGA; and in the north by Nsukka Local Government and Udenu LGA. Therefore, Igbo-Etiti LGA has readily available markets for honey as people from other parts of the state and beyond get honey from the LGA.

Sampling techniques

This study employed a two-stage sampling technique. The purposive sampling technique was used in selecting five communities in Igbo-Etiti L.G.A. This was done because of the higher concentration of beekeepers in the communities than the others. The communities selected are Aku, Ohodo, Ozalla, Ukehe, and Umunko. Twenty beekeepers were randomly selected from the five communities, making it hundred (100) respondents in the area.

Data collection

Data was gathered primarily through a well-structured questionnaire which contains beekeepers' socio-economic information, revenue generated from apiculture, costs incurred in apiculture, and barriers faced in apiculture.

Empirical analysis and model specification

Descriptive statistics, including mean, standard deviation, bar chart, and percentages, Likert scale, and gross margin analysis were used in realizing the objectives.

Gross margin (GM) is the return on investment obtained when the operating costs have been removed from the total revenue after the transaction (Mukaila, 2022). It was calculated as follows:

$$GM = Total\ revenue - Total\ variable\ costs \quad (1)$$

Benefit-cost ratio (BCR): It measures financial desirability, the viability and strength of a business, and its benefit (Falola et al., 2022a). When the BCR is higher than 1, the farm is profitable. It is calculated as:

$$BCR = \frac{Total\ revenue}{Total\ variable\ cost} \quad (2)$$

Likert scale: The barriers faced in apiculture were identified using a four-point Likert scale. The apiculturists were presented with some barriers and were asked to rank them based on their perceptions. The barriers were ranked as strongly disagree (1), disagree (2), agree (3), and strongly agree (4). A Likert mean score of 2.5 was used to group the barriers as severe and not severe. Thus, barriers with a mean score of less than 2.5 are severe, while those equal to or higher than 2.5 are not severe.

RESULTS and DISCUSSION

Socio-economic characteristics

Age is a crucial socioeconomic feature of farmers as it determines the ability of farmers to work on the farm (Chiemela et al., 2021). The results presented in Table 1 showed that the majority of the beekeepers fall below 40 years of age, and they have an average of 41.1 years of age. This is an indication that beekeeping is dominated by younger and economically active farmers. This could be because the enterprise does not require much start-up capital. This finding is not in conformity with that of Akinade (2019), who found that elderly farmers are more into beekeeping. However, it agrees with Bhatta et al. (2020), who reported that small-scale beekeepers had an average age of 40 years and Saner et al. (2004) reported that small-scale beekeepers had an average age of 43 years.

Table 1. Distribution of respondents by socio-economic characteristics (Source: Field survey, 2021)

Çizelge 1. *Katılımcıların sosyo-ekonomik özelliklere göre dağılımı*

Socio-economic characteristics	Categories	Frequency	Percentage
Age (mean = 41.1)	21-30	14	14
	31-40	38	38
	41-50	24	24
	51 and above	24	24
Gender	Male	88	88
	Female	12	12
Marital status	Married	82	82
	Single	16	16
	Widow	2	2
Level of education	Tertiary education	20	20
	Secondary education	36	36
	Primary education	30	30
	No formal education	14	14
Household size (mean = 6.2)	1-5	40	40
	6-10	56	56
	Above ten	4	4
Major occupation	Beekeeping	80	80
	Otherwise	20	20
Access to Credit	No	90	90
	Yes	10	10
Cooperative membership	No	98	98
	Yes	2	2

The majority (88%) of the respondents were male, while the rest of them were female. This is a clear indication that male farmers are more into beekeeping than female farmers, which could be a result of a fear of bees stinging among women. The result also showed that the majority (82%) were married, while a few were single (16%) and widowed (2%). Furthermore, the result showed that the beekeepers have some level of education; 36% had secondary education, 30% had primary education, and 20% had tertiary education, while only 14% had no formal education. This can influence their decision-making and adoption of technology positively (Achoja & Ukwama, 2020; Boyacı, 2022; Gbigbi et al., 2022). The result showed that a larger proportion (56%) had household sizes of 6 to 10, 40% fell within the range of one to five, while 2% had more than 10 people. Their average household size of six people is an indication that the household size can serve as cheap labour for their honey production, and this increases their revenue after sales. The majority (80%) of the beekeepers are into beekeeping as a major occupation, while 20% are not into enterprise as a major occupation. The result also revealed that the majority (90%) of the beekeepers did not have access to credit. This could restrict their production to small-scale (Mukaila et al., 2021). Also, the majority (98%) did not belong to cooperative association in the research area for beekeeping. This could affect their ability to get financial assistance (Koşum et al., 2019; Akanbi et al., 2022).

Identification of the existing beekeeping activity

Figure 1 shows that the majority (84%) of the total beekeepers practice traditional beekeeping, whereas (16%) of them practice modern beekeeping. The low number of farmers involved in modern beekeeping practice could be because of a lack of skills involved in modern beekeeping or insufficient capital to embark on the enterprise. It was discovered that both traditional and modern beekeeping are practiced in one way or the other in the study area. In the traditional method, the beekeeper begins their business by attracting a swarm to the hive and sometimes inheriting the hive, whereas in the modern method, the beekeeper purchases the colony. The cost associated with the purchase of a colony and the skills required for its use make most farmers find it easier to practice the traditional beekeeping system. The low use of the modern approach could only indicate the high level of poverty that exists among farmers. In addition, modern beekeeping practices require capital or skills. With the necessary training from agricultural extension officers and adequate grants from government and non-governmental agencies, farmers can be able to acquire and operate modern equipment and techniques in honey production enterprises.

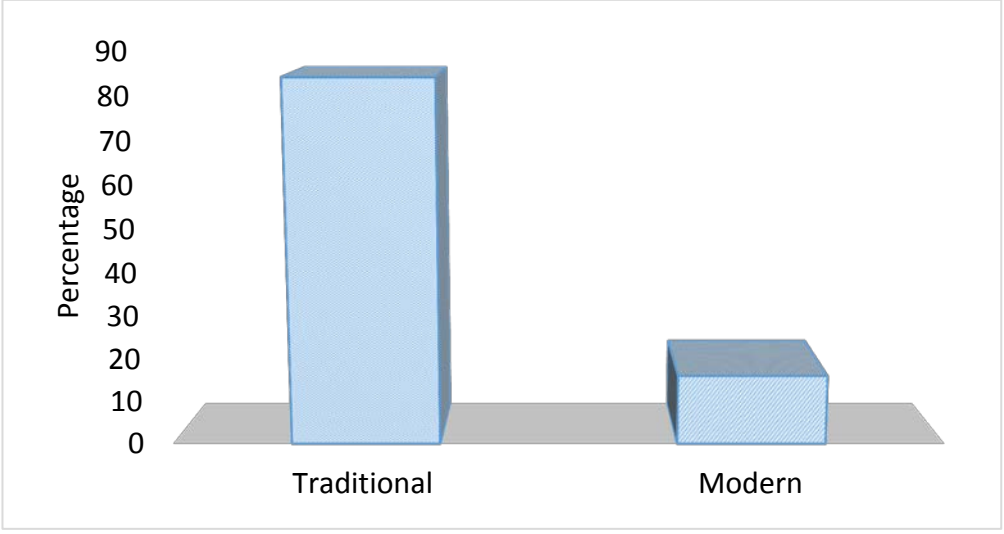

Figure 1. Beekeeping activity among the respondents (Source**:** Field survey, 2021).

Şekil 1*. Ankete katılanların arıcılık uygulamaları*

Costs and returns of traditional and modern beekeeping activity

Table 2 presents the costs and returns of traditional and modern beekeeping activity. The modern methods of apiculture had a higher honey yield (105.4 litres per production cycle) than the traditional method (52.3 litres per production cycle). Also, the quality of honey produced by modern methods was better than by traditional methods. Analysis of costs and returns of the traditional method of beekeeping revealed that the average variable cost, total revenue, and gross margin were ₦36,785, ₦109,840.46 and ₦73,055.46, respectively. The average variable cost for modern beekeeping activity was ₦98,630 while the total revenue derived from the enterprise was ₦295,120, and a gross margin value of ₦196,490. The result of the gross margin indicated that the modern beekeeping method was more profitable by ₦123,434.54. This implied that the modern beekeeping practice is more profitable even with the higher production cost compared with the relatively cheaper traditional method. The benefit-cost ratio was 2.99 for the traditional method and 2.99 for the modern method. This further gave credence to the viability of the enterprise. The result aligns with the study in Southwest, Nigeria by Ogunola et al. (2019), Assi et al. (2020) in Côte d'Ivoire and Asmiro et al. (2017) in Ethiopia, who indicated that beekeeping was very profitable. Apart from being a profitable venture for farmers, modern beekeeping practice seems to have other beneficial attributes for the quality and quantity of the honey product, such that it reduces the level of contaminated honey and as well helps to improve the yields of honey produced. It is worth noting that the cost of constructing hives had the highest share of variable costs in apiculture. The low share of labor costs was due to using household members to do most of the activities.

Table 2. Costs and returns of traditional modern apiculture practices **(**Source: Field survey, 2021)

Çizelge 2. *Geleneksel modern arıcılık uygulamalarının maliyetleri ve getirileri*

	Traditional method		Modern method	
Items	Value	Percentage share	Value	Percentage share
Quantity (Litres)	52.3		105.4	
Unit price (₦)	2,100.2		2,800	
Revenue (₦)	109,840.46		295,120	
Variable Costs (₦)				
Hive cost (₦)	34,270	0.95	93,845	0.95
Labour cost (₦)	2,100	0.03	1,850	0.02
Transport Cost (₦)	415	0.01	775	0.01
Sugar cost (₦)	-		2,160	0.02
Total variable costs (₦)	36,785		98,630	
Gross Margin (₦)	73,055.46		196,490	
Benefit Cost Ratio	2.99		2.99	

Constraints of beekeeping activity

Table 3 shows that pests are the major problem faced by traditional beekeepers with a mean of 3.32, followed by hive theft (3.24), hive vandalism (3.14), and varying climatic conditions (3.10). This implies that theft, hive vandalism, and varying climatic conditions were rated as the most frequent constraints to the traditional beekeeping system. This finding conforms with the study of Akinade (2019) and Keralem (2005), who reported that theft is a major problem associated with beekeeping. Ajao & Oladimeji (2015) also reported hive vandalism as a major problem in apiculture. In addition, these findings support the findings of Akinade (2019), Edessa (2002), and Gezahegne (2001), who stated that apiculture is affected by environmental factors. The major constraining factors facing modern beekeeping practices are lack of equipment (3.08) and lack of capital (3.04). This is an indication that the modern beekeeping

system requires capital to acquire equipment for the practice. Capital is an important aspect of agribusiness and contributes to farm investments (Falola et al., 2022b). Elzaki & Tian (2020) also reported that a lack of capital is a severe barrier to beekeeping. According to the data presented above, pests, changing climatic conditions, hive vandalism, and hive theft had little impact on modern apiculture. This could be because hives in modern apiculture are well constructed, covered, and placed in a good and secure location. Therefore, apiculturists would benefit from these important features of modern methods. On the other hand, lack of equipment and capital were not severe barriers in traditional beekeeping, which is due to the low capital requirements in the method.

Table 3. Constraints to beekeeping practices (Source: Field survey, 2021)

Çizelge 3. *Arıcılıkta karşılaşılan sorunlar*

Constraints	Traditional beekeeping		Modern beekeeping	
	Mean	Standard dev.	Mean	Standard dev.
Pests	3.32*	0.60	2.00	0.66
Indiscriminate herbicide application	2.02	0.68	2.30	0.70
Lack of knowledge and skill in modern beekeeping	2.04	0.78	2.08	0.72
Varying climatic conditions	3.10*	0.70	2.13	0.74
Lack of equipment	2.08	0.69	3.08*	0.67
Lack of capital	2.01	0.67	3.04*	0.75
Hive vandalization	3.14*	0.78	2.07	0.66
Hive theft	3.24*	0.84	2.03	0.65

* Above mean value

CONCLUSION

This study focused on the economics of the use of modern and traditional methods of honey production among beekeepers and critically assessed the costs and returns of modern and traditional methods of production in apiculture. Some studies have noted the differences in beekeeping enterprises in terms of practice, but this current study focused on the costs related to the use of traditional and modern honey production methods. Modern beekeeping practices generate long-lasting, high-quality honey and increase honey output. It is also more profitable than the usual way and is simple to grasp and apply. Thus, farmers that adopt the modern approach benefit more in terms of profit, quality of honey output, and ease of production. Even though beekeeping has economic value and helps farmers' livelihoods, the study found that both traditional and modern beekeeping practices suffer from some restrictions, including theft, hive vandalism, changing climatic conditions, a lack of equipment, and a lack of cash.

The following recommendations were made based on the findings:

- There is a need for adequate training of farmers in modern apiculture, the provision of modern beekeeping equipment and credit facilities by government and research institutes. There is also a need for farmers to locate the bee-keeping farm in a secure and favourable environment.
- Beekeepers should be educated on the value of modern apiculture to limit the consumption of contaminated honey, which is harmful to the body. In addition, beekeepers should be encouraged to adopt and use modern beekeeping practices as it is the best approach and strategy to honey production as it boosts both the quantity and quality of honey produced and, as well, makes the honey product readily available for human consumption.

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