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Article

Cost Accounting in Beekeeping Activities and Its Impact on Efficiency

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Abstract: Beekeeping represents a strategically important branch of agriculture that contributes not only to the production of honey and other valuable bee products—such as beeswax, propolis, royal jelly, and pollen—but also plays a critical ecological role through crop pollination and the maintenance of biodiversity. The economic relevance of beekeeping both nationally and internationally is further augmented by the growing demand for organic and environmentally sustainable goods in recent years. In such environment, an accounting system organized in a rational and analytical manner is needed for the effective management of beekeeping businesses, especially with regards to cost accounting. It can be very helpful for the positive construction of financial management and sales management. Because of the unique biological and seasonal nature of beekeeping, cost structures for this activity are not comparable to those of other agricultural operations. As a result, it is necessary to develop an appropriate methodical approach for the identification and classification of costs (for example: feed, payment for labor, transportation costs, maintenance of equipment and facilities used in the objects of protection). The objective of this article is to analyze the importance and role of cost accounting in beekeeping activities, emphasizing its contribution to at least two aspects: production efficiency and economic sustainability. The theoretical foundations of cost accounting, general systems of classification of costs (fixed and variable, direct, indirect), as well as a review of widespread methods for calculating production costs (full costing and variable costing approaches). Moreover, the study also assesses the impact of effective cost control and cost management practices on optimizing resources in beekeeping enterprises and operational efficiency. This study draws upon theoretical analysis, comparative evaluation and practical observations from beekeeping operations to form a methodological framework. Given the specificities of moderate cost accounting, the authors analyze its integration with management practices focusing specifically on strategic planning and sector competitiveness. The study findings suggest that by adopting standardized and transparent cost accounting system, one can significantly improve resource utilization efficiency, minimize unnecessary and hidden costs incurred in different directions of the business, and eventually enhance profitability. Furthermore, an efficient management of costs plays a significant role in better pricing policy development, ensuring financial well-being and the long-term viability of beekeeping sectors as economic units. Moreover, in this study it was found that cost accounting is not only a technical accounting function but also an important part of modern management probably due to its impact on the operational efficiency of beekeeping. As a result, enhancing cost accounting in this field is an important step towards higher economic efficiency, sustainable agricultural development and increasing the competitiveness of beekeeping enterprises in the national and international markets.

Keywords: Beekeeping, Cost Accounting, Production Costs, Efficiency, Agricultural Accounting, Honey Production, Financial Management

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1. Introduction

Beekeeping is considered one of the most valuable agricultural activities due to its economic, ecological, and social importance. Bees do more than produce honey, wax, propolis, pollen and royal jelly — they fundamentally make pollination happen within crops. They increase agricultural productivity greatly. The increasing global consumption of bee products makes the efficiency and sustainability of beekeeping enterprises an important issue [1]. Minimizing production costs is one of the main determinants of beekeeping farms success. Cost accounting gives detailed insights about day costs of labor, machine, feed, medicine transport charges & any other activities. Beekeeping enterprises may not know their actual cost of production and assess financial performance without proper cost accounting [2]. The introduction of an efficient cost accounting system in beekeeping activities ensures a proper control over the expenditure, obtaining exact prices of the products and making rational economic decisions. The purpose of this study is to carry out a cost analysis in apiculture and its performance in improving efficiencybeekeeping production [3].

2. Material and Methods

The Concept of Cost Accounting in Beekeeping

Cost accounting refers to a systematic process of recording, classifying, analyzing, and controlling costs that arise during production and business operations. It provides managers and business owners with detailed financial information about how resources are used and how much it costs to produce goods or services. In the context of agricultural activities such as beekeeping, cost accounting plays an essential role in managing production processes and ensuring economic sustainability.

Beekeeping is a unique agricultural activity because it involves biological assets and natural processes. The productivity of bee colonies depends on various factors such as climate conditions, the availability of flowering plants, seasonal changes, and proper management of bee colonies. Because of these characteristics, beekeeping enterprises must carefully track and analyze production costs in order to maintain efficiency and profitability [4].

The primary objective of cost accounting in beekeeping is to identify all expenses related to the production process and allocate them correctly to specific products or activities. Beekeeping does not only produce honey but also several other valuable products such as beeswax, pollen, propolis, royal jelly, and bee venom. Each of these products requires certain resources and labor inputs. Therefore, accurate cost allocation allows beekeepers to determine the true cost of producing each product and to evaluate which products are more profitable.

Another important function of cost accounting in beekeeping is cost control. By monitoring costs regularly, managers can identify inefficient operations, unnecessary expenditures, and opportunities to reduce production costs. Effective cost control contributes to better financial planning and improves the overall performance of beekeeping enterprises [5].

Furthermore, cost accounting helps support strategic decision-making. For example, beekeepers may need to decide whether to increase the number of bee colonies, invest in modern equipment, or expand into new markets. Reliable cost information provides the necessary basis for making such decisions in a rational and economically justified manner.

Classification of Costs in Beekeeping Activities

Production costs in beekeeping enterprises can be classified into different categories depending on their nature, purpose, and relationship to production activities. Proper classification of costs is important because it helps managers understand how resources are used and how costs influence the final price of bee products [6].

The Figure 1 is one of the most common classifications. difference between direct costs and indirect costs.

Direct costs are those made directly associated with the production of honey and other bee products. Such expenses typically include feed and sugar used to sustain bee colonies during times of low nectar flow, medicines and veterinary services used for the prevention and treatment of diseases affecting bees, and equipment directly employed in production activities such as beehives, frames, and protective clothing. Labor involved in hive management, honey extraction, and processing of products also falls under direct costs since it is directly involved in production [7].Conversely, indirect costs are expenses that assist the production process but are not easily assigned to a single product. Such costs might be electricity used in honey extraction centres, transportation costs for moving hives between areas and back to water or nectar sources, administrative costs, truck maintenance costs for communication equipment buildings or upkeep. While these expenses do not generate honey directly, they are essential for the functioning of the business as a whole [8].

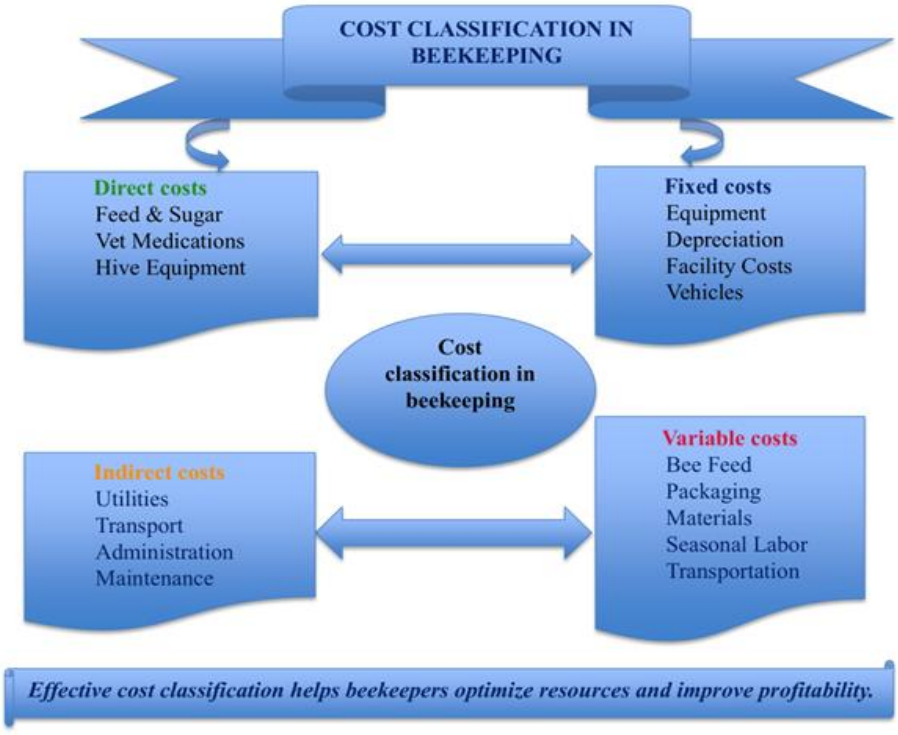


Figure 1. Cost Classification in Beekeeping Activities

Another important classification of costs is based on their behavior relative to production volume. In this case, costs are divided into **fixed costs and variable costs**.

Fixed costs remain relatively stable regardless of the level of production. In beekeeping, fixed costs may include the depreciation of equipment such as honey extractors, buildings, storage facilities, and vehicles used for transporting hives. These costs must be paid even if production levels fluctuate [9].

Variable costs, however, change depending on the scale of production. Examples of variable costs include feed for bees, packaging materials for honey, seasonal labor wages, and transportation expenses related to the movement of hives. As production increases, these costs generally increase as well [10].

Understanding these cost categories helps beekeepers analyze the cost structure of their operations. This knowledge allows them to identify areas where expenses can be

reduced, improve resource allocation, and ultimately enhance the economic efficiency of the enterprise.

Methods of Calculating Production Costs

In order to manage production efficiently Figure 2. beekeeping enterprises must calculate the cost of producing honey and other bee products accurately. Various cost accounting methods can be used for this purpose depending on the size of the enterprise and the complexity of its operations.

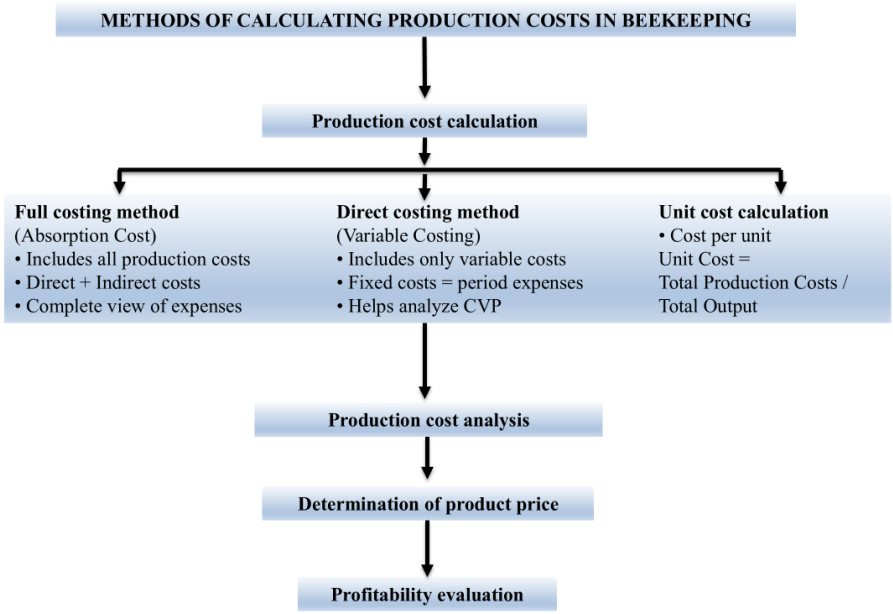


Figure 2. Methods of calculating production costs in beekeeping

One commonly used method is the **full costing method**. Under this method, all production-related costs, including both direct and indirect costs, are included in the calculation of product cost. This approach provides a comprehensive view of the total expenses involved in producing honey or other bee products. Full costing is particularly useful for determining long-term profitability and establishing product prices that cover all operational expenses.

Another important method is **direct costing**, also known as variable costing. In this method, only variable production costs are included in the calculation of product cost, while fixed costs are treated as expenses of the accounting period. Direct costing helps managers analyze the relationship between production volume, costs, and profit. It is especially useful for short-term decision-making, such as determining whether it is profitable to increase production during a specific season [11].

In practical beekeeping operations, the cost of production is often calculated by dividing the total production costs by the total quantity of products produced during a given period. For example, the cost of producing honey can be calculated by dividing the total annual production costs by the total kilograms of honey harvested.

To illustrate this process Figure 3. consider a beekeeping farm that spends $10,000 annually on feed, medicines, equipment maintenance, transportation, labor, and other operational costs. If the farm produces 5,000 kilograms of honey during the same year, the average production cost per kilogram of honey would be calculated as follows:

Production Cost per kg = Total Production Costs / Total Output

Production Cost per kg = $10,000 / 5,000 kg = $2 per kg

This calculation allows the beekeeper to determine whether the selling price of honey is sufficient to cover production costs and generate profit. Accurate cost calculations also help producers develop competitive pricing strategies and ensure the financial sustainability of their businesses [12].

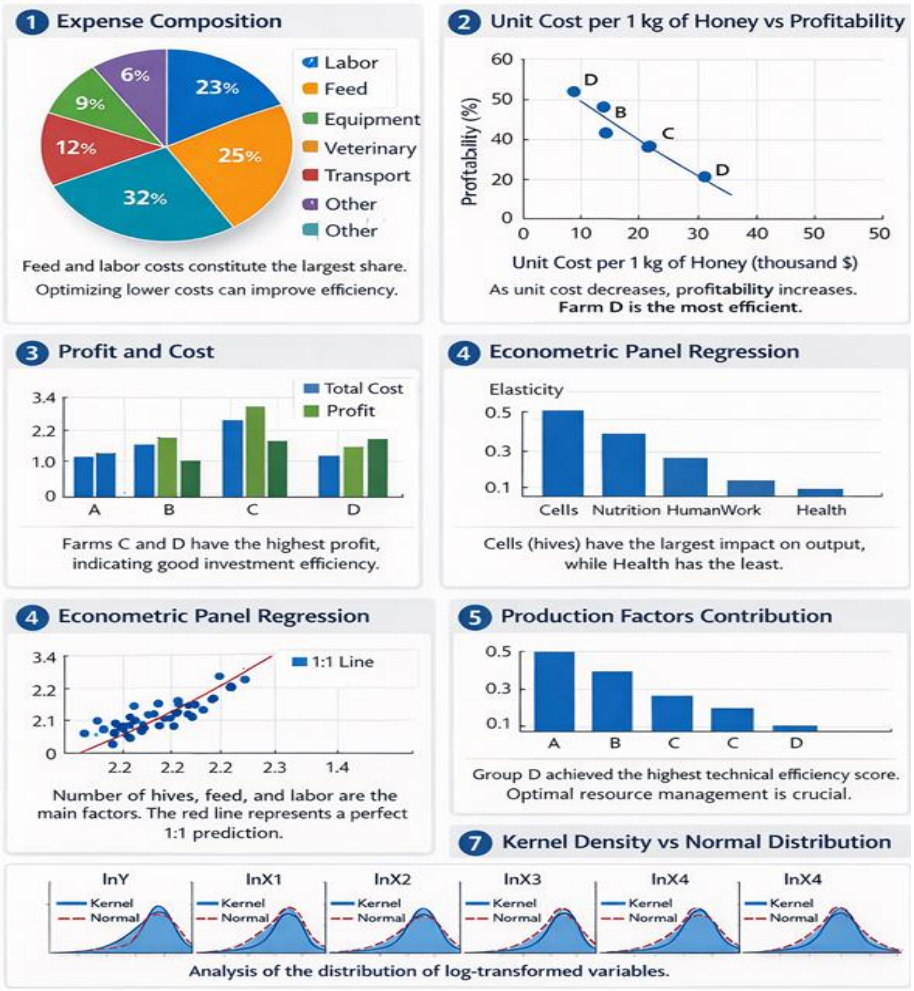


Figure 3. Beekeeping Efficiency – Visual Report (Final Version)

3. Results and Discussion

The main objective of this study was to analyze the efficiency and profitability of beekeeping operations across multiple farms. Specifically, it aimed to:

1. Assess the cost structure and identify the main contributors to expenses.
2. Evaluate the relationship between unit cost and profitability.
3. Examine production factors and their contribution to honey output.
4. Measure technical efficiency using DEA and econometric panel regression.
5. Compare log-transformed variable distributions to normal distributions to understand data patterns [13].

Results:

- **Cost Structure:** Feed and labor represent the largest share of operational expenses.
- **Profitability:** Farms C and D are the most profitable and efficient. Lower unit costs are associated with higher profitability.
- **Production Factors:** Number of hives (Cells) has the largest impact on honey output, followed by nutrition and labor. Health factors contribute the least.

- **Technical Efficiency:** Farm D achieved the highest DEA technical efficiency score, indicating optimal resource management.
- **Data Distribution:** Kernel density analysis shows that log-transformed variables closely follow normal distributions, validating assumptions for regression analysis.

Recommendations:

1. **Optimize Costs:** Focus on reducing feed and labor costs without compromising hive productivity.
2. **Expand Efficient Practices:** Farms should adopt practices used by Farm D to improve profitability and technical efficiency.
3. **Focus on Key Factors:** Invest in increasing the number of hives and improving nutrition and labor management to maximize output.
4. **Data-Driven Management:** Use regular monitoring and statistical analysis to guide decision-making and identify inefficiencies.
5. **Sustainable Development:** Encourage practices that maintain hive health while optimizing resource allocation for long-term efficiency.

Summary: By analyzing cost, profit, production factors, and technical efficiency, this study provides actionable insights for enhancing beekeeping productivity. Implementing data-driven optimization strategies can significantly improve profitability and sustainability in apiculture operations.

Economic analysis: The Table 1. average variable costs, fixed costs and total production costs per hive were found at 18.53 US$, 34.79 US$ and 53.32 US$, respectively. According to Kruskal Wallis test, feed, drug, honeycomb, jar-tin, temporary labor expenses, bee capital interest, device-machine amortization, device-machine capital interest, union subscription, total fixed costs and total production costs changed according to the enterprise size groups.

Table 1. Total fixed costs and total production costs changed according to the enterprise size groups

Table 1. Variable, fixed and total costs of beekeeping in the enterprises (US$/hive).

Cost items	Enterprise groups			Average	P
	First group	Second group	Third group		
Variable costs	17.52	18.55	19.74	18.53	0.916
Feed (sugar) costs	2.28	4.66	5.49	4.13	0.038**
Drug costs	2.89	1.76	2.38	2.27	0.010*
Honeycomb costs	3.44	2.06	2.76	2.67	0.035**
Fuel-transport costs	5.46	6.87	5.24	6.02	0.116
Jar-tin costs	1.66	1.15	1.63	1.43	0.047**
Accommodation costs	0.47	0.41	0.36	0.42	0.571
Temporary labor costs	0.07	0.70	0.83	0.54	0.082*
Repair and maintenance costs	0.73	0.40	0.47	0.52	0.868
Circulating capital interest	0.51	0.54	0.57	0.54	0.912
Fixed costs	46.10	31.81	26.07	34.79	0.004***
General administration expenses	0.53	0.56	0.59	0.56	0.910
Family labor fee	33.90	25.68	22.09	27.32	0.274
Bee capital interest	6.98	2.47	1.35	3.59	0.000***
Device-machine amortization	2.64	1.74	1.17	1.87	0.001***
Device-machine capital interest	1.15	0.72	0.52	0.80	0.002***
Subscription	0.42	0.18	0.11	0.24	0.000***
Insurance fee	0.48	0.47	0.24	0.41	0.930
Total production costs	63.62	50.36	45.81	53.32	0.057*

*: Significant at 10% significance level; **: Significant at 5% significance level; ***: Significant at 1% significance level; 1 US$= 4.813 TL in 2018 (average).

The figure 4. “Operational costs in beekeeping” illustrates the main categories of current (operational) expenses that arise during the management of a beekeeping enterprise. These costs represent the resources required to maintain bee colonies, produce

honey and other bee products, and manage the overall functioning of the apiary. Each category reflects a specific aspect of beekeeping operations.



Figure 4. Structure of operational costs in beekeeping

Transport and logistics. Transport and logistics costs are associated with the movement and handling of beekeeping equipment and bee colonies. In migratory beekeeping, hives are often relocated to areas with abundant flowering plants in order to increase nectar collection and honey production. This category includes expenses related to hive relocation, loading and unloading of beekeeping equipment, fuel and transportation costs, transportation of hives for crop pollination, and delivery of honey and other bee products to markets or processing facilities. Efficient logistics management is essential to reduce transportation expenses and ensure timely movement of bee colonies.

Feed costs. Feed costs represent the expenses related to providing additional nutrition to bee colonies, especially during periods when natural nectar and pollen sources are limited. These costs typically include sugar syrup used as an energy source, protein supplements that substitute natural pollen, vitamins and mineral additives that strengthen bee immunity, spring stimulative feeding to accelerate colony development, and winter feeding to ensure colony survival during cold seasons. Proper feeding practices are crucial for maintaining healthy and productive colonies.

Veterinary and preventive costs. Veterinary and preventive costs are related to maintaining the health of bee colonies and preventing the spread of diseases. Beekeeping enterprises often require veterinary services for professional inspection, disease diagnosis to identify infections at early stages, disinfection procedures to maintain hygienic conditions in the apiary, and parasite control measures to combat pests that threaten bee colonies. Preventive health management reduces colony losses and improves productivity.

Medications and biological treatments. This category includes the cost of medicines and biological treatments used to control bee diseases and parasites. The most common treatments are Varroa mite treatments, Nosema disease control, organic acids used as natural treatments, and biological remedies that enhance colony resistance to diseases. Effective use of medications helps maintain colony health and ensures stable production of bee products.

Labor costs. Labor costs include the wages and benefits paid to workers involved in beekeeping activities. These expenses consist of regular wages of beekeepers responsible for colony management, salaries of seasonal workers hired during peak periods, additional labor required during honey harvesting, and insurance contributions or social payments related to employees. Skilled labor is essential for maintaining colony health and maximizing honey production.

Equipment maintenance. Equipment maintenance costs are associated with keeping beekeeping tools and infrastructure in proper working condition. These costs include repairing and maintaining beehives, replacing damaged frames, maintaining honey extractors and other processing equipment, and storage costs related to keeping beekeeping equipment and materials. Regular maintenance helps prolong equipment life and prevents unexpected production disruptions.

Production utilities. Production utility costs are the operational expenses associated with processing bee products. These charges generally cover the electricity utilized for honey extraction and processing machinery, water expenses incurred during cleaning and processing operations, fees related to honey processing and packaging, as well as other materials required for manufacturing activities. Poor management or wasted utilities can add up to substantial costs which could be minimized with proper management.

Winter preparation. These are incurred winter preparation costs related to activities that help maintain the survival of bee colonies during winter. These costs include helping to feed bees enough to stockpile food supplies, beehive insulation to protect the colonies from low temperatures, buying the necessary materials for winter protection and giving bees a leg up ahead of winter. Winters can be challenging for bee colonies and proper preparedness is essential to reducing colony losses and ensuring productive hives the following season.

Administrative and management costs. Administrative and management costs are those associated with organizing and managing the beekeeping enterprise. These costs cover communication expenses, accounting as well as office management related costs, traveling expenses dedicated to bee operation businesses and insurance or marketing costs linked with selling honey bee products. It is only through effective managerial skills that production and marketing can be interspersed at the same time.

Overall significance. These categories encapsulate the complete scope of operational costs of beekeeping. Detailed understanding and analysis of these cost components assists beekeeping enterprises in determining the real cost Sitka benefits, effective control of production costs, and improve economic effectiveness. Through proper cost management strategies, beekeepers can manage their resources better, eliminate unnecessary spenderings and maximize profitablity and sustainability of operations.

Example of how cost advantage makes MNCs more efficient

It is very important to improve operational efficiency of beekeeping enterprises with effective cost accounting. This also provides beekeepers with a clearer picture of how resources can be improved by systematically recording and analyzing production costs. Cost accounting is one of the key advantages as it helps identify unnecessary costs and inefficiencies. For example, if a beekeeper notices that the costs of feed appear to be excessive, a closer examination may show issues related to inefficient feeding or poor management practices within their bee colonies. By spotting these issues, managers can take corrective measures that decrease costs and increase productivity.

It also helps management to make smart business decisions. This information is one of the building blocks for producers to assess potential strategies, whether it be increasing the scale by adding more bee colonies, investing in new technology or diversifying production through the additional use of other bee products such as pollen or propolis.

Those decisions would rely on assumptions, not on objective financial analysis[14], without accurate cost data.

Cost accounting has one more major benefit, which is the increase of profitability. Monitoring production costs closely enables beekeeping enterprises to find ways in which they can reduce costs without sacrificing product quality. It is imperative that lower production costs boost the profit margin whilst promoting the financial viability of the enterprise.

Furthermore, cost accounting plays a vital role in ensuring transparency and accountability in financial reporting. This is especially significant for agricultural entrepreneurs seeking investment, financing, or participation in government development programs. Clear and precise financial records make beekeeping enterprises more credible, allowing them to attract investors' attention or obtain loans from financial institutions. Finally, effective cost accounting helps improve long-term planning and risk management. Since beekeeping production is influenced by environmental factors such as weather conditions, disease outbreaks, and changes in nectar availability, careful financial planning becomes essential. By maintaining accurate cost records, beekeepers can better prepare for potential risks and maintain stable financial performance even under challenging conditions [15].

4. Conclusion

Cost accounting in beekeeping farms plays a significant role as it is closely related to management and can help not only with the financial records, but also determining whether the company has enough means of production available for ongoing operations. This allows beekeepers to gain accurate and full information about the economic structure of its activities through a systematical identification, recording, classification and analysis of production costs. This is fundamental for determining the actual cost of producing something, measuring profitability and providing evidential support for managerial decisions.

The study further validates the idea that correct accounting of cost, whether it be fixed and variable or direct and indirect, along with methodical calculation, is critical in driving production efficiency. The use of the right costing methods, like full costing and variable costing, will help beekeeping units to comprehend cost action for pricing strategies and financial performance. They should also have effective cost control mechanisms that can help enterprises to identify inefficiencies, get rid of unnecessary expenses, and use resources optimally.

Additionally, the findings underscore that an organized cost accounting system plays a crucial role in enhancing transparency and accountability in beekeeping practices. It also enhances internal financial control, ensures effective monitoring and evaluation as well as adherence to modern accounting standards. Greater transparency is essential to gaining access to new markets, attracting investment, and earning the continued trust of stakeholders in an increasingly competitive and globalised market. One more significance of this study is the involvement of cost accounting in strategic and risk management planning. Cost accounting systems facilitate beekeeping businesses to assess risks, react to changes in the environmental and economic environment, and plan for sustainable growth by providing timely and detailed financial information. This has special significance in the field of beekeeping, as production relies heavily on biological processes and environmental externalities. As demand for honey and other bee products worldwide burgeons, especially in the organic and eco-friendly lands of production, it becomes clear why advanced cost accounting systems are needed. The modern enterprise accounting practice can improve the competitiveness, product quality and high value-added into higher industrial clusters.

As a result, it is necessary to consider the development and improvement of beekeeping enterprise cost accounting systems as a strategic task at the microeconomic (enterprise) and macroeconomic (country) levels. Improvement of financial management tools will mean not only raising economic efficiency and profitability at the level of a single beekeeping farm but also this is an indispensable factor for sustainable development within the agricultural sector. Related to this, additional research and policy assistance, focused on the incorporation of cost accounting into contemporary management practices, is critical for releasing the full economic power of the beekeeping sector.

REFERENCES

[1] R. A. Morse and N. W. Calderone, *The Value of Honey Bees as Pollinators of U.S. Crops*, Ithaca, NY: Cornell Univ., 2000.

[2] E. Crane, *The World History of Beekeeping and Honey Hunting*. London: Routledge, 1999.

[3] Food and Agriculture Organization (FAO), *Beekeeping and Sustainable Livelihoods*. Rome: FAO, 2013.

[4] FAO, *Good Beekeeping Practices: Practical Manual on How to Identify and Control the Main Diseases of the Honeybee*. Rome: FAO, 2011.

[5] J. R. Moffett and R. W. Meyer, "Economic value of honey bees in crop pollination," *American Bee Journal*, vol. 125, no. 12, pp. 781–783, 1985.

[6] A. A. Al-Ghamdi, N. Adgaba, and A. Tadesse, "Cost-benefit analysis of beekeeping in developing countries," *Journal of Apicultural Research*, vol. 56, no. 3, pp. 1–10, 2017.

[7] D. Sammataro and A. Avitabile, *The Beekeeper's Handbook*, 4th ed. Ithaca, NY: Cornell Univ. Press, 2011.

[8] M. K. Gupta, "Financial management and cost accounting in small-scale beekeeping," *International Journal of Agricultural Economics*, vol. 4, no. 2, pp. 45–52, 2019.

[9] S. R. Joshi and P. K. Joshi, "Profitability and efficiency of honey production: A case study," *Agricultural Economics Review*, vol. 10, no. 1, pp. 89–97, 2009.

[10] International Labour Organization (ILO), *Beekeeping for Rural Development: A Training Manual*. Geneva: ILO, 2015.

[11] A. Bogdanov, *Quality and Standards of Pollen and Beeswax*. Bern: International Honey Commission, 2009.

[12] P. Kotler and K. L. Keller, *Marketing Management*, 15th ed. Pearson, 2016.

[13] C. T. Horngren, S. M. Datar, and M. V. Rajan, *Cost Accounting: A Managerial Emphasis*, 16th ed. Pearson, 2018.

[14] R. G. Hubbard and A. P. O'Brien, *Economics*, 7th ed. Pearson, 2019.

[15] World Bank, *Agriculture and Food: Beekeeping and Rural Economy Development*, Washington, DC: World Bank, 2020.