Analytical Study of Small Scale Beekeeping Farming in Eswatini: A case study in Manzini Region, Eswatini

ABSTRACT

AIMS: Smallholder beekeepers play an important role especially livelihood of the rural and semi-urban communities of Eswatini yet the enterprise attracts less beekeeping farmers. This study aims at contributing to the existing literature related to socio-economics analysis of beekeeping farmers and their impact on production, and highlights the opinion on challenges and opportunities of small scale beekeeping farmers.

STUDY DESIGN & METHODOLOGY: A descriptive cross-sectional research design was employed in the study across the region with the main objective of determining the socio-demographic factors and output of beekeeping farmers. The study engaged 47 randomly selected beekeepers and random sampling technique was used. The study employed the multiple regression models to analyse the factors affecting honey production among small-scale beekeeping farmers.

RESULTS: The results indicate that majority (70.2%) of respondents were male apiculture farmers, averagely aged 32 years old, attained secondary education (51.0%), majority of interviewed farmers had less than 5 years of experience in apiculture, and about 31% of the small scale beekeeping farmers used traditional and Swazi top bar hives. The results also revealed that a large percentage of farmers obtained only between E1,001 and E2,500 in income from the beekeeping farming. The regression model results indicated that experiences in beekeeping and number of hives were significantly related to honey produced by the beekeeping farmers. The results also revealed that apiculture farmers interviewed indicated that they had poor access to technical support, limited access government support, poor access to financial credit, use of ICT in marketing their produce and limited access to extension services related to beekeeping.

RECOMMENDATIONS: This study recommends that in addition to improved access to beekeeping financial support and number of bee hives, the government, private sector and other organisations promoting improved livelihoods of smallholder beekeeping farmers should formulated and implement strategies aimed at increased access to extension services mostly related to technical support and use of digital technology to enable increased production and marketing of farmers' output.

Keywords: *Beekeeping, Eswatini, Honey Production, Small-Scale Beekeeping Farmers, Analytical Regression Model*

1. INTRODUCTION:

"Agriculture is the backbone of the economy of Eswatini (former Swaziland) and a major source of livelihood for urban and rural households. Among the agricultural enterprises carried out in the Eswatini include the following farming: sugarcane, citrus, maize, dairy and beekeeping. Given the government importance of agricultural sector in the country, the Ministry of Agriculture of Eswatini sets goals and objectives of increasing the contribution of agriculture to economic development, reduce rural poverty and improve food and nutrition security. In addition, rural development has become more important in Eswatini because rural areas also contribute to the development of the national economy. Beekeeping is one of the agricultural sub-sector carried out by smallholder farmers in Eswatini and this enterprise is mostly supported by the man-made forest cover. Eswatini's vegetation is mostly covered by the man-made forest and the major parts of the country that are covered by forests are in the highlands regions. Literature attests that honey production is positively affected by the type of vegetation, thus, thanks to the presence of forests, the promotion of beekeeping has great potential in the country" [1].

"Forestry is one of the most important sectors of the economy of Eswatini. The outskirts of the Manzini region have a substantial potential in beekeeping with their rich flora, proper ecological conditions and existence of colonies. Moreover the area is mostly covered by natural and commercial forests. As per the survey areas conducted by Masuku in 2013" [1], "apiculture can be one of the potential solution to the Government of Eswatini's by creating jobs, increasing income generation capabilities to reduce poverty and improving the food insecurity situation of households and the country as a whole" [1].

Food security is a major global issue, and a heavier burden in developing countries like Eswatini. The United Nations placed this problem second on the Global Sustainable Development Goals (SDGs) speaking to the gravity of the problem. Food security can be defined as the ability of a household, community, region or country to have enough balanced dietary food, reliable and sustainable food. In the quest to combat this problem countries have placed different strategies most suitable to them. Eswatini as well has a number of avenues to alleviate this problem, including capacitating of the agricultural sector to both generate food and further sell to gain income. However, not all the placed strategies are sufficient. Like apiculture which holds a great demand but has limited information for farmers to be applicable in practice and generate income for the attaining of the global goal. The constraints to information access have even limited the production of honey in Eswatini. Furthermore, the practicing farmers are not producing at their potential capacity, and do not make profits or even break even. Literature reviewed also revealed that the farmers experience a lot of challenges which include: bees being exposed to a number of threats such as climate change, reduced biodiversity, and invasive species that reduce their quality of health and longevity [2].Therefore this study seeks to add to recent literature by exploring the factors influencing profitability of small scale apiculture farmers in Eswatini [2]. The main objective of this study was to investigate and explore the socio demographic characteristics of small-scale beekeeping farmers and their impact on production, and highlight the opinion on challenges and opportunities of small scale beekeeping farmers.

2. LITERATURE REVIEW:

According to Eswatini's Government National strategic opportunity programme (2022), "agriculture is considered as the backbone of the economy in the African continent as a whole. About 70% of Africans and roughly 80% of the continent's poor live in rural areas and depends on the agriculture for their livelihoods. After the decline of agriculture's contribution to the nation's Gross Domestic Product (GDP) from 21% to only 7.8%, the Eswatini National Agricultural Summit (SNAS) was organized in 2007 to respond Eswatini Agricultural Development programme (SADP) [3-4]. The major drive of the SNAS was to plan the reunion of agricultural productivity systems to enable farmers to create wealth for themselves, thereby making a significant and positive contribution to food security, rural development, job creation and poverty reduction in Eswatini".

According to Tabinda et al. "apiculture can be defined as the maintenance of honey bee colonies, commonly in hives by humans" [5]. "Beekeeping provides an excellent source of income for landless farmers, since it is migratory in nature, even the landless farmer can take up this enterprise. It is prudent that the intervention does not compete with crop production or animal husbandry for any input. The beekeeper needs only to spare a few hours in a week to look after the bee colonies, making it ideal as part time activity" [6]. Okpokiri et al. mentioned the use of honey for health remedies in rural areas

[7]. “Honey provides an important part of the energy needed by the body for blood formation and helps in cleansing the blood” [8]. According to Carruthers and Rodriguezi [8], “beekeeping provides local people with an economic incentive for preservation of natural habitat enhancing environmental quality thus; labour in rural areas can be utilized especially during dry seasons. Beekeeping is an activity that fits well with the concept of small-scale agricultural development. It is a labour-intensive undertaking, which can be easily integrated into larger agricultural or forestry projects”. “Beekeeping is an enterprise that offers great potential for development in Eswatini since it is easy and cheap to manage. For farmers to practise beekeeping they require little land and its quality is less important since the beehives are placed on trees” [9]. “This enterprise serves as a means of empowering small-scale farmers who have low capital investments” [10].

“Many uses of honey according to Issa include pollination of flowers for food increase and production” [11]. “Beeswax is used in the manufacturing of cosmetic candles, foundation sheet (for houses), and polishes. Propolis produced by honey bee has some therapeutic and antibiotic usage, pollen is used for making of perfumes, and bee venom is useful for treatment of rheumatism, eye and skin diseases while royal jelly is used to cure infertility. Other benefits of beekeeping include cheapness as the insects can produce their own food all year round. Availability of all necessary inputs locally can easily be initiated on limited level for employment and income generation, does not depend on importation of foreign equipment’s or inputs” [12].

2.1 Factors Affecting Honey Production:

“According to Pokhrel, predators, uncontrolled forest fires, parasites and diseases are some of factors affecting beekeeping and this will eventually lower production due to the fact that honeybees will be engulfed by a lot of diseases, limiting the status of bees making honey” [10]. “Angelo and Giovanni highlighted the advancements and challenges of beekeeping farming” [13]. “Masuku pointed out that this is attributed to lack of adequate knowledge of management practices needed in beekeeping. Honeybees can also be affected when using plants for their nectar that had been treated with a high concentration of pesticides because the use of this treated nectar kills the bees and, in that case, lowers production in terms of output” [1]. “Beekeepers therefore should control damage on vegetation planted close to the project area, by making use of less concentrated pesticides on such plants or crops” [14]. Tulu et al. mentioned “the improved beekeeping technology in South Western Ethiopia and also highlighted the beekeepers’ perception, adoption rate and determinants” [15]. “Masuku found that age can be a factor in beekeeping, during harvest times or hard operations you may find that only young adults are able to do all operations requiring man-power” [1].

“Gender is another factor that affects honey production in a country. Take for instance, a lot of women find it difficult harvesting their product due to bees" stings; and may be the division of labour that exist may limit the participation of women in beekeeping” [16]. “Lack of technical know-how can be another factor in honey production in the sense that beekeeping is mainly practiced in rural areas. These areas have people who are less educated in agricultural practices due to the fact that they are unable to get funds for their education thus limiting the harvested honey yields” [16]. According to Gamez *et al.*, “poor availability of bees especially during winter affects honey production. When the colony is not well fed, it will leave the area at the same time affect the yield. Beekeepers therefore, introduce sugar syrup in their feeds at least 6 weeks prior to the onset of the first major nectar flow and this may encourage the production of bees that will be at the appropriate age for foraging by the time of the main nectar flow” [17].

2.2 Honey production in Eswatini:

“The nutritional and healing properties of honey have been given much accolade throughout the ages. Honey contains a diversity of substances, which are indispensable to all living things [18]. Although, honey and other beekeeping products are very important (economically and socially), humans have not fully utilized the benefits of these products” [1]. “Beekeeping is regarded as a vocation. It is yet to be practised as a paying occupation. It is obvious that the practice improves the ecology of an environment and helps in plant reproduction, which largely improves the living standard of the people and the nation’s economy at large. Despite its numerous benefits and uses to humans and its importance in the society, very few people are engaged in bee keeping” [1]. “Consequently, the few people who engage in beekeeping as a business are not only sceptical but are also not totally committed to it. Another source of

concern is that, because of the associated bee-keeping problems, especially the seemingly lack of technical know-how, only little or nothing is known about the level of production levels of the few who practice it. Some NGOs are promoting and providing the services for the uplift of beekeeping farming through projects and programmes in Eswatini" [19-20].

3. METHODOLOGY:

3.1 Study area

The study was conducted in the Manzini region, located in the center-west of the country. The Manzini region has an area of 4,093.km and a population of 355,945 (Swaziland Census, 2017). The economy of the region is dominated by services, tourism, forestry, citrus and vegetable production. The forestry industry and vegetable production as well as crop production is one of the most important sectors of the Manzini economy.

3.2 Research design

A descriptive cross-sectional research design was employed in the study across the region with the aim of determining the socio-demographic factors of small scale beekeeping farmers in the region of the country Eswatini. The primary data was collected from the small scale beekeeping farmers. The target population was 79 beekeepers in the Manzini region and this was based on a sample frame that was obtained from the Ministry of Agriculture, Govt. of Eswatini. The study engaged 47 randomly selected beekeepers and random sampling technique was chosen because it is capable to eliminate biasness, both intentionally and unintentionally and provide the better estimate of parameters. This helps in such a way that every member of the population has an equal chance of being chosen in the study [21-22]. Self-designed, well-structured and pre-tested questionnaire were used to obtain the relevant information from the beekeeping farmers [23]. Simple descriptive statistics were used to analyse the data obtained. Analytical regression model used to determine the factors affecting honey yields. Theoretically, the analytical framework used in this study was based on the production function. The regression analysis was used to determine the impact socioeconomics characteristics on beekeeping farming and honey production. A Cobb-Douglas production function was used to determine the factors that influence honey production among beekeeping farmers [1].

3.2 Analytical Regression Model:

$Y = \beta_0 X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} e^u$ ---------- (1)

By taking the natural logarithm,

$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + u$ ---------- (2)

Where; Y = Total honey produced (kg); X_1 = Experience of beekeeping (years); X_2 = Family Labour measured in working hours; X_3 = Number of hives; X_4 = Age of beekeeping farmers; X_5 = Gender of beekeeping farmers; X_6 = Inputs cost

Table 1. Description of variables used in the study.

Variables	Description and Unit	Expectations
Y	Honey Produced in Kg.	+
X_1	Experience in beekeeping farming in Years	+ or –
X_2	Family Labour (Working hours)	+
X_3	Number of Hives	+
X_4	Age of beekeeping farmers in Years	+ or –
X_5	Gender of beekeeping farmers (1= Male; 0 = Female)	+ or –
X_6	Total Inputs costs in Emalangeni (E)	+ or –

4. RESULTS AND DISCUSSIONS:

The results revealed that about 70% of the respondents were males, and this is due to the nature of the vocation since the farmers were exposed to the risk of being stung by the bees for which the women fold

are not strong enough to withstand or are scared off. The results further that a majority of the farmers practicing beekeeping farmers are between 31 and 40 years age and 61.7 were married. The nature and size of the household also gives to the need of gaining more income to feed and care. The results indicate that average household size was 8.6 and about 52% had secondary education and 14% had primary education. This is good for the beekeeping industry because farmers will be able to read and adopt and new technologies associated with beekeeping. Beekeeping like any other agricultural enterprise, it success and sustainability depends on the number of years it has in the business or how long the workers have been in this field. Results indicate that average experience was 2.8Years. A large percentage (36.2%) of farmers revealed that they obtain between E1001 and E2500 and only14.9 % obtained more than 10000 per month and 59% of famers who have other alternative source of income other than beekeeping farming (Table 2).

Table 2. General information about the beekeeping farmers

Socio Demographic Variables	Frequency	Percentage
Gender		
Male	33	70.2
Female	14	29.8
Age		
15-20	11	23.4
21-30	12	25.5
31-40	13	27.7
41-50	6	12.8
50>	5	10.6
Marital Status		
Married	29	61.7
Single	18	38.3
Level of Education		
Primary level	21	44.7
Secondary Level	19	40.4
Tertiary Level	07	14.9
Household Size		
1 - 5	17	36.2
6 - 10	10	21.3
11 - 15	17	36.2
>15	3	6.4
Family Members Employed in the Farming		
1 - 2	23	48.9
3 - 4	21	44.6
➢ 4	3	6.4
Experience in beekeeping (Years)		
< 1	11	23.4
2 - 3	22	46.8
4 - 5	12	25.5
> 6	2	04.3
Family Income in Emalangeni (Monthly)		
1001-2500	17	36.2
2501-5000	16	34
5001-10000	7	14.9
>10000	7	14.9
Any other source of Income		
Yes	28	59.6
No	19	40.4

Table 3 presents information related to the types and beehive characteristics. The type of beehives used by small scale beekeeping farmers in the Manzini region includes Lang troth hive, Top bar hive and the

Traditional hive. Result shows that 68% of the farmers used the traditional and Swazi top bar hive which is mostly homemade and is affordable for the beekeepers. Table 3 indicates that only 27.7% farmers received extension services from government. This table also mentioned majority (42.6%) of the farmers only produce less than 100 kg.

Table 3. Beekeeping Farming Variables with Frequency

Beekeeping Farming Variables	Frequency	Percent
Type of Hives		
Lang troth Hive	01	2.1
Top bar Hive	17	36.2
Lang troth & Top bar Hive	13	27.7
Lang troth & Traditional Hive	01	2.1
Top bar & Traditional Hive	15	31.9
Extension Service Provider		
Government	13	27.7
Techno Serve	03	06.4
Others	04	08.5
None	27	57.4
Total Honey Produced in Kg.		
10-100	20	42.6
101-200	11	23.4
201-300	05	10.6
301-400	03	06.4
401-500	02	04.2
>501	06	12.8

The results in Table 4 reveal that 78% of the variation in honey production is explained by the variables in the model. The results further revealed that honey production was positively and significantly influenced by the experience of the beekeeping in honey production ($p < 0.05$) and the size of the colony ($p < 0.05$). The findings suggest that an increase in the beekeeping experience by 1% would result in an improvement in honey production by 0.405%, while an increase by colony size by 1% would result in an improvement honey production by 0.568%. The more experienced farmers tend to have better management skills of bee farming. Experience promotes farmers to master complex practices in bee keeping. Hauser and Lensky [24] and Masuku [1] also found significant influence of colony size on honey yield.

TABLE 4. Variation in honey production

Variable	β (Coefficients)	p- value
Constant	2.980	0.01
Experience in beekeeping	0.405	0.02
Family Labour	0.239	0.11
Age of beekeeping farmers	0.259	0.81
Gender of beekeeping farmers	0.058	0.85
Number of hives	0.568	0.01
Total Input costs	0.031	0.51
R^2 = 0.81	**Adjusted R^2= 0.78**	

Results in the Table 5, indicates the constraints faced by respondents in the beekeeping activity. The major problem was disease and pests incidence and it was difficult for farmers to overcome this issue. Second constraint was absconding of honey bees and floral density. Time and market management also important constraint for the beekeeping farmers, if they can produce more quantity of honey then it's problematic for market and also to get good price of honey in the market. Many other constraints are listed in Table 5.

TABLE 5. Constraint in Beekeeping

Constraint in Beekeeping	Frequency	%
Disease and pests control	11	23.4
Absconding of honey bees	09	19.2
Floral Density	09	19.2
Marketing problem	08	17.0
Reduction of honeybee hives	07	14.9
Time constraint	07	14.9
Death of colony	06	12.7
Transportation	04	08.5

About 60% of the farmers said they are able to overcome challenges they face, and only 40.4% said they are poor in handling the challenges (Table 6). These results reveal that the beekeeping has a huge potential and therefore continuous monitoring required in disabling the challenges. Over 70% of the respondents revealed that they are able to secure and service reliable market and only 25.5 said they have challenges regarding markets. Table 6 indicates how the respondents revealed that they have a significant problem with adapting with the markets during winter season, as over 50% responded poor in ability to adapt to market changes in winter season due to low production, which points another challenge there still challenging in beekeeping in the another hand 40% farmers also using social media for business purposes. Farmers also significantly mentioned about the Government policy and technological support.

Table 6. Opinion of Beekeeping farmers

Opinion of Beekeeping farmers	Good Frequency (%)	Better Frequency (%)	Poor Frequency (%)
Able to handle the situations	13 (27.7)	15 (31.9)	19 (40.4)
Availability of Reliable Market	11 (23.4)	24 (51.1)	12 (25.5)
Ability to adopt market changes during the off season	03 (06.4)	20 (42.5)	24 (51.1)
Using Social Media for Business	03 (06.4)	16 (34.0)	28 (59.6)
Access to financial credit	04 (08.6)	11 (23.4)	32 (68.0)
Extension Services	06 (12.8)	13 (27.6)	28 (59.6)
Technical Support	02 (04.3)	07 (14.9)	38 (80.8)
Government Support	04 (08.6)	06 (12.7)	37 (78.7)

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Eswatini has a huge potential in beekeeping, because of immerse and dense the forest, and much flora, providing the ideal conditions for colonies. Unfortunately, the Eswatini beekeeping sector has not yet bloomed to capacity and use of the natural resources. Beekeeping in the Manzini region faces with challenges especially technology, extension services, credit access and marketing of honey. This study revealed that opportunities to improve and raise the standard of living are possible through the implementation and exploring of the beekeeping. In order for farmers to improve their honey production, they need to increase the colony size and also to make use of Langstroth beehives because of their high productivity. Diversifying the beekeeping industry with orchard can significantly improve the enterprise and further overcome the problem of seasonality in honey especially by providing alternative sources for the honey and income for the farmer.

5.2 Conclusion

Although the involvement of small-scale beekeeping is still at an infant stage, the enterprise shows a great potential in improving the livelihoods of the farmers in the region. The favourable natural environment and low disease incidence in the Manzini region of Eswatini makes the farmers to be competitive in honey production compared to the other regions. From the foregoing, it can be concluded that the majority of the farmers who engaged in beekeeping in the study area were males, most of them had secondary school education and this is an indication that they can read literature so adopting new technology will be easy for them. On a different note, most of them earned reasonable income from beekeeping and the enterprise has proved to be a profitable venture in the study area. The findings also claim that socio-economic factors farming experience and colony size influenced the total honey production. However, inadequate knowledge about the latest technology, marketing, extension services, access to credit in the study area. Most farmers in the study area used the local top bar hives but further enhanced honey production by using Lang troth hives because of the high productivity.

5.3 Recommendations

There are opportunities to improve the livelihoods of the smallholder beekeeping farmers through beekeeping. Farmers need to gain more experience in beekeeping in order to improve honey production. This could be done through trainings by government extension officers. Farmers also need to increase the colony size of their beekeeping and use more of Langstroth beehives because they are highly productive. Non-governmental organisations in collaboration with the farmers' cooperative groups should provide improved beekeeping technologies at subsidized rate to the farmers. There is also the need to form vigilance groups to monitor and check the activities of honey production in the region. Financial institutions should be made aware of the potential the industry has in terms of eradicating poverty and making Eswatini a food secure country. This will make the companies to be able to insure the financial institutions will be able to offer credit to the farmers. A study to find out the reasons as to why insurance companies and financial institutions are less or not interested in the beekeeping industry yet it has the potential to yield high returns is highly recommended.

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