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THE POTENTIAL TO DEVELOP APICULTURE FOR ENHANCING RURAL COMMUNITIES' LIVELIHOODS: EXPERIENCES FROM SAME DISTRICT IN TANZANIA

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ABSTRACT

The importance of apiculture to the improvement of rural livelihoods and the condition of ecosystems cannot be overemphasized. However, globally, the level of beekeeping is still low. Therefore, it is important to examine the potential to develop apiculture, the extent of beekeeping, and the factors for practicing it in various places. This study explores these themes, focusing on Same District in Tanzania. Two wards with apparently great potential to engage in beekeeping were purposefully selected, and one village was selected from each ward. Structured and in-depth interviews were conducted and remote sensing and geographic information system were deployed to obtain the land cover map indicating the potential to develop apiculture. It was found that Same District has enormous potential to develop apiculture, including, forests, which cover 17,430 hectares, equivalent to 2.8% of the district's total area, woodland, which covers 65,358 hectares (10.5% of the total area) as well as extensive agricultural land and water bodies. Further, a good road network makes the district more potential to apicultural development. Despite this state of affairs, only 9.5% of the respondents were beekeepers. Low practicing of beekeeping is attributed to limited knowledge, bees' aggressiveness, lack of capital and lack of access to suitable areas to situate beehives. Moreover, lack of modern beekeeping skills, conflicts, deforestation, bees' absconding behaviour, and drought hinder the apiculture development. Therefore, it is recommended that farmers be educated on modern beekeeping and environmental management practices to improve bee forage.

Keywords: Apiculture, bee products, communities' livelihoods.

1. INTRODUCTION

Rural communities depend heavily on agriculture and livestock keeping for their livelihoods and general socio-economic development (Ipbuker *et al*., 2013; Nandi and Mistri, 2018). In turn, these activities rely on the natural environment: soil, rainfall, water, and the biotic components of Mother Nature. Thus, rural communities are highly vulnerable to natural disasters, including, *inter alia*, floods, droughts, hurricanes, and pests and diseases. Thus, a sustainable rural livelihood requires sustainable livelihood activities that can withstand the effects of such disasters.

Apiculture (the science and art of beekeeping, including the knowledge of bees, bee products, their uses and markets, trade, and equipment fabrication) is recognized as a source of income and general livelihood for many people in rural areas amid extreme climatic events and the attendant

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disasters (Yohana *et al*., 2020; FAO, 2021). Apiculture is very important for socio-economic development as well as environmental health to maintain the ecosystems functions (FAO, 2021). From the socio-economic viewpoint, the products of apiculture such as honey, pollen, and brood are a source of food known for its richness in various nutrients. Additionally, bee products are used as industrial raw materials in producing various products, namely lubricants, candles, cosmetics and beeswax (URT, 1998a; Babatunde *et al*., 2007; FAO, 2021). Besides, various bee products, such as honey, propolis, bee venom, and beeswax are recognized for their medicinal value (URT, 1998a; Babatunde *et al*., 2007). Therefore, it is clear that many benefits can be obtained from beekeeping through direct use of some of the products at home and by selling other products to increase income (URT, 1998a).

On the other hand, the importance of beekeeping to improve the health of ecosystems cannot be overemphasized. Bees are the primary animal pollinators that support biodiversity and provide very important agro-environmental services (URT, 1998a; FAO, 2021; Vercelli *et al*., 2021). According to FAO (2021), about 75% of the world's fruit and seed crops depend on pollinators for sustainable production. Thus, apiculture is important economically and is an environment-friendly activity that contributes substantially to maintaining the health of ecosystems.

In 2018, globally, about 1.9 million tons of honey were produced from 92.3 million beehives (Vercelli *et al*., 2021). The world's major producers of honey in 2018 were China, Turkey, Iran, Ukraine, the USA, India, and Russia. By comparing the amount of bee products produced in various African countries with that produced in other parts of the world, we find that apiculture is still low in Africa. For instance, honey production in Ethiopia, the first honey producer in Africa, is estimated to be about 24,700 tons compared to over 400,000 tons produced in China (Bahta, 2018; FAO, 2021; Vercelli *et al*., 2021).

Tanzania has a natural and a legislative environment that supports apiculture. To start with the natural environment, the country has 33.5 million hectors of forests and woodlands, 115,500 hectors of mangrove forests, and extensive agriculture lands on which crops such as sisal, mangoes, sunflower, green beans, coffee and coconuts, are grown (National Beekeeping Programme, 2001). This is a conducive environment for beehives and bee forage. Besides, the country has formulated various laws, policies, and programmes that promote apiculture in general and beekeeping in particular. These include the National Beekeeping Policy of 1998, the National Forest Policy of 1998, the National Beekeeping Programme of 2001, and the Beekeeping Act of 2002 (URT, 1998a; URT, 1998b; NBKP, 2001; URT, 2002). These provide for, and encourage, beekeeping by recognizing that beekeeping is important to people's livelihoods, the economy, and the ecosystems' health.

Despite the aforementioned potential and benefits, beekeeping is still very low in the country (URT 1998a; Babatunde *et al*., 2007). According to the 1998 National Beekeeping Policy (URT 1998a), the production of bee products is only 3.5% of the very great production potential. The low level of beekeeping is observed even after about twenty years since the passing of the beekeeping policy. Various studies undertaken after the passing of the policy report a low level of beekeeping in the country. In fact, only a few places are said to have a relatively large number of beehives, including some rural areas in Tabora and Singida (Yohana *et al*., 2020).

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Same District is one of the districts in Tanzania whose communities are essentially rural, with agriculture as their main source of livelihood. The district faces various production challenges, including drought, which causes poor production of crops and animal products. This is because the district is located in a semi-arid area, which experiences the impact of climate change (Enfors and Gordon, 2007; Afifi *et al*., 2014). The strategies commonly used to adapt to the impact of drought, including changing planting dates, planting early maturing crops, terracing, and irrigation, have not been effective due to a decrease in the amount of rainfall and the short length of the rain season. Literature show that many adaptation strategies are not effective due to the increasing climate change and systems have to adopt novel strategies (McCarthy, 2001).

The adoption of beekeeping would help rural communities to live sustainably amid such agricultural challenges. It is, therefore, important to examine the potential to develop apiculture and evaluate the extent of practicing this activity together with finding the clear understanding of the factors for practicing apiculture so as to inform policy review process on ways to motivate farmers adopt this activity and these were the objectives of undertaking this study.

2. MATERIALS AND METHODS

2.1 The Study Area and Criteria for its Selection

The study was conducted in Same District, which is located in Kilimanjaro Region, north-eastern Tanzania. The district lies between 3^0 47` and $4^0$ 36` south of the equator, and 37^0 29` and $38^0$ 24` east of the Greenwich meridian. Figure 1 shows the location of Same District and its administrative wards.

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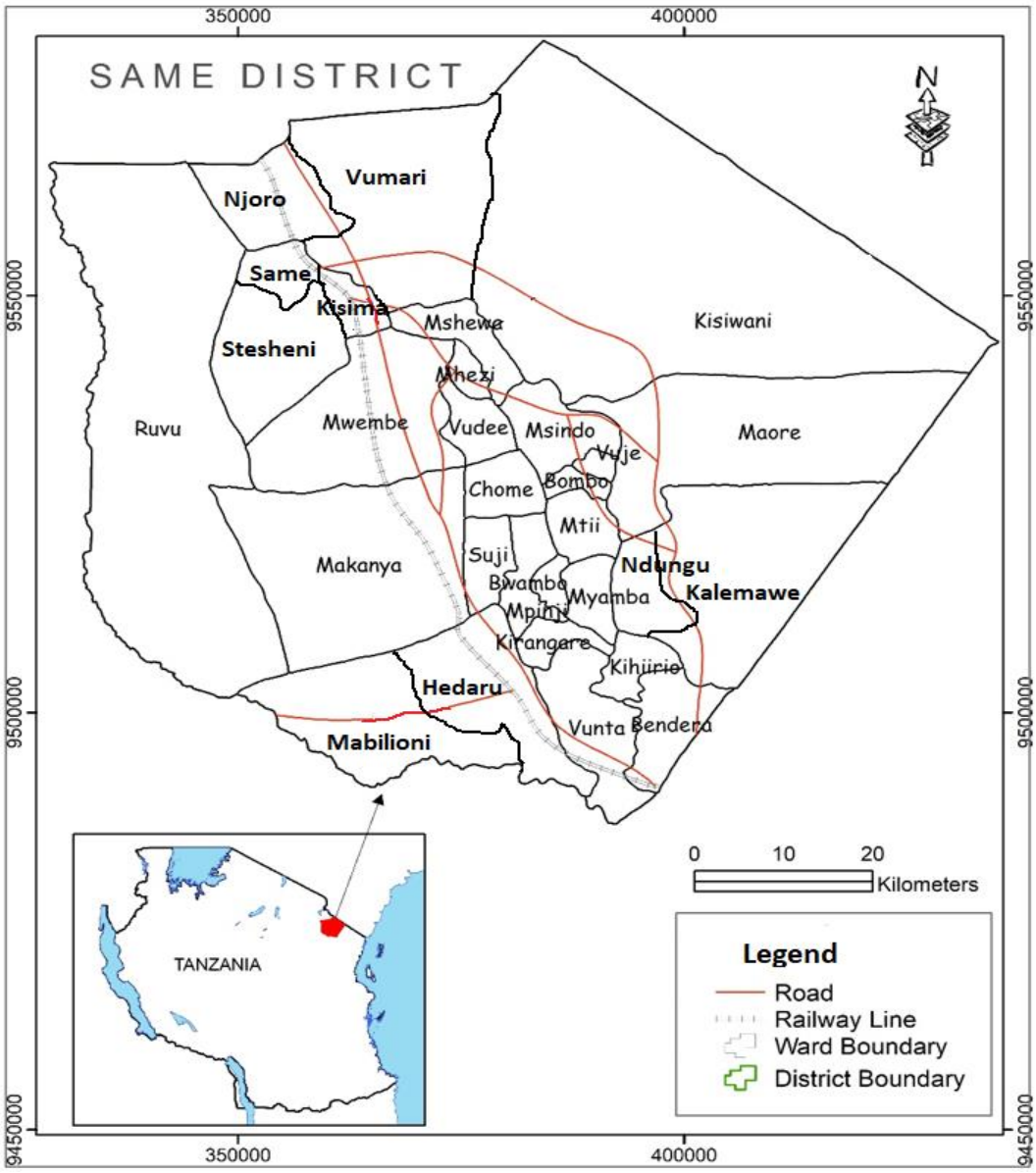

Figure 1: Location of Same District and Administrative Wards

This district was selected on the basis of its high reliance on rain-fed farming, despite the semi-aridity climatic conditions which make it vulnerable to climate change-induced droughts (Enfors and Gordon, 2007; Afifi *et al*., 2014). Such climatic features affect production and the general well-being of the residents, thereby making them potential adopters of beekeeping. Moreover, the district is endowed with forests and woodland areas, as well as crops like sisal, which make it a conducive environment for keeping bees.

2.2 Sampling Procedures

Chome and Makanya wards were purposefully selected in this study. These were selected because they have areas suitable for practicing beekeeping, including the Shengena forest (a large part of it is in Chome ward), the sisal estate (in Makanya ward) and the nearness of the

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Pangani River to Makanya ward which provide conducive environment for beekeeping. One village was selected from each ward; the villages were Marieni and Makanya from Chome and Makanya wards respectively.

Households were the units of analysis and the sampling frame comprised the names of the heads of households obtained from the village executive officers. The sampling frame comprised 1,469 heads of households, 10% of whom participated in structured interviews. As such, quantitative data were collected from 147 respondents. Further, the respondents who reported to keep bees were appealed to be involved in in-depth interviews to obtain their dimension with regard to beekeeping on which 14 respondents were involved from both villages.

2.3 Data Types and Data Collection Methods

Quantitative and qualitative data were collected to achieve the objectives of this study. Quantitative data included data on the extent of beekeeping as well as on the characteristics of the respondents, households, and institutions. The data were collected using questionnaire from heads of households or their representatives. Qualitative data included perceptions on, and knowledge of, various aspects of apiculture, namely knowledge of beekeeping as well as the benefits of, and markets for, bee products. The data were collected through in-depth interviews with beekeepers.

Besides, the potential to develop apiculture was indicated on a land-cover map. This was obtained using remote sensing (RS) and geographic information system (GIS) techniques. Google earth code editor was used to obtain the image during the dry season of 2021 from Landsat 8 at 30m resolution. Taking image during dry season helps to obtain images with minimum cloud cover (less than 10%).

2.4 Data Analysis Techniques

Quantitative data were analyzed using descriptive statistics as well as correlation techniques. The statistics were used to obtain a summarized picture of the variables, whereas a correlation analysis was done to find the relationship between the variables so as to understand the potential to develop apiculture, the extent of practicing beekeeping, and factors for practicing or not practicing beekeeping. By contrast, qualitative data was analyzed through content analysis to obtain views, perceptions, and knowledge regarding apiculture in general and beekeeping in particular.

A remote-sensed image was pre-processed visually and digitally, and scenes of the area of interest were extracted from the full scenes using ArcGIS 10.6 software. The image was geo-corded to UTM coordinate zone 37, which is the coordinate and mapping system used in making national topographic maps. Then, image enhancement was done to reinforce visual interpretation. A colour composite, Landsat 8 bands 5, 6 and 4, was prepared and its contrast was stretched using a standard deviation for further enhancement of visual interpretation of features like forests, agricultural land, and rivers. The supervised image classification using a maximum likelihood classifier (MLC) was used to create a base map which was then used in ground trothing whereby forests, water, bush-land, grass-land, bare soils, agricultural land, and

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settlements were classified. Then, the classified images were re-corded in their respective classes and filtered using a majority-neighbourhood filter to eliminate patches smaller than a specified value and replace them with values most common among the neighbouring pixels. The classes of land cover so obtained were used to establish the potential to keep bees in Same District.

3. RESULTS AND DISCUSSION

3.1 The Potential to Engage in Beekeeping in Same District

Same District has enormous potential to keep bees, including forests, rivers, agricultural land, internal and external markets, as well as roads for transporting bee products. The findings from in-depth interviews with the farmers practicing beekeeping indicated that the presence of forests and rivers in Same made them keep bees. One male farmer, who keeps bees along the Pangani River said, "We keep bees along the River because the area is green almost throughout the year". Examining the land-cover map of Same District, this study found that the district is endowed with various natural and man-made resources conducive for keeping bees. Forests covered 17,006 hectares, which is over 2.7% of the district's total area. Woodland covered 65,358 hectares, which is about 10.5% of the total area (see Figure 2 and Table 1). Moreover, as indicated in Figure 2 and Table 1, the presence of water bodies and extensive agricultural land give the district the potential to develop apiculture.

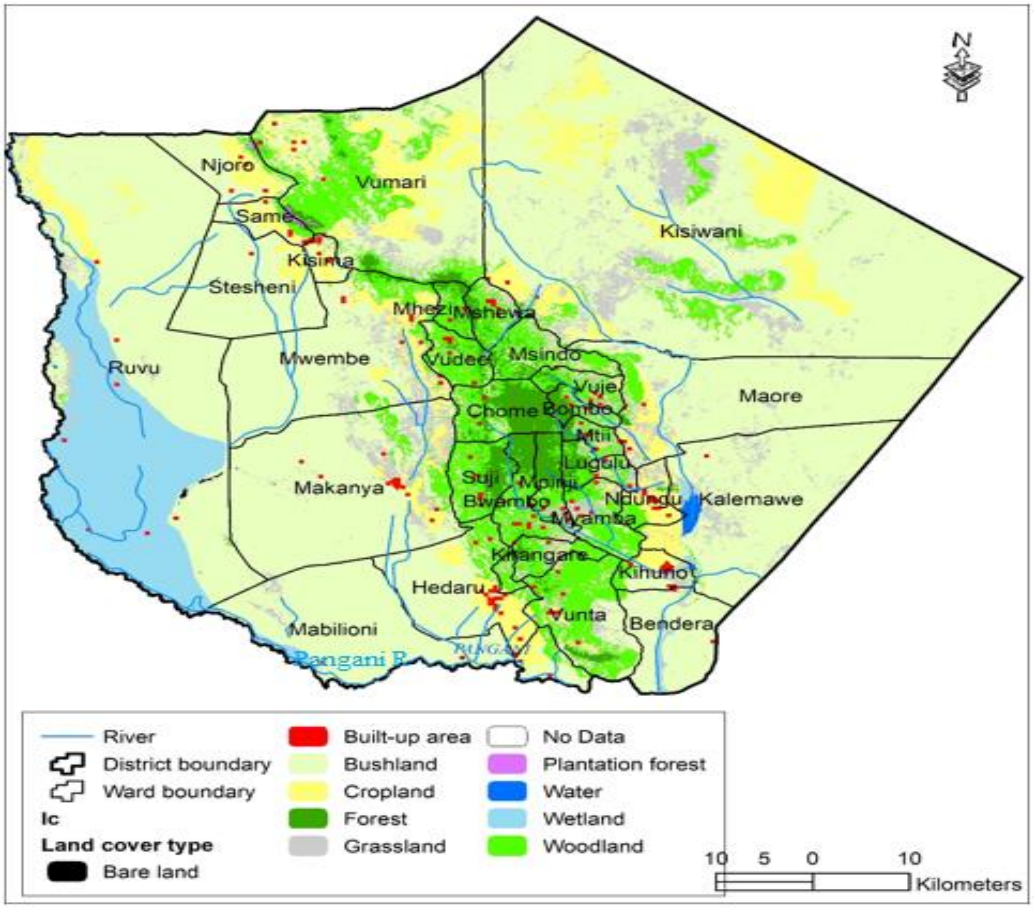

Figure 2: Land-cover Map of Same District

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Table 1: Land Cover

S/N	Land-cover Type	Hectare	%
1	Bare land	96	0.02
2	Built-up area	4,282	0.69
3	Bushland	388,660	62.34
4	Agricultural land	58,161	9.33
5	Forests	17,006	2.73
6	Grassland	45,982	7.38
7	No data	19	0.00
8	Plantation forests	424	0.07
9	Water	849	0.14
10	Wetland	42,641	6.84
11	Woodland	65,358	10.48

The forests found in Same District include the Chome Nature Forest Reserve (CNFR), in which the highest peak of the Southern Pare Mountains (2,462 masl), known as Shengena is found. Covering 14,283 hectares, the CNFR is the largest single forest in the district and is one of the forests managed under the Eastern Arc Mountain Endowment Fund (EAMCEF). Forests under the EAMCEF are among the world's most important forests in the conservation of biodiversity (EAMCEF, 2022). Other forests under the EAMCEF in other parts of Tanzania are the Amani nature reserve in Tanga Region, the Uluguru forest in Morogoro Region, and the Udzungwa forest in Iringa Region (EAMCEF, 2022). The CNFR is surrounded by thirteen (13) out of the district's thirty four (34) administrative wards (Figure 2). Chome ward has the largest share of the CNFR, as 3,875 hectares of the forest are located in this ward. It is followed by Suji, Mpinji and Vumari with 1,674, 1,648 and 1,476 hectares each. The other forests found in Same District include Mwala forest in Vunta ward, Vumari forest in Vumari ward, and Lolweni forest in Kirangare ward, which extends into Bwambo ward, where it is known as Ntambwe forest and Kidoda forest in different areas.

Regarding the woodland, the leading ward in terms of coverage is Vumari with 11,138 hectares. It is followed by Kisiwani (6,090 hectares) and Msindo (3,348 hectares). The findings on the other wards with regard to forest and woodland coverage (and other land-cover types) are shown in Table 2. Thus, a large part of the population in Same District could keep bees in the forests and woodlands (see Figure 2 and Table 2).

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Table 2: Land Cover per Ward

Land-cover Types (in Hectares)										
S/N	**Ward**	**Built-up area**	**Bush land**	**Agr. land**	**Forest**	**Grass land**	**Plantation forest**	**Water**	**Wet land**	**Wood land**
1	Bendera	66	10,611	53	13	488	0	0	475	158
2	Bombo	79	26	40	923	448	0	0	0	685
3	Bwambo	171	145	105	1,397	685	0	0	0	2,794
4	Chome	53	646	40	3,875	132	0	0	0	2,583
5	Hedaru	461	10,360	3,598	92	171	0	0	0	1,951
6	Kalemawe	40	28,510	1,753	40	2,939	0	804	382	198
7	Kihurio	237	1,358	791	13	593	0	0	13	593
8	Kirangare	66	198	198	290	593	0	0	0	1,779
9	Kisima	171	844	844	0	132	0	0	0	53
10	Kisiwani	66	114,501	18,466	66	14,314	0	0	0	6,090
11	Lugulu	40	66	171	936	962	0	0	0	1,199
12	Mabilioni	92	27,047	1,134	53	844	0	0	857	1,305
13	Makanya	316	34,731	2,267	0	5,101	0	0	0	1,938
14	Maore	79	28,180	2,096	158	3,018	0	0	0	1,371
15	Mhezi	79	40	13	593	66	13	0	0	1,437
16	Mpinji	132	92	40	1,648	527	0	0	0	1,252
17	Mshewa	119	211	105	554	593	0	0	0	1,885
18	Msindo	0	646	303	817	883	0	0	0	3,348
19	Mtii	132	13	132	382	593	0	0	0	870
20	Mwembe	264	23,791	3,572	250	3,282	0	0	0	2,373
21	Myamba	132	567	356	132	1,199	0	0	0	3,005
22	Ndungu	171	171	1,924	40	699	0	26	0	830
23	Njoro	92	5,470	1,990	53	13	26	0	0	501
24	Ruvu	119	56,045	3,928	0	2,966	13	40	40,676	237
25	Same	105	1,503	1,213	79	26	132	0	0	488
26	Stesheni	40	16,384	1,410	0	13	0	0	0	0
27	Suji	119	567	0	1,674	119	0	0	0	3,401
28	Vudee	198	738	40	501	119	13	0	0	2,544
29	Vuje	145	145	264	330	791	0	0	0	1,621
30	Vumari	171	21,155	9,833	1,476	3,177	185	0	0	11,138
31	Vunta	224	3,137	554	567	1,410	26	0	0	7,131

As Figure 2 and Tables 1 and 2 show, the water bodies in the district, including the Pangani River in the west of the district and Saseni, Yongoma, Hingilili, and Nakombo Rivers, support various kinds of vegetation, which makes the district more suitable for apicultural development. These natural features and the extensive agricultural land, including the Makanya sisal estate, suggest that the beekeeping can be developed in the district.

Same District also has a large market for bee products. When asked about the places where bee products are sold, all of the respondents practicing beekeeping said they sold their bee products (especially honey) within the district. None of the respondents reported to sell bee products

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outside the district. This suggests that bee products have large market within the district such that farmers have not started selling products at large urban centres like Moshi, Arusha and Dar es Salaam, let aside the international markets. Selling bee products to the large cities just mentioned will be facilitated by the existence of the Dar es Salaam–Arusha highway, which passes through this district and connects Dar es Salaam, Tanga, Arusha and the neighbouring country of Kenya (Figure 1). In this study, no farmer practicing beekeeping reported to have any difficulty in finding a market for his bee products. This was especially the case with bee honey, which is the major bee product harvested. This finding is similar to the finding of Mwakatobe and Mligwa (2006), who report that the local and international demand for bees' products, especially honey and beeswax, exceeds supply. However, maintaining the markets requires continued quality control and proper packaging of bee's products (Mwakatobe and Mligwa, 2006; URT, 1998a).

3.2 Extent of Practicing Beekeeping in Same District

Regarding the extent of practicing beekeeping, the findings indicate a low level of undertaking the activity in the district. During structured interviews, 90.5% of the respondents reported that they were not practicing beekeeping; only 9.5% were doing so (Table 3).

Table 3: Practicing Beekeeping

Practicing Beekeeping	Number of Respondents	Percent
Yes	14	9.5
No	133	90.5
Total	**147**	**100.0**

Thus, the majority of respondents do not practice beekeeping. "We have never practiced beekeeping in my household. In fact, very few villages have beehives," said a respondent in Makanya village. Further, the respondent could hardly mention the three villagers known to have beehives. This suggests that only a few villagers practice beekeeping.

One feature of beekeeping in the study area is that although beekeepers are few, they own relatively large number of bee hives. When the respondents were disaggregated into those who kept bees and those who were not, the findings on the former indicated that six respondents (equivalent to 42.9% of all the respondents) owned more than 100 beehives, three (21.4%) owned 50–100 beehives, two (14.3%) owned 11–49 beehives, and three (21.4%) owned 1-10 beehives. These findings indicate that while beekeepers are few, but they own many bee hives. This may be due to benefits they obtain from the activity. Since farmers who keep bees are very few, it is clear that beekeeping in the study area is still low. Same District, or Tanzania, is not the only place in Africa where beekeeping is less developed. Ojeleye (2003) and Bahta (2018) reported a low level of practicing beekeeping in Nigeria and Ethiopia respectively, although the countries have the potential to develop the sector further.

The in-depth interviews with those who keep bees revealed various benefits of the activity, including increasing income, improving food security, and provision of medicine for curing certain diseases. A respondent from Makanya village who own more than 100 bee hives had this to say during in-depth interview, "over 70% of the household's livelihoods depend on

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beekeeping. One year I had to pay over Tshs. 8 million for school fees, and it was beekeeping which made it possible". The findings are in tune with those of Babutunde *et al*. (2007) whose study, which was done in Nigeria, showed that the keeping of bees could provide employment and reduce poverty.

Further, beekeeping was said to be the activity which require little investment and which is not highly affected by environmental hazards compared to other farming activities. A 53 years old man in Marieni village said, "Once you have placed a beehive, no more costs are required, you don't have to spray some pesticides, nor do you have to use fertilizers". Moreover, findings indicate that beekeepers help in protecting the environment. During in-depth interview, one village leader at Marieni village had this to say, "Recently there was fire outbreak in the CNFR and only beekeepers participated in stopping it". Thus, beekeeping is good activity for socio-economic development and environmental protection.

3.3 Factors for the Low Level of Practicing Beekeeping in Same

The factors for the low level of practicing beekeeping in Same include limited knowledge about beekeeping and bee products, the aggressiveness of honey bees, lack of suitable areas in which to place beehives and lack of capital. These factors were mentioned by the respondents who were not practicing beekeeping in response to a question on the reasons for their not practicing beekeeping. Figure 3 shows the percent of the respondents who mentioned certain factors.

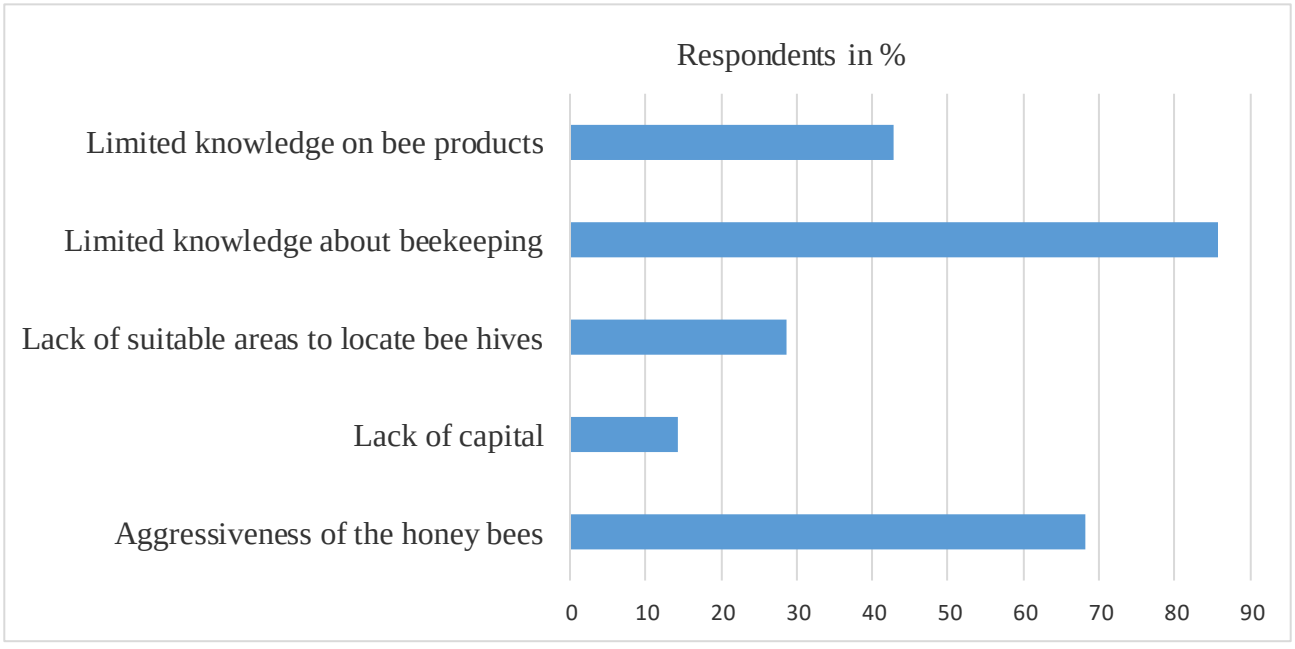

Figure 3: Factors for not Practicing Beekeeping
Based on a Multiple Response Analysis (N = 153)

According to Figure 3, about 85.7% of the respondents mentioned limited knowledge of beekeeping as one of the factors for their not practicing beekeeping. The respondents pointed out

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that they had limited knowledge of the modern beekeeping equipment and practices, and that the lack of such knowledge was among the reasons for their not keeping bees. Besides, 42.8% of all the respondents mentioned limited knowledge of bee products as one of the factors for their not keeping bees. In fact, even those engaged in beekeeping had limited knowledge of bee products. While the literature identifies a number of bee products, including propolis, bee venom, bee wax, pollen, brood, and honey (URT, 1998a; Babatunde *et al*., 2007; FAO, 2021), majority of the respondents knew about only one bee product, that is, honey. When asked to mention bee products, only nine respondents (equivalent to 6.1% of all respondents) could mention more than one bee product. All the other respondents (93.9%) mentioned only honey as bee products known to them. Thus, limited knowledge of beekeeping in general and of bee products in particular was a major factor for the low rate of practicing beekeeping in the area. This finding is supported by the National Beekeeping Policy, which mentions lack of knowledge of how to make various products and lack of knowledge about bee protective measures, especially among women and the youth, as being the constraints hindering development of the beekeeping sector (URT, 1998a).

The impact of knowledge was also evident among those who owned relatively many beehives, as they were the ones who attended seminars on beekeeping or worked closely with those who attended seminars. The correlation coefficient of 0.72 was obtained with regard to the relationship between attending seminars on beekeeping and ownership of beehives. These findings agree with the diffusion of innovation theory, which posits that the nature of change agents and the extent of their promotion efforts influence the rate of adopting innovations (Rogers, 2003). Thus, it is said that the provision of knowledge of proper and modern beekeeping techniques, as well as the benefits of the activity is important for farmers engaging in beekeeping and apiculture in general.

Another factor for the low rate of practicing beekeeping in Same District was the aggressiveness of honey bees, especially during harvesting of some bee products. This factor was reported by 68.3% of the respondents. The findings indicated that many farmers considered beekeeping as a dangerous activity, especially during harvesting and where beehives are located near people's houses. Besides, 28.6% of the respondents reported that they could not practice beekeeping because they lacked suitable areas in which to undertake the activity. Most of such farmers were living in areas that were somewhat far from the forests. Besides, lack of capital was said to be the factor for not practicing beekeeping by 14.3% of the respondents. The respondents indicated that capital was needed to buy beehives and other kinds of bee gear. But lack of capital prevented them from keeping bees. When asked about the cost of one beehive, a respondent from Makanya ward reported that one traditional beehive costs Tsh 25,000 (equivalent to USD 10.72) and modern beehive costs about Tsh 80,000 (equivalent to USD 34.3). Findings from in-depth interviews indicated that high cost of modern beehives coupled with limited knowledge on modern beehives caused many beekeepers to use traditional beehives.

3.4 Constraints on Keeping Bees and Developing Apiculture in Same District

In this study, the respondents were disaggregated into those who were practicing beekeeping and those who were not. The in-depth interview with the respondents who were practicing

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beekeeping revealed that drought, lack of beekeeping skills, deforestation, lack of working tools and equipment, bees' absconding from hives, and conflict with pastoralists hindered the development of beekeeping and apiculture. Table 4 shows the number and percentage of the respondents who ranked each constraint as the most important constraint in his household.

Table 4: Constraints on the Development of Beekeeping and Apiculture

Constraint	Number of Respondents	%
Drought	0	0
Lack of skills	6	42.9
Deforestation	3	21.4
Lack of working tools and equipment	3	21.4
Bees' absconding behaviour	0	0
Conflicts with pastoralists and other groups of people	2	14.3

Lack of skills was identified by 42.9% of the respondents as the main constraint on the practice of beekeeping. The findings indicate that farmers were not well informed about various beekeeping techniques, including modern beehives, good harvesting techniques, and the processing of bee products. The lack of skills made them use traditional methods like fires during the harvest of bee products, which kills many bees and sometimes causes them to abscond from the beehives. The lack of skills faced the farmers who had not attended beekeeping seminars. The farmers who had attended such seminars were better off with regard to having knowledge of beekeeping. At Makanya village, farmers who attended seminar on beekeeping were found to have beekeeping association known as MABEA (Makanya Beekeepers Association) which encourage beekeeping and members help each other in solving beekeeping problems. Though were reported to be 11 only, members of this association were found to own relatively many beehives and practiced beekeeping as an important economic activity. The knowledge of technologies and their usefulness is important for people to adopt the technologies (Davis, 1986; Rogers, 2003).

Lack of working tools and equipment was identified by 21.4% of the respondents as the main constraints on the practice of beekeeping. Farmers mentioned gumboots, modern beehives, and harvesting gear as the tools that they did not have. The lack of these tools discouraged them from undertaking the activity. Another 21.4% of the respondents mentioned deforestation as a most important constraint on the practice of beekeeping. A respondent from Makanya village reported that people were cutting down trees along the valley near the Makanya sisal estate, where they placed their beehives. Another respondent from Marieni village said, "Fire is a constraint to beekeeping because when it happens it destroy beehives, bees and the forage". This is in tune with village chairman of Marieni who indicated that currently there was fire outbreak at CNFR.

Conflicts between the pastoralists and other farmers were identified by 14.3% of the respondents as the most important constraints of beekeeping at their households. It was found that the conflicts were sometimes caused by the aggressiveness of bees to cattle. A respondent who owned over 100 beehives in Makanya village had this to say, "Sometimes pastoralists break our

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beehives or take them down because they want to feed cattle in the places where they are, and they fear that the bees might sting their cattle". As a solution to this constraint, the respondent continued "we have to locate the bee hives at the long trees".

Bees' absconding behaviour and drought were not mentioned by any respondents as the most important constraints on beekeeping. Although they are not very important, they were mentioned along with other constraints during in-depth interviews. One respondent reported that bees tended to vacate beehives, especially after the harvest of bee products or during drought seasons. Further inquiry indicated that many absconding cases occurred after the harvest of bee products using fires. With regard to drought, one respondent said, "This year, for instance, we have had a poor harvest due to drought, which has reduced bee forage." Drought reduces the amount of flowers on plants and wild vegetation, both of which are important to bees as forage; this reduces bee products and causes some bee colonies to abscond from beehives.

4. CONCLUSIONS

In Same District there is great potential to develop apiculture in general and beekeeping in particular. It includes the abundance of natural resources and man-made features that are important for this development. The resources and man-made features include forests, rivers, agricultural land, and a road network. Besides, the availability of internal and external markets for bee products also makes it possible to develop the sector. In fact, even if beekeeping is highly adopted in Same District, it cannot satisfy the demand of the national and international markets. Despite the great potential and benefits of apiculture development in Same District, the practice of beekeeping is very low in terms of number of beekeepers. The low level of practicing beekeeping in the district is due to various factors, including limited knowledge of beekeeping and bee products, aggressiveness of honey bees, lack of suitable areas in which to place beehives in some areas, and lack of capital. In order to develop apiculture in the district and the country at large, it is recommended that seminars on various apiculture-related issues be organized. The seminars could focus on good beekeeping practices like the use of modern equipment, proper harvesting and processing methods, and market issues. Further, farmers should be educated on the importance of environmental management to improve forage. Besides, farmers can increase bee forage by planting some flowering crops/plants around their beehives. Doing so will also reduce the impact of drought on beekeeping.

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