The role of Tanzania Forest Services Agency (TFSA) in the dissemination of apicultural information to smallholder beekeepers in Bahi District, Dodoma, Tanzania

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ABSTRACT

A cross-sectional study was conducted in Dodoma's Bahi district to assess how the Tanzania Forest Services Agency (TFSA) informs nearby smallholder farmers about beekeeping. The study is anchored in Berlo's Model of Communication. The study used a sample size of 78 beekeepers chosen by snowball sampling strategy. Questionnaires were used to collect quantitative data and analyzed using SPSS software whereas qualitative data were collected through interviews and analyzed through content analysis. The results show that to increase productivity, smallholder beekeepers rely significantly on useful information about market channels, ideal harvesting times, and site preparations. TFSA primarily uses participatory, community-anchored communication channels like exhibitions, seminars, peer groups, and village leaders to disseminate information. Effective communication and the implementation of Good Beekeeping Practices (GBPs) are still hampered by a number of serious structural and operational issues. Remote rural villages are isolated by poor road infrastructure, which makes physical outreach challenging. Furthermore, there are linguistic inconsistencies between extensions officers and local language-speaking farmers, which is further compounded by low literacy levels among beekeepers and an overall shortfall in the reach of agricultural extension services. The study recommends local government authorities and beekeeping sector to strengthen grassroots networks by establishing official partnerships with village leaders and empowering beekeeper associations as primary information hubs.

Key Words: Apicultural Information, Beekeeping, Dodoma, Information Dissemination, Smallholder beekeepers, Tanzania Forest Services Agency

I. INTRODUCTION

Bees are regard as vital to agricultural sector and beneficial to our world in many different ways (Alakoç Burma, 2023; Food and Agricultural Organization (FAO, 2021). Apiculture (beekeeping) on other hand is an activity of managing honeybees in hives for the production of honey and other products such as, pollens, wax, royal jelly, propolis, and bee venom (Crane, 2009; Jones et al., 2011; Çakmak & Cakmak,2016). It plays an important part in raising the standard of living in rural communities for achieving sustainable rural development (Haldhar et al., 2023; Prodanović et al., 2024; TFSA, 2026). Furthermore, beekeeping is a promising non-farm enterprise that benefits both smallholder farmers and the national economy at large (Degu, & Megerssa, 2020). Zafeiraki *et al.* (2022) are of views that not only honey bees constitute an essential agricultural pillar, because of their fundamental role in pollination services, but they also contribute to the food industry, as pollen and honey are edible apicultural products which are well known for their exceptional nutritional value and for health concerns as natural medicine (Çakmak & Cakmak, 2016). Other researchers e.g Gring-Pemble and Perilla (2021) have reported that in the absence of bees, human food security might be in jeopardy, the agricultural industry is compromised and the environment will suffer. The authors further add that an investment in bees is an investment in people, the prosperity of local communities and even the planet as a whole.

Azeez (2022) reported that beekeeping can be used to increase foreign exchange earnings of the country through exportation of bee products, which in turn contributes to the sustainable economic development of rural households and poverty eradication (FAO, 2021). It further creates jobs and provides recreational and eco-tourism endowments. Gupta et al. (2026) reported that beekeeping provides self-employment for rural and agro-based populations.

Beekeeping also contributes significantly to the promotion of biodiversity and crop output through pollination (FAO, 2021). Honey beekeeping also empowers communities through sustainable beekeeping. It promotes multi-disciplinary, experiential and entrepreneurial approaches to honey bee sustainability. It offers opportunities for engaging in scientific research such as pollen quality, pests and queen rearing, art projects, innovative teaching and research such as artificial insemination, pollen research and beekeeping and community outreach, honey bees and hive product (Çakmak & Cakmak, 2016) among others. All these opportunities are not only vital for developing the creativity or

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entrepreneurial intelligence critical for addressing wicked problems but they are also fundamental to life-long learning and career success (Gring-Pemble &Perilla, 2021).

Beekeeping is ubiquitous in African continent, with the most popular regions being Ethiopia, Kenya, and Tanzania (Goshme & Ayele, 2020) where it is used to generate revenues and alleviate poverty. In Tanzanian context, beekeeping is a traditional economic activity among many communities living around or in the vicinity of forests (United Republic of Tanzania (URT, 2020b). It is a sector which drives socio-economic development and environmental conservation, it contributes to the reduction of deforestation and forest degradation as well as climate change adaptation through the offering of alternative income (Rahman, 2017) in climate-vulnerable areas (TFSA, 2026; Mussa et al., 2026). It also serves as a vital livelihood option (Kata, 2019) for small-scale farmers and forest-adjacent communities. By enabling people to derive economic and socio-cultural benefits from indigenous forests and floral resources without causing destruction, it promotes sustainable and eco-friendly livelihoods. Furthermore, beekeeping provides critical ecosystem services; their pollination of more than 70% of economically important crops significantly boosts agricultural production and food security while enhancing crop quality, quantity, and nutritional value (URT, 2020a; Kasese et al., 2025).

Nevertheless, in order to deliver these benefits, beekeepers must have access to up-to-date and relevant information about beekeeping practices such as hive management, pest and diseases control, market prospects and awareness of threats to bees (Gring-Pemble & Perilla, 2021) and provides technical assistance for enabling formulation of supplementary diets (Landaverde et al., 2023).Honey Care Africa (HCA) is an example of an entity that actively promotes beekeeping in Africa by doing research and disseminating pertinent information to beekeepers (Hecklé, 2019).This implies that information helps beekeepers to maintain their hives, avoid disease, and extract honey in the best way possible. Access to precise and up-to-date information allows beekeepers to execute tactics that maximise productivity while protecting the health of bee families and the environment. Petro *et al*. (2020) are of views that information is essential for beekeeping in a variety of ways such as helping for the success and sustainability of operations. Information serves as the cornerstone for beekeeping succeeded by providing beekeepers with the knowledge and skills they need to manage difficulties, increase productivity, and contribute to the general health of bee families. Sungusia *et al*. (2020) reported that remaining current with industry advances are critical for beekeepers to prosper in their practices. Furthermore, Said et al. (2022) reported that beekeepers who get information on modern beekeeping practices are more likely to use technology for innovation such as filtering of honey for clarity.

The Tanzania Forest Services Agency (TFSA) is a dedicated government institution committed to the sustainable management and conservation of Tanzania's forest and bee resources. As an executive agency, TFSA was established in 2010 to safeguard these vital ecosystems for the benefits of both present and future generations. TFSA mission is to harmonize environmental protection with the socio-economic needs of local communities. Through strategic planning and effective implementation of national forestry policies, TFSA works tirelessly to combat deforestation, promote reforestation, and encourage responsible forest utilization practices. TFSA is entrusted with the management of all forest reserves across the country. The goal is to protect and enhance the ecological integrity of these areas by promoting sustainable practices. TFSA works in close collaboration with local communities, government institutions, and non-governmental organizations to develop and implement conservation strategies tailored to the unique needs of each forest reserve.

Additionally, TFSA actively promotes beekeeping as a sustainable economic activity. This initiative empowers communities, fosters engagement, and enhances biodiversity. By integrating beekeeping with forest management, TFSA contributes to both environmental preservation and the production of high-quality honey and other bee-related products, supporting rural livelihoods and local economies. TFSA is also deeply committed to raising public awareness about the importance of forests and their critical role in climate change mitigation aiming to instill a strong sense of environmental responsibility among Tanzanians through education, outreach programs, and stakeholder engagement. Through continued investment in research and innovation, TFSA remains at the forefront of modern forest and beekeeping practices. As a guardian of the nation's forests and reserves, TFSA is unwavering in its dedication to balancing environmental conservation, community development, and sustainable economic growth. It is committed to fostering a harmonious co-existence between nature and human communities through a comprehensive, integrated approach to forest and bee resources management. The TFSA's mission is aligned to the Sustainable Development Goal (SDG) 15 which advocates on ensuring protection and sustainable management of terrestrial ecosystems (forests), combat desertification, halt and reverse land degradation and biodiversity loss (TFSA, 2026). The establishment of a communication network between beekeepers and local farmers favors effective communication for increasing information flow towards farmers concerning the value of bees for the pollination of particular crops which may increase cooperation between beekeepers and farmers. The communication network will enable beekeepers to access information such as proper setting up of hives, harvesting techniques and maintenance among others (FAO, 2021).

The TFSA was established as a semi-autonomous government executive agency with the goal of developing and managing forest and bee resources sustainably in collaboration with other stakeholders in order to provide sufficient and high-quality goods and services to meet local and international socio-economic and environmental needs (Kata,

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2019; TFSA, 2026). Researchers like (Al-Ghamdi et al. 2020) reported that the provision of relevant information to enhance restoration of degraded apicultural landscapes and other environmental, climate change adaptation and mitigation development works is of particular importance.

Despite the fact that the TFSA has put emphasis on the importance of supplying beekeepers with adequate information to help Tanzanian's beekeepers prosper and progress their knowledge and talents through relevant and free access to information (Kata, 2019), yet there is inadequate information on improved management practices amongst beekeepers (Mussa et al., 2026; URT, 2020b). Similarly, studies by Mwihomeke and Mwongera (2021), Ababor and Tekle' (2018) and Tutuba and Vanhaverbeke's (2018) indicate that beekeepers have limited access to beekeeping information. Inadequate access to information has been linked to major challenge in improving the productivity, profitability and sustainability of beekeeping enterprises (Schouten & Lloyd, 2019). Furthermore, there is no study which has been conducted to examine the role of TFSA contributions to the distribution of information to beekeeper in Dodoma's Bahi district. This study was therefore conducted to assess the contributions of TFSA in the provision of beekeeping information to the small-scale beekeepers in Bahi district for awareness creation.

1.1 Research Objectives

The study sought to establish types of information disseminated to beekeepers, identify the channels of communication used by TFSA to disseminate information to beekeepers and determine the challenges facing TFSA when disseminating information to beekeepers.

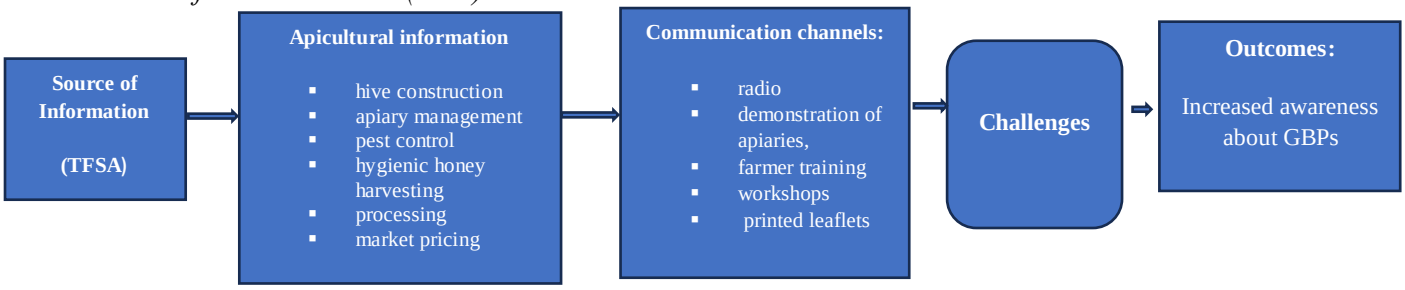
II. LITERATURE REVIEW

2.1 Theoretical Framework

The theoretical framework of this study is guided by Berlo's Model of Communication (1960), which emphasizes the dynamic interaction between the Source, Message, Channel, and Receiver (SMCR).

Figure 1

Berlo's Model of Communication (1960)



Source: Adopted Berlo's Model (1960)

In this study, Berlo's Source-Message-Channel-Receiver (SMCR) linear framework model was applied to evaluate how apicultural information is disseminated from TFSA as the source of information whose extension skills, technical knowledge, and attitude determine communication quality to the smallholder beekeepers in Bahi district, the receivers of this information whose abilities to interpret and adopt information depends on their socio-economic characteristics such as education, and literacy level. The Messages represent types of apicultural information (Objective 1) which encompass technical content such as modern hive management, pest control, hygienic harvesting, and market pricing translated into accessible Swahili language. The Channels reflect the communication pathways (Objective 2) including demonstration of apiaries, physical workshops, radio broadcasts, and printed materials. Furthermore, the framework integrates institutional, infrastructural, and socio-economic noise or communication barriers such as TFSA's transport constraints, low extension officer ratios, and poor mobile network reach in rural wards (Objective 3) which are acting as moderating variables that disrupt message delivery, ultimately determining whether the communication results in the adoption of improved apicultural practices and enhanced honey production.

2.2 Empirical Review

Dissemination of apicultural information is important for knowledge sharing about beekeeping, research, practical skills with beekeepers, extension workers, and policy makers. Effective communication in beekeeping industry is crucial for improving honey yields, managing bee health, and promoting biodiversity. Provision of useful beekeeping information and suggestions is important for proper management of bees (FAO, 2021). Beekeeping information covers practices such as pollination, honey production, hive products such as wax, royal jelly, propolis, pollen and natural resources conservation. The importance of information dissemination cannot be overstated as it helps beekeepers to manage forest reserves, comply with legislation, access extension services, and adopt he best practices such as

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monitoring harvest timing, adjusting hive space, and controlling pests. It is a significant element of the knowledge translation pathway, and a necessary step to ensure GBPs are adopted and implemented by key end users in order to improve honey productivity. A study conducted by Said et al. (2022) show that by providing beekeepers with timely information directly drives them to adopt modern beekeeping practices including use of specialized aluminum storage containers, filtering machinery, and modern beehives over traditional methods which leads to effective exploitation of apicultural potentiality (Mussa *et al*., 2026).

TFSA uses a variety of avenues to share information and knowledge, including mass media, friends, and neighbors. These channels play an important role in supplying beekeepers with relevant information and knowledge. Beekeepers can also obtain information and expertise on beekeeping techniques, disease prevention, and market trends from written materials such as brochures, manuals, and booklets, as well as training workshops and seminars (Tassew et al. 2019). According to Hecklé et al. (2018) beekeeping information and knowledge can be delivered to beekeepers through mass media, such as radio and television. Other studies (Engebretson et al., 2022; Jabbari et al., 2022) have found that beekeeper groups are the primary sources and outlets of beekeeping information and knowledge for other beekeepers.

In other parts of the global, studies such as by Jones *et al*. (2011) indicate that journals have been an important part of providing a platform from which well proven, verifiable scientific evidence on the quality and efficacy of hive products can be disseminated to the widest possible public. The authors further contended that the prime reason behind the development of the Journal of ApiProduct and ApiMedical Science (JAAS) was indeed, the provision of a platform for the publication and dissemination of the science behind all hive products. JAAS aimed to be a "one stop shop center" for researchers wishing to publish peer reviewed materials. This is also in alignment with the Maderson (2023) who reported that beekeepers are highly informed generators and users of both formal and informal data on the environment in which their bees live. Other publications such as guidelines are important for the dissemination of beekeeping information. FAO (2021) reported that guidelines aim to provide useful information and suggestions for a sustainable management of bees around the world, which can then be applied to project development and implementation.

Although Funom and Soyemi's (2019) study found that television is an essential source and a communication channel, other studies (e.g. Mwantimwa, 2019) demonstrated that most rural people do not have access to this mass media. When radio and television are available, a number of factors can influence their use. For example, beekeepers find it inconvenient to watch and listen to the limited beekeeping programs accessible on television and radio because they are aired or broadcasted at a time when they are away from their localities for beekeeping and other activities in the field. This leads to these broadcasting media fail to transmit beekeeping information and knowledge to users at a timely moment. Further to that, in most rural parts of Tanzania, access to and use of radio and television is limited because of poor signal coverage (Mkenda et al., 2020). Numerous other studies such as Funom and Soyemi (2019) found that radio's usefulness is problematic in terms of content relevancy and delivery timing.

Various other challenges encountering beekeeping information dissemination are identified. For example, FAO (2021) reported that one of the problems that hamper GBPs include inadequacy of circulation of up-to-date knowledge on changes in the industry. Further to that, available literature indicates a lack of adequate statistical information to guide plans and operations for the development of the beekeeping sector in Tanzania (URT, 2020a). The study further indicates that information on bees and bee fodder resources which exist in the various ecological zones in the country is not readily available. A study by Mussa et al. (2026) indicate that dissemination of information to beekeepers is hampered by limited awareness of supportive policies, guidelines, regulations and development projects coupled with weak organized community groups and cooperatives. FAO (2021) indicated that in order to obtain accurate information on the beekeeping industry depends on the registration of each beekeeper, apiary location and honeybee colony, and therefore, registration of the categories should be made compulsory.

Other challenges encountering dissemination of information to bee keepers include; language barriers, beekeepers lack of awareness of the existence of various information sources and beekeepers' lack of funds to acquire information dissemination tools leading to insufficient provision of beekeeping knowledge to beekeepers (Wakjira et al., 2019; Lydia et al., 2019). In those studies, it was also reported that there is a scarcity of information on how long opening of hives and pulling combs affects the behavior of bees or nest structure/architecture and homeostasis. Furthermore, some of the challenges that TFSA might face while giving beekeeping information, include financial constraints, insufficient facilities and professionals. Study conducted by Sanga et al. (2015) has shown that various issues influence the flow of information to rural farmers in Africa; which include a scarcity of radios and television sets, farmers' poor literacy levels, and an insufficient number of professionals skilled in agricultural information.

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III. METHODOLOGY

3.1 Research Design

This study used a cross-sectional research design which enabled data collection from different groups of respondents at a single point in time so as to capture important aspects and allowing for questionnaire survey (Sedgwick, 2014). The design is also considered appropriate for descriptive analysis and for generalization of findings. The study used both qualitative and quantitative research approaches. The key assumptions for combining quantitative and qualitative approaches are to provide a more comprehensive understanding of a research problem than when either of the approaches is used alone (Creswell, 2014). Qualitative and quantitative approaches were therefore combined to enable the analysis and output to complement each other so as to reach the desired conclusions.

3.2 Study Area

The study was conducted in Ilindi Ward, Bahi district-Dodoma. This area of the study was selected for its significant role in beekeeping because the beekeepers compliment it with sunflowers farming.

3.3 Target Population

The targeted population of this study consisted of TFSA staff and beekeepers from Bahi district in Dodoma region.

3.4 Sampling Technique and Sample Size

Snowballing or chain-referral sampling technique was used to identify 78 beekeepers for this study. The technique was used because the sampling frame of beekeepers was not available leading to unknown size and boundaries of such population. Saunders et al. (2007) and Dragan and Isaic-Maniu (2013) remarked that snowballing technique is used when it is difficult to identify members of desired population. This technique required the researchers to have a contact with a beekeeper who in turn could help to identify up to three beekeepers. The three identified beekeepers helped to further identify other respondents until the saturation point of 78 beekeepers was researched.

3.5 Data Collection Instruments and Procedures

Quantitative data were collected through questionnaire whereas qualitative data were obtained using key informant interviews (KIIs).

3.6 Data Analysis

Quantitative data were analyzed through IBM Statistical Package for Social Sciences (SPSS) Statistics software Version 25 based on descriptive statistics including frequencies, means and percentages. Qualitative data were analyzed using content analysis.

3.7 Ethical Considerations

Ethical standards were strictly observed throughout the study to protect participant rights and enhance data validity and reliability. Official research permissions were secured from Mzumbe University as well as from Bahi district council authority prior to field operations. Participation was fully voluntary, free from coercion, and conducted using self-administered questionnaires to safeguard respondent autonomy. Participants were guaranteed confidentiality, privacy, and anonymity, with all data used exclusively for academic purposes. Finally, transparent data handling and reporting were maintained, and all external sources were properly acknowledged.

IV. FINDINGS & DISCUSSION

4.1 Findings

4.1.1 Types of beekeeping information disseminated to beekeepers by TFSA

Respondents were provided with a series of responses describing types of beekeeping information disseminated to them by TFSA. Provision of information concerning honey transportation to beekeepers is of particular importance. This information is important because it will consequently improve market access and product quality. This means that effective transportation networks, which are crucial for ensuring that honey reaches markets timely and in good condition are highly needed. This corroborates to the findings by Mwakatobe and Mlingwa (2006), who reported that funding for enabling the development of infrastructure like roads and storage facilities, which are critical for reducing post-harvest losses and maintaining honey quality during transportation are highly needed. Furthermore, the FAO (2017) emphasizes that well-funded training programmes may give beekeepers with the knowledge and skills required to efficiently handle and transport honey, ensuring that it remains uncontaminated and retains its market value. The findings showed that majority of respondents highly agreed with the distribution of information to improve beekeeping. Providing beekeepers with information helps to enhance apicultural practices. It has been reported that beekeepers with

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clear information on the use of improved beehives are assumed to be in a good position to transform their practices from using traditional beehives to improved or modern beehives (Said et al. (2022).

Table 1

Types of beekeeping information disseminated to beekeepers by TFSA (N = 78)

S/N	Types of Information	Responses							
		Strongly Agree		Agree		Strongly Disagree		Disagree	
		F	%	F	%	F	%	F	%
1	Information about the right time to harvest honey	20	25.6	34	43.6	11	14.1	13	16.7
2	Information for improving beekeeping	36	46.2	16	20.5	9	11.5	17	21.8
3	Honey marketing information	17	21.8	32	41.0	14	17.9	15	19.2
4	Honey transportation information	27	34.6	31	39.7	9	11.5	11	14.1
5	Area preparation information	24	30.8	26	33.3	15	19.2	13	16.7

Respondents agreed that they received information about the best time to harvest honey. TFSA works with international aid and non-governmental organisations (NGOs) to provide beekeeping information, allowing them to run training programmes, workshops, and distribute educational materials for empowering beekeepers with modern techniques and sustainable practices for improving beekeeping methods aimed at maximizing production and ensure high-quality honey. An interview with TFSA respondent produced the following information:

> *…" TFSA officials often run programmes to impart varied beekeeping information to beekeepers. These programmes aim to keep beekeepers up to date on technological advancements in the business. Beekeepers are also trained on how to get beekeeping information from various sources which makes it easier for them to learn skills and procedures"* (TFSA Respondent, 15 January, 2024).

Honey marketing is yet another type of information needed by beekeepers for decision-making processes. The results show that respondents agreed to have received information on honey marketing. Providing honey marketing information to beekeepers is crucial for an improved honey marketing for beekeepers in Bahi district, Dodoma. It has also been documented that by providing information on the production methods, the origin, quality and integrity of the products enable smallholder beekeepers to market their own honey (FAO, 2021). In other parts of the world, it has been indicated that by providing consumers with information about the higher nutraceutical qualities of honeydew (e.g., greater antioxidant power, greater content of mineral elements, greater antibacterial effects) could increase their perceived value of the product and, as a result, increase its market potentials (Landaverde, et al. 2023). Mwakatobe and Mlingwa (2006) emphasized the importance of financial resources in creating honey processing and packaging facilities that ensure honey quality and marketability. This means that well-funded projects can help beekeepers to conduct market research and build cooperative networks, allowing them to market their honey more efficiently and negotiate better pricing. Adequate funding enables the development of marketing plans, training programmes, and infrastructural improvements that assist beekeepers in reaching new markets and pricing their goods more effectively (FAO, 2017).

The results of this study indicate that respondents received information regarding area preparations. The provision of beekeeping information to beekeepers with regards to areas preparations is important for the establishment of productive apiaries. Proper area preparation entails identifying acceptable sites, guaranteeing environmental sustainability, and establishing the necessary infrastructure, all of which necessitate financial investments. Mwakatobe and Mlingwa (2006) reported that financing allows beekeepers to receive training on how to assess and prepare apiary sites, including considerations for floral resources, water availability, and pest and predator protection.

4.1.2 Channels of communication used by TFSA to disseminate information to beekeepers

Table 2 represents the responses for the channels used by TFSA to disseminate apicultural information to the beekeepers. Results indicate that majority (62.8%) of respondents agreed with the assertion that exhibitions are important communication channels used by TFSA to distribute information to beekeepers. Exhibitions provide a dynamic platform for beekeepers to learn about beekeeping firsthand practices. Furthermore, exhibitions play an important role of boosting information transmission and innovation among farmers for improving their undertakings, for example exhibitions on how to manage apiaries.

Table 2

Channels used to disseminate information to beekeepers (N = 78)

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	Channels used to disseminate information to beekeepers	**Responses**					
S/N		**Yes**		**No**		**Undecided**	
		F	**%**	**F**	**%**	**F**	**%**
1	News papers	20	25.6	30	38.5	28	35.9
2	Exhibitions	49	62.8	15	19.2	14	17.9
3	Seminars	40	51.3	22	28.2	16	20.5
4	Community meetings	46	59.0	17	21.8	15	19.2
5	Farmers groups	37	47.4	18	23.1	23	29.5
6	Radio	34	43.6	25	32.1	19	24.4
7	Village leaders	41	52.6	17	21.8	20	25.6
8	Brochures and fliers	21	26.9	30	38.5	27	34.6
9	Television	19	24.4	32	41.0	27	34.6

The findings revealed that beekeepers acquired information from community meetings and seminars. Community meetings and seminars serve as key information sources for beekeepers, providing in-depth training through lectures and discussions on industry topics. These interactive methods effectively deliver diverse technical knowledge to enhance beekeeping practices. In one of the interviews, one member from TFSA commented that:

> …"*Every year, TFSA officers conduct seminar training to beekeepers for sharing information such as apiculture improvement, honey commercialization, honey transportation, and area preparations"* (TFSA Respondent, 17 January, 2024).

These findings, corroborated to Jeil et al. (2022) who demonstrated the value of face-to-face interactions in agricultural extension services, with seminars serving as useful platforms for information transfer. Chen et al. (2023) posited that agricultural extension agents serve as a vital conduit for transferring knowledge, technologies, and practices to farmers, thereby enhancing productivity, sustainability, and rural livelihoods.

Results of this study indicate that 52.6% of respondents agreed that village leaders serve as TFSA's communication channel for disseminating information to beekeeping communities. Collaborations with village leaders is critical for proper communication of beekeeping knowledge. Village leaders form village government and thus they play a key role in distributing information to other members of the village. These findings corroborate to that of Jones and Robson (2017) who underlined the necessity of including local leaders in extension initiatives and highlighting their position as trusted intermediates in rural areas. Additionally, in other parts of the world local leaders have shown to have played a vital role in the dissemination of agricultural information among their followers and farmers in a way that are responsible for bringing desirable changes in the community overall developmental issues (Hameed & Sawicka, 2017).

Beekeeper's groups or associations are important sources of information. Findings of this study indicated that beekeepers got information from their fellow group members. This concurs with Morawetz et al. (2026) who reported that beekeeping associations, comprise equally strong and most important sources of information. The groups are essential because they can maximize GBPs and enable participatory forest management approaches (Sewando, 2023). Furthermore, Prodanović et al. (2024) reported that beekeeper's collaboration in cooperatives or associations enhance knowledge sharing, resources, and marketing channels for improving beekeeping practices.

Radio broadcasts are an important medium for spreading information especially in remote areas where access to other forms of media is limited. The results indicate that 43.6 % of beekeepers agreed with the radio channel's usage of beekeeping information, whereas 32.1%) disagreed. URT (2020a) mentioned radio as an important source of information in Tanzania. On the other hand, Landaverde et al (2023) reported that newspapers, brochures and television are not sources that the beekeepers used for information in other parts of the world.

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4.1.3 Challenges encountered by TFSA when disseminating beekeeping information

Table 3 presents the challenges encountered by TFSA officials when providing information to the beekeepers. The challenges include poor road networks, language barriers, low literacy level, and bee keepers' inadequate income.

Table 3

Challenges encountered by TFSA when providing beekeeping information (N = 78

S/N	Challenges encountered	Strongly Agree		Agree		Strongly Disagree		Disagree	
		F	%	F	%	F	%	F	%
1	Language barrier	39	50	14	17.9	12	15.4	13	16.7
2	Limited number of radio and television sets for beekeeping information provision	17	21.8	20	25.6	21	26.9	20	25.6
3	Inadequate extensions services	23	29.5	19	24.4	19	24.4	17	21.8
4	Poor road networks for enabling TFSA officers to visit beekeepers in their localities	40	51.3	18	23.1	15	19.2	13	16.7
5	Low literacy level to the beekeepers	32	41.0	16	20.5	14	17.9	16	20.5
6	Low Income for enabling beekeepers to acquire information media such as newspapers, radio, television	28	36.0	24	30.8	9	11.5	17	21.8

Respondents strongly agreed that poor road networks make it difficult for TFSA officers to visit beekeepers in their localities for providing them with beekeeping information. Inadequate infrastructure makes it difficult for TFSA officers to reach isolated beekeepers, limiting their capacity to give timely assistance and instructions. The geographical isolation of many beekeeping communities also exacerbated the problem. Lee et al. (2023) highlighted the significance of good infrastructure in agricultural extension services, as well as the importance of well-maintained roads in facilitating access to rural areas and efficiently delivering extended support. In this study it was also reported that improved infrastructure not only reduce agents' burden of transportation costs but also enhance farmers' access to markets for enabling them to lower various transaction costs associated with acquiring farm inputs.

Language issues constituted a hurdle for TFSA when disseminating beekeeping information to beekeepers by impeding effective information distribution among beekeepers. Many beekeepers speak the Gogo language, but TFSA officials mainly converse in Swahili. This linguistic mismatch impeded communication, preventing the transfer of critical beekeeping information and practices. Language problems may lead to misinterpretation and misunderstanding, limiting the efficiency of agricultural extension programmes. This concurs with Antwi-Agyei et al. (2021) who reiterated that extension services are important vehicles for knowledge transmission to farmers for enabling them to change behaviors. This implies that there is a necessity of investing in language-specific resources and individuals for improving communication and for ensuring the effective transmission of information for proper decision-making process.

It has been reported that GBPs need to be communicated or made easily accessible to bee keepers. These practices need to be placed into context for bee keepers to understand their importance and to readily implement for decision making processes (Morawetz et al. 2026). Bee keepers fail to understand `written information or complex instructions, which limits their capacity to implement new techniques and practices because of low literacy. Jeil et al. (2022) reported that low literacy levels impede the adoption of new knowledge and innovation. This means that low literacy levels, make it difficult to disseminate beekeeping information effectively. Jones and Robson (2017) opined for the creation of simpler training modules that include visual aids and practical demonstrations to improve comprehension among low-literacy populations.

Broadcasting media such as television sets and radio are important medium for information delivery, particularly in distant places where access to other kinds of media may be limited. Thirty- six (36%) of respondents strongly agreed that low income hindered bee keepers' access to information because of low income which makes them unable to acquire communication media tools. Lack of bee keepers' access to radios and television sets due to financial constraints limit their capacity to get crucial updates and educational programming being aired or broadcasted by such electronic media. Agricultural extension services are vital for disseminating innovations and enhancing technical efficiency (Alhassan et al., 2025). However, inadequate extension services present a major barrier to information access among beekeepers. This mirrors URT (2020a) in which it was reported that extension services fail to effectively reach key stakeholders across the value chain. This lack of reach ultimately limits public awareness of bee products and stifles overall beekeeping practices.

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V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

TFSA's role in disseminating beekeeping knowledge to beekeepers is significant because of the ability to improve and enhance apiculture activities. The study shows that smallholder beekeepers in Bahi district rely on practical information such as land preparations, harvesting periods and market channels to boost productivity and commercialization of beekeeping products. The most effective channels used by beekeepers for knowledge dissemination were interactive and community-anchored communication platforms such as exhibitions, seminars, peer groups and local village leaders. The successful adoption of GBPs is ultimately hampered by structural and operational bottlenecks such as poor road infrastructure that isolates remote communities, language mismatches between extension officers and dialect local language-speaking beekeepers, low literacy levels and short fall in agricultural extension reach.

5.2 Recommendations

Local government authorities and beekeeping sector should strengthen grassroots networks by establishing official partnerships with village leaders and empowering beekeeper associations as primary information hubs. This implies that by establishing a communication network between beekeepers and local farmers would favor effective communication of apicultural information for awareness creation. Furthermore, targeted investments are needed to upgrade rural road networks and equip extension personnel with suitable transport facilities to extend their operational reach. Empowered local associations should also lead efforts to disseminate updated scientific information while also managing a comprehensive registry of beekeepers, apiary locations, and honey bee families to generate accurate industry data. Additionally, establishing a District Apiculture Information Centre (DAIC) staffed by a trained experts will be essential for educating communities on the ecological and agricultural value of bees in the study area.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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