



Challenges of Disseminating Agroecological Knowledge and Practices: Experience from Farmer Research Networks in Singida District, Tanzania

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Farmer Research Networks (FRNs) are essential for disseminating and promoting the adoption of agroecological (AE) knowledge and practices among smallholder farmers. However, many issues that restrict the efficient dissemination of AE knowledge and practices that frequently hinder FRN

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efforts are poorly documented. This paper examined the challenges of disseminating AE knowledge and practices faced by FRNs in Singida District in Tanzania. The study used a cross-sectional research design where data were collected at a single point in time. Qualitative data were collected using focus group discussions, key informants, and In-depth interviews. Thematic analysis was used to analyze the qualitative data. The study findings show that the recurrent obstacles, such as resistance to change, are because most farmers are still dubious about AE practices because of firmly rooted traditional farming attitudes and the labor-intensive nature of some techniques, such as the nine-seeds hole method and compost-making. The findings revealed that FRNs face challenges in reaching all farmers due to limited access to resources like financing and transportation, and village meetings do not give enough time for in-depth instruction and hands-on demonstrations. Gender inequality and social barriers to women's involvement in decision-making and the sharing of AE knowledge are further restricted by social and cultural norms. Furthermore, the lack of expertise in new AE technologies impacts FRNs' capacity to deliver current information, highlighting the importance of ongoing tailor-made training. This study recommends that policymakers should allocate more significant resources to addressing the perceived obstacles associated with comprehensively disseminating AE knowledge and practices.

Keywords: Farmer research networks; agroecology; knowledge dissemination; practice dissemination.

1. INTRODUCTION

Agroecology is a science, practice, and social movement that uses social and ecological concepts to design, implement, and manage sustainable farming systems (Hatt *et al.*, 2016). With the escalation of global issues such as food insecurity, poverty, biodiversity loss, and climate change, agroecology has become a viable substitute for traditional farming methods (Pereira *et al.*, 2018; Wijerathna-Yapa & Pathirana, 2022). It highlights the importance of biodiversity, healthy soil, water management, and combining traditional wisdom with contemporary research, which can boost agricultural productivity while conserving the environment. Healthy soil, biodiversity, and effective water management all contribute to environmental preservation by lowering the use of chemicals, preventing soil degradation, protecting water sources, and promoting sustainable farming practices that preserve ecological balance. Dissemination involves transferring relevant information, knowledge, technologies, and practices from the source to end users, who, in most cases, are farmers, extension agents, and community development officers. However, the extent of adoption of agroecological (AE) knowledge and practices is low and slow in both developed and developing countries. Wijerathna-Yapa and Pathirana (2022), who focused on bringing the AE knowledge and information divide, noted that for effective adoption and implementation of agroecological farming systems, timely access to relevant AE knowledge and best practices was a strategy that has the potential to help smallholder

farmers make informed decisions regarding their farming system productivity, marketing of their agricultural produce for better profits, and health benefits, disease prevention and advice. Thus, disseminating AE knowledge and practices is crucial for farmers to embrace economically and ecologically sustainable food systems.

The dissemination of AE knowledge and practices is an essential first step in attaining broad adoption of best agroecological practices. The efficient distribution of information guarantees that farmers may learn techniques like crop rotation, intercropping, organic fertilization, and pesticide control. Subsequently, farmers who use these techniques have a more significant opportunity to improve soil fertility and increase agricultural productivity and production. However, the dissemination process is often hindered by obstacles that might reduce its efficiency and hinder adoption and implementation, especially in settings with low resources and rural areas (DeLonge, Miles, & Carlisle, 2016).

FRNs are participatory platforms that aim to empower farmers through their participation in agricultural research, experimentation, and dissemination (Richardson *et al.*, 2022). These networks allow farmers to exchange knowledge, learn from one another, and jointly develop solutions. According to Nelson *et al.* (2019), FRNs are a link between agricultural communities and research institutes, as they facilitate the exchange of information between farmers and researchers, promoting innovation and shared learning. Existing literature has

demonstrated that FRNs are essential for fostering shared learning, bridging the gap between farming communities and research institutions, and sharing agroecological knowledge (Hausmann *et al.*, 2020; Richardson *et al.*, 2022; Chilewa *et al.*, 2023). Similarly, studies by Nelson and Hausmann (2019), Hassen *et al.* (2019), and Wenndt *et al.* (2021) have emphasized the value of FRNs as a participatory platform that encourages farmers to adopt sustainable agricultural practices. However, they face significant obstacles in disseminating agroecological knowledge and practices to local farmers. In addition, government agencies and FRNs often struggle to share agroecological principles due to various constraints effectively. Since FRNs serve as a crucial link between scientific research and local farmers, it is essential to understand the difficulties they face (Duru *et al.*, 2015). Identifying these challenges can help improve knowledge-sharing strategies, strengthen farmer participation, and support the successful adoption of AE practices.

This study aimed to determine the key challenges FRNs face in disseminating agroecological knowledge and practices. Thus, it was guided by the following key research question: What are the main challenges confronting FRNs in communicating and disseminating agroecology knowledge and practices to end users in the Singida district?

By examining how FRNs and government agencies work to overcome these obstacles, the paper offers recommendations for enhancing knowledge dissemination and promoting the adoption of sustainable farming methods. Furthermore, the findings will contribute to policy discussions on sustainable agricultural transformation at local, regional, and potentially global levels. By addressing the barriers to agroecological knowledge dissemination, this research can help shape policies that support resilient and sustainable agricultural systems, ultimately contributing to food security and climate resilience by 2030.

2. METHODOLOGY

2.1 Profile of the Study Area and Sampling Procedures

Singida district is one of the six districts in the Singida region: Singida, Iramba, Manyoni, Ikungi, Mkalama, and Singida Urban. The district lies

between latitudes 3°52' and 7°34' south and longitudes 33°27' and 35°26' east. A semi-arid climatic variation, including drought and unreliable rainfall, characterizes it. The annual average precipitation ranges between 600 millimeters (mm) and 700 mm per year. The minimum and maximum temperatures range between 15 and 30°C (Singida District Profile, 2015). The Singida District was selected because it engaged with the RECODA-FRN Project, where agroecological practices were implemented, and agriculture was the main economic activity. Two hundred eighty-four thousand eight hundred ninety-five people live in the district, and the gender proportion is relatively balanced (NBS, 2022). Although the district's economy is based mainly on agriculture, food shortages are frequent because of poor weather patterns and dwindling soil fertility.

The study used a cross-sectional research design to investigate the challenges FRNs face while trying to disseminate agroecological knowledge and practices. The cross-sectional research design allowed data collection at a single time to represent a large population (Cresswell, 2018). The target populations for this study were FRN members from five wards famous for implementing AE principles in the Singida district, namely Ilongero, Mrama, Ikhanoda, Mwasauya, and Merya (Fig. 1). One village was selected from each ward, and five FRNs were involved in each of the chosen villages. A purposive sampling of farmers was also used to guarantee that relevant and comprehensive data were gathered.

2.2 Data Collection Methods

Primary qualitative data were collected from members of FRN by using a validated checklist for focus group discussions (FGDs), key informant interviews (KIIs), and in-depth interviews. A total of 75 participants spanning a range of demographics, including men, women, village and FRN leaders, and other stakeholders, participated in five focus group discussions (FGDs) conducted once per village. In addition, 19 key informants, including community leaders, agricultural extension agents, and lead farmers, and 26 lead farmers were interviewed during in-key informants and in-depth interviews, respectively. The collected data were social, economic, and environmental challenges such as behaviour and attitudes to change their farming system, limitation in access to resources, gender, and social norms barrier to communication to

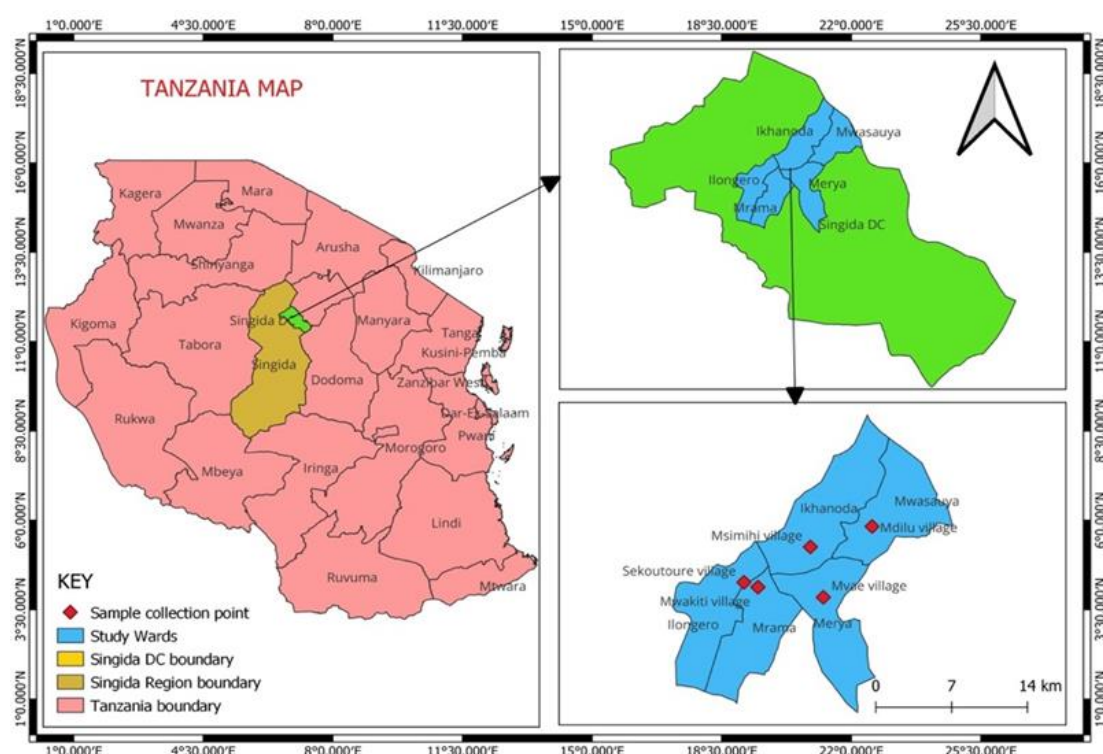


Fig. 1. Map showing the location of the study area

Source: GIS (2024)

different gender social groups, time required for disseminating the knowledge and practices and skills and knowledge of the disseminators/members of the FRNs. All these collected data were recorded and transcribed to understand farmers' perspectives better and helped reveal subtle, context-specific difficulties in knowledge and information dissemination. Furthermore, information on institutional factors, such as access to extension services and perceived advantages of FRNs as channels for co-creating knowledge, were collected.

2.3 Data Analysis

Thematic analysis was used to analyze qualitative data to identify FRNs' challenges while disseminating AE knowledge and practices. Key informant interviewers and focus group members' frequently used terms and phrases were methodically coded using this method. A better comprehension of the challenges faced was made possible by the thematic analysis's systematic approach to locating patterns and themes in the textual material. The approach facilitated a sophisticated data analysis by gathering various viewpoints from stakeholders, such as lead farmers, agricultural extension agents, and community leaders. This

inclusiveness allowed for identifying broad patterns and context-specific obstacles in disseminating AE knowledge and practices. The thematic analysis provided a structured framework for understanding the main challenges faced by FRNs, focusing on recurring scores.

3. RESULTS AND DISCUSSION

3.1 Challenges faced by FRNs in Disseminating AE Knowledge and Practices

FRNs face many obstacles in sharing AE knowledge and practices despite their vital role in assisting farmers. These obstacles make exchanging knowledge and using sustainable farming practices more difficult. Table 1 shows the pair-wise ranking of the main challenges that FRNs encounter while attempting to advance agroecology. These challenges include resistance to change, limited access to resources, gender inequality and social barriers, limited dissemination time, and a lack of skills in new agroecology technologies. This pair-wise ranking method involves comparing each challenge against all other challenges in pairs to determine which one is more significant or

pressing in each comparison. For every pair, the more important challenge is selected and given a score (typically 1 point), while the less important one receives a 0.

Table 1. Pair-wise ranking of challenges faced by FRNs in disseminating AE knowledge and practices in the study areas

	Resistance to change	Limited access to resources	Gender inequality and social barriers	Limited time for dissemination	Lack of skills in new technologies of agroecology	Score
Resistance to change	Resistance to change	Resistance to change	Resistance to change	Resistance to change	Resistance to change	4
Limited access to resource		Limited access to resource	Limited access to resource	Limited time for dissemination	Limited access to resource	3
Gender inequality and social barriers			Limited time for dissemination	Gender inequality and social barriers		1
Limited time for dissemination				Limited time for dissemination		2
Lack of skills in new technologies of agroecology						0
Total						10

Source: Field Survey, 2024

Table 2. Results of the pair-wise ranking

Method	Score	%	Rank	Reason
Resistance to change	4	40	1	Many farmers still adhere to traditional agricultural practices because they believe that modern AE practices are superfluous or challenging to use.
Limited access to resources	3	30	2	Resource limitations directly prevent farmers from engaging with the knowledge being shared. Even if farmers understand and accept AE principles, a lack of essential inputs makes it nearly impossible to apply what they learn. Consequently, without addressing resource access, efforts to disseminate AE knowledge and practices remain largely ineffective.
Gender and social barriers	1	10	4	It slows down dissemination. Women may face resistance, but some still manage to access and share knowledge, even if it requires extra effort or external support.
Limited time for dissemination	2	20	3	Its impact is more indirect, affecting farmers' perceptions and the effectiveness of AE knowledge and practices over time rather than directly limiting the ability of FRNs to share knowledge.
Limited skills on AE innovations	0	0	5	Not a challenge

Source: Field Survey, 2024

3.1.1 Resistance to change

The findings presented in Table 2 show that resistance to change is a challenge that scored high (40%) in pairwise ranking, followed by limited access to resources (30%), limited time for dissemination (20%), and gender inequality and social barriers (10%). The lack of skills in new agroecology technologies scored 0%. The study found that one of the biggest obstacles to FRNs' ability to disseminate knowledge and practices of agroecology was reluctance to change. This resistance it may cause by different factors like cultural factors and economic factors. Many farmers still adhere to traditional agricultural practices because they believe AE practices present numerous challenges; it is cultural factors here that make this a barrier. These practices often require specialized knowledge; for example, the use of a nine-seed hole demands specific skills in how to prepare it correctly. In addition, some modern methods require special tools, such as the Zambian hoe, which may not be easily available or affordable to all farmers; here are economic issues.

Furthermore, most farmers continue to practice traditional farming out of habit. There is a deep-rooted trust in these methods, as they have been passed down through generations and have proven effective in their local contexts. As long as traditional techniques continue to meet their basic needs, farmers may see no urgent reason to change.

This unwillingness to adopt new methods is also driven by a lack of awareness about modern agricultural practices like conservation agriculture, as noted by an extension officer:

"...Farmers still rely on conventional farming methods because they are used to them and are yet to understand the benefits of agroecology. "(Key Informant interview with an Extension Officer, Mwakiti Village, April 18, 2024).

Moreover, some farmers perceive traditional farming as simpler, requiring less effort and posing less risks. Indeed, traditional practices, unlike AE practices such as the nine-seed hole practice, require less labour, as observations by a male farmer in FGD show:

"...When you introduce the nine-seed hole method or the Zambian planting technique to older farmers or young people, they often

dismiss it, saying, 'We have always farmed this way; why change now?' This resistance is widespread among the youth and older people. Young people, in particular, prefer allowing livestock to graze rather than digging planting holes, as they see it as too much work..." (A male participant in FGD, Sekoutoure Village, April 18, 2024).

Farmers' unwillingness to adopt AE practices is primarily influenced by their fixed practices and preference for familiar, tried-and-tested methods. Many farmers remain doubtful about the effectiveness of AE techniques, especially when initial results do not meet their expectations. Key informants noted that older farmers, in particular, are hesitant to abandon the conventional agricultural practices they have relied on for years, ultimately slowing the transition to sustainable farming.

This unwillingness is reflected in the remarks by a male farmer from Mdilu village, who expressed concerns about shifting away from traditional methods to agroecological methods during a focus group discussion:

"...Some people have not left Indigenous agriculture; they are still struggling with it because they believe it is less labor-intensive and more reliable than sustainable farming...." (A male participant in FGD, Mdilu village, April 16, 2024).

Similarly, a female farmer from Mwakiti village highlighted the social resistance farmer's face when trying to implement AE practices:

"...The problem is that when we dig nine-seed holes, people claim we are ruining our farms. According to them, it cannot boost productivity....." (FGD in Mwakiti village, April 17, 2024).

These statements illustrate how deep-seated beliefs and disbelief within farming communities hinder AE adoption. Without tangible proof of long-term benefits, many farmers remain hesitant to change their ways. Therefore, continuous education, demonstrations, and evidence-based success stories must build trust and encourage a gradual shift toward AE practices.

Indeed, when there is no quick proof of benefits, farmers are likely to oppose change, which underscores the necessity of constant teaching and demonstration. Overcoming this opposition

requires a participative strategy that includes farmer-led trials and demonstrations (Pretty et al., 2020). Extension officers and FRNs should increase community involvement through peer learning and hands-on field demonstrations to highlight the advantages of AE techniques in order to overcome this obstacle.

3.1.2 Limited access to resources

According to the study, one of the biggest obstacles to disseminating AE knowledge and practice is the lack of access to necessary resources, which is ranked at the top of the issues raised. To disseminate AE knowledge and practice, FRN finds it challenging to reach farmers without resources to facilitate knowledge sharing, it needs, among others, equipment and funding. The absence of equipment for digging nine-seed holes and implements like the Zambian hoe was often cited as a significant obstacle, which brought difficulties during the demonstration. A male farmer participating in FGD highlighted this challenge when he remarked.

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"...I remember attending a seminar at some point where we discussed equipment challenges, and we suggested being provided with machines to dig these nine-seed holes to make the work easier during disseminating practices to farmers. Some people see it as a joke, but it is important to have machines to ease the work because, as I see it, most of the group members here are elderly. So, when you tell them to dig nine-seed holes, they feel like you are torturing them. Therefore, if machines are available and adapted to our needs, we can farm more easily...."(A male farmer FGD in Mvae village, April 19, 2024).

This is crucial, considering that nine-seed hole farming is being prioritized. Machines are essential during demonstrations because farmers will see this practice as tough without them, affecting their willingness and capacity to engage with shared knowledge.

This is due to the importance of providing practical education, as highlighted by one of the contributors. Farmers learn better through demonstrations, but valuable training opportunities are limited. In this regard, some

farmers only accept AE practices after seeing their real-life application and results. This is evident in remarks by a male participant:

".... Getting the farmer to accept the information is the most challenging task. To completely comprehend, they would rather see it in action than only hear it in theory. If you tell them, they think you are not providing them with specific information. When they are presented with new ideas, they frequently have many questions. Additionally, many techniques, like the nine-seed hole technique, are challenging to describe..."(FGD in Sekoutoure village, April 18, 2024).

Also, it was found that lack of equipment like soil testing equipment impacted on the farmers' willingness to adopt recommended practices such as fertilizer as remarks below show:

"...During meetings or farmer-to-farmer visits, when AE knowledge is given, farmers frequently ask questions like which crops to plant or what kind of fertilizer is best for their farm. The lack of equipment to evaluate the soil makes it difficult for them to find solutions. For instance, it is essential to have soil testing equipment if a farmer wants to determine the type of fertilizer required for their area. This presents a difficulty for FRNs..." (A male participant in FGD in Mwakiti village, April 18, 2024).

This quotation illustrates that farmers are eager to adopt AE practices but struggle to make informed decisions due to the absence of soil testing tools. Without the ability to assess soil conditions, it becomes difficult to determine the appropriate fertilizers or amendments needed for sustainable farming, hindering the adoption of AE techniques. Beyond the issue of inadequate farming tools, transportation constraints further limit the effective dissemination of AE knowledge. A female participant in FGD at Mvae village emphasized this challenge, stating:

"...For instance, it might be a long journey from one village to another if I wish to teach agroecology. Transportation is the first obstacle. You will arrive exhausted if you walk, and training will not work even if you give it. To have the energy to educate, you also need to eat. As a result, transportation expenses, such as hiring a motorbike, exist. Farmers in remote places will not receive

education if no intermediary pays for the transportation expenses....." (In-depth interview, Mvae village, April 19, 2024).

This statement highlights how geographical remoteness and financial constraints make it difficult for FRNs to reach all farmers. Limited transportation options mean many farmers miss training sessions, leaving them uninformed about AE practices. Physical exhaustion and financial barriers also reduce the effectiveness of training even when it is available.

These combined challenges of lack of essential farming tools and difficulties in reaching farmers result in gaps in knowledge dissemination, ultimately slowing the transition to AE farming. Research has shown that a lack of resources is one of the main obstacles to sustainable agricultural transitions in underdeveloped nations (Tittonell, 2019). According to a review by Vanlauwe et al. (2023), farmers frequently have difficulty obtaining the inputs needed to sustain crop output and soil fertility in AE systems. Interventions including subsidized inputs, FRN cooperatives for bulk purchases, and increased financial inclusion through microfinance programs to promote resource gaining are necessary to address this problem.

3.1.3 Limited time for dissemination

One of the main challenges in effectively disseminating AE knowledge is the limited time allocated for educational sessions during village meetings. Village meeting is one of the methods which are used by FRNs to disseminate AE knowledge to the farmers. Meetings are usually called by the chairperson in the village, where citizens attend, and FRNs use this opportunity to educate citizens about agroecology through a special agenda about agroecology. The brief nature of these discussions makes it challenging to convey detailed information, leaving farmers with an incomplete understanding of AE practices. A male key informant from Mwakiti village highlighted this concern:

"...We are only given a short time to speak, which is insufficient to explain everything..." (Key Informant, April 24, 2024).

This statement underscores how time constraints prevent FRNs from fully explaining critical agroecological concepts, such as soil management, pest control, and organic fertilizers. Without sufficient time for discussion,

farmers struggle to grasp the knowledge required for successful implementation.

Adding to this challenge, an FGD participant from Mwakiti village shared a similar concern:

"...We are given very little time. For example, if I ask the village chairperson for time to discuss agroecology, I am only allocated a short period. Since many people attend the meeting, some may receive the message well, while others may not, due to time constraints...." (FGD in Mwakiti village, April 18, 2024).

This highlights how village meetings serve as a platform for multiple discussions, making it difficult for AE training to receive adequate attention. Some farmers may absorb the information effectively, while others may miss key details due to the rushed nature of the sessions.

Furthermore, farmers pointed out that other community issues often overshadow agroecology discussions during village meetings. A female farmer from Msimihi village noted:

"...There is no time for practical demonstrations, and agroecology is only briefly mentioned when village leaders schedule meetings...." (In-depth interview, April 22, 2024).

This illustrates another critical issue: the lack of practical demonstrations. Since AE practices often require hands-on training for effective learning, brief mentions of these practices during general village meetings are insufficient. Farmers need dedicated time and space to practice and internalize these methods.

According to research by Pretty et al. (2018), specialized training sessions with practical demonstrations are essential for effectively spreading agricultural knowledge. One possible solution is to organize separate meetings focused solely on agroecology and establish farmer field schools to enhance knowledge retention and practical learning.

3.1.4 Gender inequality and social barriers

The study findings reveal that gender inequality and societal barriers significantly hinder the efforts to promote AE practices. Despite their active involvement in farming, women face

obstacles in sharing AE knowledge, particularly in village meetings and community settings, leadership roles or resource distribution. One major challenge is the reluctance of women to speak publicly due to fear of criticism and cultural norms. A male participant in FGD held at Mwakiti village explained:

"...Women themselves hesitate to stand in front of people because they fear making a small mistake and being laughed at. Moreover, in reality, women often criticize each other, while men do not do the same. Even here, if you ask a question, a woman will answer, but if you ask without pointing her out, meaning without encouraging her to raise her hand and speak, they typically will not respond. This is due to many traditional customs in Tanzania, where women are not allowed to speak publicly in the presence of men..." (FGD in Mwakiti village, April 18, 2024).

This statement highlights how deep-rooted cultural norms discourage women from actively participating in knowledge-sharing discussions. Their voices remain unheard unless explicitly encouraged, limiting their ability to contribute to AE dissemination efforts.

In addition to these barriers, some men resist learning from women, believing that farming knowledge should be male dominated. A female participant from FGD in Mvae village noted:

"...Some males are still quite obstinate. They reject when you teach them about agroecological farming, such as pouring fertilizer directly into planting holes rather than sprinkling it over the entire field or employing the nine-seed hole method to boost yields when rainfall is limited. Because he thinks, "What can a woman tell me?" such a guy is unwilling to learn. He believes that men are more knowledgeable than women. Despite not being the one working on the farm, he makes all of the choices by using his masculinity. While the lady struggles with farming and child-rearing, his sole worry is consuming beer..." (FGD on April 19, 2024, at Mvae village)

This shows the power imbalance in farming decisions, where men, despite not actively engaging in agricultural work, control farming practices and resist adopting new methods if introduced by women. This limits the effectiveness of AE knowledge dissemination.

Even when women receive AE training, male land ownership often constrains their ability to implement new techniques. A female farmer from Mvae village expressed her frustration:

"...I know how to farm using AE methods, but the land is not mine, so digging holes for the nine-seed method is challenging because men own the farms. If the father does not understand, he refuses...." (FGD, April 19, 2024, Mvae village).

Similarly, a male farmer at Mdilu village acknowledged this issue in in-depth interview when he remarked:

"...Men make most farming decisions in our community. Women cannot use new methods without authorization, even if they teach them. This limits disseminating AE knowledge and practices to farmers because FRNs cannot establish demonstration farms for others to learn from...." (In-depth interview, Mdilu village, April 14, 2024).

These quotes illustrate how land ownership and decision-making power are concentrated among men, preventing women from applying the knowledge they have acquired. Since AE techniques often require demonstration farms, women's inability to establish these learning spaces further obstructs knowledge dissemination.

Furthermore, cultural biases often lead women to downplay their contributions to farming. During discussions, participants hesitated to answer truthfully when asked who the main contributors to farming activities were. However, one male participant stated:

"...No, the women are the main contributors because they do everything while men only wait to sell the produce....." (FGD in Mwakiti village, April 18, 2024).

After this, all the women agreed, acknowledging that although they do most of the labor, ownership of both land and profits remains with men. This gendered dynamic significantly limits women's ability to participate in decision-making and implement AE practices. These findings are consistent with existing research on gender disparities in agricultural decision-making. Doss et al. (2018) found that women in sub-Saharan Africa have limited access to land, credit, and extension services, making engaging in

agricultural transformation harder. In addition, these results are consistent with those of the Madrid region's Vizuete et al. (2025), who found that gender-sensitive agroecological approaches are necessary to promote women's self-empowerment, resource access, and decision-making while arguing for a profound, feminist transformation of agroecology. Understanding gender as the foundation of agroecological science and social movements is very important in the development agroecological practices. Addressing these barriers requires policy interventions that protect women's land rights, promote their inclusion in farming decisions, and provide targeted support to empower them in efforts to promote AE knowledge and practices. Without such measures, the widespread adoption of AE practices will remain slow, as a significant portion of women's farming workforce continues to be sidelined from decision-making processes.

3.1.5 Lack of skills in new technologies in agroecology

FRNs faced challenges disseminating new agroecological technologies to farmers due to limited skills, training, and resources. To address this, the FRN project under RECODA has been providing training to enhance FRNs' knowledge and awareness of sustainable practices. However, due to the ever-evolving nature of agricultural technologies, continuous learning is essential. Lack of skills in new technologies in agroecology could limit FRNs' ability to solve farmers' problems. For example, in determining which method should be used during which period to ensure that the practice is safe for the environment and also increases crop yields for the farmer. The village executive officer at Mdilu village emphasized that continuous training helps farmers to adapt to climate change and improve productivity:

"...The constant change and daily development of new technologies leave FRNs lacking new information. To ensure that they are providing farmers with the most recent information, FRNs must undergo continuous training. This is significant, as even the weather is erratic and constantly shifting. Diseases that were formerly prevalent in a nearby place may reach our area, and new diseases are always emerging. As FRNs, it is therefore essential that we remain current through training or seminars to provide valuable

expertise...."(Key informant, village executive officer, Mdilu village, April 14, 2024).

The importance of continuous learning and exposure to new farming practices, as emphasized by the Village Executive Officer (VEO), is further supported by the experiences shared by the FGD participants. They highlighted how attending seminars offers them a learning opportunity as these remarks show;

".....we learned from attending several seminars. Additionally, we were brought to other areas to see what their friends had developed. Last year, we traveled to Moshi District in the Kilimanjaro Region to learn about AE.... "(FGD in Mdilu village, April 14, 2024).

Another participant added, *"..... I have been to Moshi twice and have also been to Dodoma and Arusha. We do so by sharing our experiences with trained individuals....."* (A male FGD in Mdilu village, April 14, 2024). Continuous learning is crucial for AE knowledge dissemination, with FRNs needing updated information to address agricultural challenges.

The result implies that continuous learning and exposure to new AE practices are essential for effective knowledge dissemination among FRNs. However, at the same time it highlights the challenges faced, such as inadequate training opportunities and financial constraints, which limit the ability of FRNs to stay updated with evolving agricultural practices. However, barriers like limited training opportunities and financial support persist. Investment in training programs, improved learning resources, and stakeholder collaboration can enhance knowledge dissemination and sustainable farming practices. The finding aligns with a study by Wezel et al. (2018), which found that actors and researchers need more excellent knowledge through joint development and information sharing to have sustainable food and agricultural systems. Similar findings were reported by Nelson et al. (2019), who highlighted the necessity for FRNs to know about social and technical innovations to support agroecological intensification. They also found that developing FRNs can help close the gap between farmers' unique contexts and various agricultural options.

4. CONCLUSION AND RECOMMENDATION

The study's results show that FRNs face several challenges, including effectively disseminating AE knowledge and practices. There is also a reluctance to change, as many farmers continue to use conventional farming practices because they are unaware of and unconvinced of the advantages of agroecological farming.

As FRNs struggle with insufficient tools, equipment, and financing to conduct training and demonstration operations, limited access to these resources hinders them from effectively disseminating knowledge and practices to end users. Farmers' capacity to implement AE practices was further hampered by the lack of time for in-depth conversations and practical learning during village meetings. Social barriers and gender inequality were also recognized as significant challenges, as women, despite being the primary contributors to agriculture activities, have no access to productive resources such as land and have little chance to participate in decision-making.

Based on the above conclusions, the following are recommendations: First, FRNs and agricultural extension officers should carry out additional farmer-led demonstrations and participatory research trials to provide concrete evidence of AE benefits for those farmers who resist change. Second, local government authorities in Singida Council and NGOs should support FRNs in providing affordable or subsidized AE equipment and facilitate the provision of soil testing kits and motorcycles for extension services. Third, to guarantee convenient accessibility and save money on transportation, FRNs should carry out their FFs near their homesteads. Lastly, to ensure that both men and women engage equally in disseminating AE practices, the government, through the Ministry of Agriculture, supports and mainstream gender-inclusivity in agricultural training and participates in decision-making initiatives.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

The author(s) hereby declare that no generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators were used during the writing or editing of this manuscript.

CONSENT

In compliance with global or academic norms, the authors sought and obtained written consent from the respondents.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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