### Original Research Article

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

# Abstract

Farmer Research Networks (FRNs) are essential for promoting agroecological (AE) knowledge and practices (AE K&P) among smallholder farmers. However, a number of issues that restrict the efficient dissemination of AE approaches frequently hinder their efforts. This study uses qualitative methodologies to investigate the challenges facing FRNs during dissemination of AE knowledge and practices dissemination. Using thematic analysis, recurrent obstacles, such as resistance to change, the results show that a lot of farmers are still dubious about AE practices because of strongly rooted traditional farming attitudes and the labor intensive nature of some techniques, such as the nine seeds hole method. Limited access to resources is hampered by FRNs finding it is challenging to reach all farmers due to lack of resources, financing, and transportation. Village meetings limited time for dissemination of agroecological knowledge and practices for the farmers; village meetings don't give enough time for in-depth instruction and hands on demonstrations. Gender inequality and social barriers on Women's involvement in decision making and the sharing of AE knowledge is further restricted by social obstacles and gender inequality. Last but not least, lack of skills in new technologies of agroecology: FRNs' capacity to deliver current information is impacted by lack of expertise in new agroecological technologies, highlighting the importance of ongoing education. This study suggests enhancing FRNs by ongoing training, participatory learning strategies, and better access to organic inputs and farming equipment in order to increase AE dissemination. Policymakers ought to incorporate gender-inclusive policies, community engagement and improved resource allocation. Farmers and rural communities can profit in the long run from FRNs' increased role in promoting sustainable agriculture by tackling these issues comprehensively.

**Keywords:** Farmer Research Networks, Agroecology, Knowledge Dissemination, Practice Dissemination

# 1.0 INTRODUCTION

Agroecology is a comprehensive method that uses social and ecological concepts to design, implement, and manage sustainable farming systems (Hatt et al., 2016). 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. Dissemination involves the transfer of relevant information, knowledge, technologies and practices from the source to end users, who in most cases are farmers, extension agents and community development officers. With the escalation of global issues such as food insecurity, poverty, biodiversity loss, and climate change, agroecology has emerged as a viable substitute for traditional farming methods (Pereira et al., 2018; Wijerathna-Yapa and Pathirana, 2022). However, the extent of adoption of agroecology knowledge and practices is slow in both developed and developing countries. For effective utilization, adoption and implementation of agroecological farming systems, agroecological best practices need to be disseminated to farmers through appropriate channels or extension methods that are timely, relevant and tailored to user needs. Thus, disseminating agroecological knowledge and practices is crucial for farmers to embrace economically and ecologically sustainable food systems.

The dissemination of agroecological knowledge and practices is an important first step in attaining broad adoption of best agroecological practices. The efficient distribution of information guarantees that farmers may get knowledge on techniques like crop rotation, intercropping, organic fertilization and pesticide control; and subsequent farmers who use these techniques have a greater opportunity of improving soil fertility and hence increasing agricultural productivity and production. However, the communication and dissemination process are often hampered by obstacles that might not only reduce its efficacy but also hinder adoption and implementation, especially in settings with low resources and rural areas (DeLonge, Miles, & Carlisle, 2016).

Farmer Research Networks (FRNs) are participatory platforms that aim to empower farmers through their participation in agricultural research, experimentation, and dissemination (Richardson et al., 2022). For farmers, these networks provide a chance to exchange knowledge, learn from one another, and jointly develop solutions that are suited to their particular situations. According to Nelson et al. (2019), FRNs serve as a link between agricultural communities and research institutes, as they facilitate the exchange of information between farmers and researchers, promoting innovation and reciprocal learning. Existing literature has demonstrated that Farmer Research Networks (FRNs) are essential for fostering reciprocal learning, bridging the gap between farming communities and research institutions, and sharing agroecological knowledge (Haussmann et al., 2020; Richardson et al., 2022; Chilewa et al., 2023). Similarly, studies by Nelson and Haussmann (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, there is existing research on agroecology knowledge and practices dissemination; very little focuses on the specific challenges that FRNs face in disseminating AE knowledge and practices. Since FRNs serve as a crucial link between scientific research and local farmers, it is important to understand the difficulties they face. Identifying these challenges can help improve knowledge-sharing strategies, strengthen farmer participation, and support the successful adoption of AE practices.

Agroecology, unlike conventional agricultural practices, requires adaptive management and a comprehensive understanding of ecosystems (Duru et al., 2015). FRNs are uniquely positioned to address these complexities by engaging directly with farmers. However, they face significant obstacles in disseminating agroecological knowledge and practices to local farmers. Understanding these challenges is crucial, as overcoming them can enhance the adoption of sustainable farming techniques, ultimately benefiting smallholder farmers in Singida District.

However, FRNs and government agencies often struggle to effectively share agroecological principles due to various constraints. Identifying and addressing these challenges can provide valuable insights into how knowledge dissemination can be improved, ensuring that agroecological practices are both environmentally sustainable and economically viable.

This study aims to determine the key challenges FRNs face in disseminating agroecological knowledge and practices. By examining how FRNs and government agencies work to overcome these obstacles, the research will offer 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 lies between latitudes 3°52' and 7°34' south and longitudes 33°27' and 35°26' east. The Singida District is characterized by a semi-arid climate with two rainfall seasons, namely the dry season, which is the longest, starting from April to November, and the shortest rainfall season (December to March). The annual average precipitation ranges between 600 and 700 millimeters per year, while the minimum and maximum temperatures are 15 and 30°C (Singida District Profile, 2015). The area was purposively selected due to engagement with the RECODA-FRN Project. There are 284,895 people living in the district, and the proportion of gender is rather balanced (NBS, 2022). Although the district's economy is based mostly on agriculture, food shortages are frequent because of poor weather patterns and dwindling soil fertility. The region's farmers cultivate income crops including sunflowers, onions, and other vegetables, as well as food crops like beans, sorghum, millet, and maize. One important source of income is the raising of livestock, such as chickens, goats and cattle.

The study used a cross-sectional research design to investigate the challenges FRNs face while trying to disseminate agroecological knowledge and practices. Five wards Ilongero, Mrama, Ikhanoda, Mwasauya and Merya were chosen among the six wards carrying out the FRN study using purposive sampling. The villages of Sekouture (Ilongero ward), Mwakiti (Mrama ward), Msimihi (Ikhanoda ward), Mdilu (Mwasauya ward), and Mvae (Merya ward) were then chosen. Five FRNs were included in each of the chosen villages. Purposive sampling of farmers was also used to guarantee that relevant and comprehensive data are gathered. This sampling strategy was used to optimize the data's validity and relevance by concentrating on participants who were actively associated with the FRNs and their agroecological dissemination efforts.



**Figure 1:** Map showing the location of the study area

**Source: GIS (2024)**

#

# 2.2 Data collection methods

Under the direction of pertinent checklists, focus group discussions (FGDs), key informant interviews (KIIs), in-depth interviews, and direct observations were used. A total of 75 respondents spanning a range of demographics, including men, women, village leaders, and other stakeholders, participated in five focus group discussions (FGDs), one per each village.

19 key informants, including community leaders, agricultural extension agents, and lead farmers, participated in data collected through the key informant guide. The viewpoints of those with specialised knowledge or influential roles within the FRNs were recorded in these interviews. Furthermore, 26 lead farmers participated in in-depth interviews to collect firsthand recollections of their encounters with FRNs and the difficulties they face while disseminating AE knowledge and practices. These interviews contributed to a better understanding of farmers' perspectives and helped reveal subtle, context-specific difficulties.

The approach adopted involving use of a combination of data collection methods helped to uncover gaps and difficulties in the dissemination process by offering insightful information on the real-world implementation of shared knowledge. When combined, these data-gathering techniques provided a thorough grasp of the obstacles FRNs have when trying to spread AE practices and knowledge.

#  2.3 Data analysis

Thematic analysis was used to analyze qualitative data in order to identify the challenges FRNs face while trying to disseminate AE knowledge and practices. Using this method, key informant interviewers and focus group members' frequently used terms and phrases were methodically coded. A better comprehension of the challenges faced was made possible by the systematic approach that thematic analysis offered for locating patterns and themes in the textual material. Through gathering a variety of viewpoints from stakeholders, such as lead farmers, agricultural extension agents, and community leaders, the approach facilitated a sophisticated analysis of the data. This inclusiveness allowed for the identification of both broad patterns and context-specific obstacles in the dissemination of AE knowledge and practices. Thematic analysis provided a structured framework for understanding the main challenges faced by FRNs, focusing on recurring and emphasized themes. This analysis formed the foundation for practical recommendations to address these challenges. [By](http://challenges.By) addressing these issues, the study provides actionable insights that can inform policy decisions and strengthen the role of FRNs in promoting sustainable agricultural practices. The findings emphasize the need for targeted interventions, such as capacity building programs, improved extension services, and supportive policies, to enhance the spread and adoption of AE knowledge among smallholder farmers.

# 3 RESULTS AND DISCUSSION

# 3.1 Challenges faced by FRNs in disseminating AE knowledge and practices

FRNs face a number of obstacles in sharing AE knowledge and practices, despite their vital role in assisting farmers. These obstacles make it more difficult for them to exchange knowledge and use sustainable farming practices. The following table lists the main challenges that FRNs encounter while attempting to advance agroecology. The challenges are resistance to change, limited access to resources, gender inequality and social barriers, limited time for dissemination and lack of skills in new technologies of agroecology.

Table 1: Pair wise ranking on 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 | 4 |
| **Limited access to resource** |  |  | Limited access to resource | Limited access to resource | 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 Presented in Table 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 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 inequality 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. |
| Lack of skills in new technologies of agroecology  | 0 | 0 | 5 | It is **not as severe or urgent** compared to other challenges**Training opportunities exist**  |

**Source: Field Survey, 2024**

#

# 3.2 Resistance to change

The findings presented in Table 2 show that resistance to change is a challenge which 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%), while lack of skills in new technologies of agroecology 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. Many farmers still adhere to traditional agricultural practices because they believe that modern AE practices present many challenges in their use. Most farmers continue to practices traditional farming out of habit and are reluctant to adopt new methods, primarily due to lack of awareness about conservation agriculture, as the following remarks by an extension officer suggest:

 *“.....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 observed by a male 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've always farmed this way; why change now?’ This resistance is especially common among the youth and the elderly. 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 largely 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, which ultimately slows down the transition to sustainable farming.

This unwillingness is said in the words of a male farmer from Mdilu village, who expressed concerns about shifting away from traditional 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 act as barriers to 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 are necessary to build trust and encourage a gradual shift toward AE practices.

When there is no quick proof of benefits, farmers are likely to oppose change, which emphasizes the necessity of constant teaching and demonstration. According to studies, 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.

# 3.3 Limited access to resources

According to the study, one of the biggest obstacles to the dissemination of AE knowledge and practice is the lack of access to necessary resources, which ranked at the top of the issues raised. In order to disseminate AE knowledge and practice, FRN find it difficult to reach farmers without resources to facilitate that knowledge share and practical needs; it needs 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 highlighted this challenge when he remarked

*"....I remember attending a seminar at some point where we were discussing challenges of equipment, 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 saw 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 prioritised and machines are very important to use during demonstrations because without machines, farmers will see this practice as tough, and it affects their willingness and capacity to engage with the knowledge being shared.

 And this is due to the importance of providing practical education, as highlighted by one of the contributors. Farmers learn better through demonstrations, but practical training opportunities are limited. Some farmers only accept agroecological practices after seeing real-life application and results.

*"....* *Getting the farmer to accept the information is the most difficult task. In order for them to completely comprehend, they would rather see it in action than only hear about it in theory. If you just tell them, they think you're not providing them with specific information. When they are presented with new ideas, they frequently have a lot of questions. Additionally, many techniques like the nine-seed hole technique are difficult to describe.... "(FGD in Sekoutoure village, April 18, 2024).* It̕̕s not only that a male participant from the FGD in Mwakiti village he highlighted that

"....*During meetings or farmer-to-farmer visits, when AE knowledge is being 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 from 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 from 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 won't work even if you give it. In order 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 there is no intermediary to pay 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 that many farmers miss training sessions, leaving them uninformed about AE practices. Even when training is available, physical exhaustion and financial barriers reduce its effectiveness.

These combined challenges 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 one of the main obstacles to sustainable agricultural transitions in underdeveloped nations is a lack of resources (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, FRNs cooperatives for bulk purchases, and increased financial inclusion through microfinance programs to promote resource gaining are necessary to address this problem.

# 3.4 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. The brief nature of these discussions makes it difficult 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 not enough 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 talk about agroecology, I am only allocated a short period. Since the meeting is attended by many people, 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 agroecology discussions are often overshadowed by other community issues 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.

# 3.5 Gender inequality and social barriers

The study findings reveal that gender inequality and societal barriers significantly hinder the dissemination of AE knowledge. Despite their active involvement in farming, women face obstacles in sharing AE knowledge, particularly in village meetings and community settings. One major challenge is the reluctance of women to speak publicly due to fear of criticism and cultural norms. A male participant from 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 don’t do the same. Even here, if you ask a question, a woman will answer, but if you simply ask without pointing her out, meaning without encouraging her to raise her hand and speak, they typically won’t 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 try to teach them about agroecological farming, such 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 children rearing, his sole worry is consuming beer..... ". (FGD on April 19, 2024, at Mvae village)*

This illustrates 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, their ability to implement new techniques is often constrained by male land ownership. A female farmer from Mvae village expressed her frustration:

*"....I know how to farm using AE methods, but the land is not mine, so it is a challenge to dig holes for the nine-seed method because the farms are owned by men. If the father does not understand, he refuses...."* (FGD, April 19, 2024, Mvae village).

Similarly, a male farmer from Mdilu village acknowledged this issue:

*".....Most farming decisions in our community are made by men. Women cannot use new methods without authorization, even if they teach them. This limits the dissemination of 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, the inability of women to establish these learning spaces further obstructs knowledge dissemination.

Furthermore, cultural biases often lead women to downplay their contributions to farming. During discussions, when asked who the main contributors to farming activities were, participants hesitated to answer truthfully. 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 it harder for them to engage in agricultural transformation

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 AE knowledge dissemination. Without such measures, the widespread adoption of AE practices will remain slow, as a significant portion of the farming workforce women continues to be sidelined from decision-making processes.

# 3.6 Lack of skills in new technologies of agroecology

FRN they faced to disseminate new agroecological technologies to farmers due to limited skills, training, and resources. To address this, the FRN project from RECODA has been providing training to enhance FRNrs’ 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 It could cause FRNs to fail in solving farmers' problems, example to determining which method should be used during which period to ensure that the method is safe for the environment and also increases crop yields for the farmer.. The village executive officer from Mdilu village emphasized that ongoing education helps farmers adapt to climate change and improve productivity. Expanding training programs, strengthening extension services, and encouraging knowledge sharing are crucial for building resilient farming communities;

.*".....The constant change and daily development of new technologies leaves FRNs lacking of 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 in order 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

Participants stated that *"....we learned from attending several seminars. Additionally, we that were brought to other areas to see what their friends had developed. We traveled to Moshi District in the Kilimanjaro Region last year in order to get knowledge about AE....." (FGD in Mdilu village, April 14, 2024).* This strategy enables farmers and FRNs to observe effective agroecological techniques being used in other areas and obtain personal knowledge. Being exposed to various farming settings promotes the sharing of information and the uptake of novel methods suited to particular agroecological circumstances.

Another participant added by saying that

*"...... I have been to Moshi twice and had 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).*  *This mean that* continuous learning is crucial for AE knowledge dissemination, with FRNs needing updated information to address agricultural challenges.

The result imply that continuous learning and exposure to new AE practices are essential for effective knowledge dissemination among FRNs. However, it also 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 collaboration among stakeholders can enhance knowledge dissemination and sustainable farming practices. The findings is in line with a study by Wezel et al. (2018), which discovered that in order to have sustainable food and agricultural systems, actors and researchers need to have greater knowledge through joint development and information sharing. Similar findings were reported by Nelson et al. (2019), who highlighted the necessity for FRNs to be knowledgeable about both social and technical innovations to support agroecological intensification. They also found that the development of FRNs can help close the gap between farmers' unique contexts and a variety of agricultural options.

# 4. CONCLUSION

The results of the study show that FRNs have several challenges to overcome in order to spread AE knowledge and practices. The biggest of these challenges is reluctance to change, since many farmers continue to use conventional farming practices because they are unaware of and unconvinced of the advantages of agroecology. As FRNs struggle with insufficient tools, equipment, and financing to allow training and demonstration operations, limited access to resources also had a significant impact on the dissemination process. Farmers' capacity to completely understand and use 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 major challenges, as women, despite being the primary contributors to agriculture activities.

# 5. RECOMMENDATIONS

1. FRNs and agricultural extension officers should conduct more farmer-led demonstrations and participatory research trials to provide concrete evidence of AE benefits for those farmers who resist change. Also use peer learning approaches where early adopters share their success stories to encourage reluctant farmers; it helps to motivate others to learn. Governments and NGOs should support FRNs in providing affordable or subsidized AE equipment (e.g., tools for nine-seed hole planting and soil testing kits) and motorcycles which facilitate teaching in disseminating AE knowledge and practices.
2. Village meetings and workshops should be organized by FRN leaders in collaboration with the village council, apart from regular community gatherings. To guarantee convenient accessibility and to save money on transportation, FRNs should place their FFs close by. Provide FRNs with frequent refresher training to keep them up to date on new AE technology. They can also go to other areas to observe and learn from agroecological professionals who are succeeding. The government ought to assist them by holding FRN seminars.
3. To guarantee that both men and women engage equally, the government and policymakers must support gender-inclusive agriculture training. Implement collaborative decision-making initiatives to help males comprehend the role that women play in sustainable agriculture.

**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 of the respondents.

# REFERENCES

Chilewa, H. S., Martin, R., & Ntumva, M. (2023). The role of farmer research networks’ (frn) principles in influencing farmers’ adoption of improved groundnut cultivars in Singida Rural District of Semi-Arid Central Tanzania.

DeLonge, M. S., Miles, A., & Carlisle, L. (2016). Investing in the transition to sustainable agriculture. *Environmental Science & Policy*, *55*, 266-273.

Doss, C., Meinzen-Dick, R., Quisumbing, A., & Theis, S. (2018). Women in agriculture: Four myths. *Global food security*, *16*, 69-74.

Duru, M., Therond, O., & Fares, M. H. (2015). Designing agroecological transitions; A review. Agronomy for Sustainable Development, 35, 1237-1257.

Hassen, S., Alemu, T., Dejen, A., Mulugeta, T., Ashine, E., & Girma, M. (2019). Perception of Farmers on Push-Pull Technology: Using Farmers Research Network Approach in Eastern Amhara, Ethiopia. *Abyssinia Journal of Science and Technology*, 4(1), 17-25.

Hatt, S., Artru, S., Brédart, D., Lassois, L., Francis, F., Haubruge, E., & Boeraeve, F. (2016). Towards sustainable food systems: the concept of agroecology and how it questions current research practices. A review. *Biotechnologie, Agronomie, Société* et Environnement, 20(Special issue 1).

Haussmann, B. I., Aminou, A. M., Descheemeaker, K., Weltzien, E., Some, B., Richardson, M., & Coe, R. (2020). Tackling key issues for smallholder farmers: The farmer research network (FRN) approach. Sorghum in the 21st Century: Food–Fodder–Feed–Fuel for a Rapidly Changing World, 315-329.

National Bureau of Statistics (NBS) [Tanzania]. 2022. Tanzania National Panel Survey Report (NPS) - Wave 5, 2020-2021. Dodoma, Tanzania: NBS.

Nelson, R., Coe, R., & Haussmann, B. I. (2019). Farmer research networks as a strategy for matching diverse options and contexts in smallholder agriculture. *Experimental Agriculture,* 55(S1), 125-144.

Pereira, L., Wynberg, R., & Reis, Y. (2018). Agroecology: The future of sustainable farming? Environment: *Science and Policy for Sustainable Development*, 60(4), 4-17.

Pretty, J. (2018). Intensification for redesigned and sustainable agricultural systems. *Science*, *362*(6417), eaav0294.

Pretty, J., Attwood, S., Bawden, R., Van Den Berg, H., Bharucha, Z. P., Dixon, J., & Yang, P. (2020). Assessment of the growth in social groups for sustainable agriculture and land management. *Global Sustainability*, *3*, e23.

Richardson, M., Coe, R., Descheemaeker, K., Haussmann, B., Wellard, K., Moore, M., & Nelson, R. (2022). Farmer research networks in principle and practice*. International Journal of Agricultural Sustainability,* 20(3), 247-264.

Richardson, M., Coe, R., Descheemaeker, K., Haussmann, B., Wellard, K., Moore, M., & Nelson, R. (2022). Farmer research networks in principle and practice. International *Journal of Agricultural Sustainability*, 20(3), 247-264.

Tittonell, P. (2019). Agroecological transitions: multiple scales, levels and challenges.

Vanlauwe, B., Amede, T., Bationo, A., Bindraban, P., Breman, H., Cardinael, R., & Groot, R. (2023). Fertilizer and soil health in Africa: The role of fertilizer in building soil health to sustain farming and address climate change.

Wenndt, A. J., Sudini, H. K., Pingali, P., & Nelson, R. (2021). Farmer research networks enable community-based mycotoxin management in rural Indian villages. *Agricultural Systems,* 192, 103192.

Wezel, A., Goris, M., Bruil, J., Félix, G. F., Peeters, A., Bàrberi, P., & Migliorini, P. (2018). Challenges and action points to amplify agroecology in Europe. *Sustainability*,  *10*(5), 1598.

Wijerathna-Yapa, A., & Pathirana, R. (2022). Sustainable agro-food systems for addressing climate change and food security*. Agriculture,* 12(10), 1554.