International Journal of Environment and Climate Change

Volume 15, Issue 2, Page 365-373, 2025; Article no.IJECC.131070
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Extension Advisory Services on Farmer's Climate Change Mitigation Strategies in Misungwi District, Tanzania: Issues and Options

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Authors' contributions

This work was carried out in collaboration among all authors. Author SNS conceptualized and designed the study, collected and analyzed the data and interpreted the results. Author SNS wrote, reviewed and edited the manuscript. Author RM and MN reviewed the methodology, provided guidance on data analysis, and offered critical feedback on the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ijecc/2025/v15i24733

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://pr.sdiarticle5.com/review-history/131070

Original Research Article

Received: 10/12/2024
Accepted: 12/02/2025
Published: 17/02/2025

ABSTRACT

This study evaluates the impact of extension advisory services on farmers' climate change mitigation strategies. Questionnaires were completed by 64 extension agents and data were analysed using descriptive statistics. The study found that the most common method used for identifying farmers' climate change adaptation needs is extension agents visiting farmers (84.6%), followed by training sessions are less frequently used (26.2%), and other methods are rarely employed (1.5%). Insufficient training on climate change, with a frequency of 55, resource

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Cite as: *Samweli, Sagire Nelson, R. Martin, and M. Ntumva. 2025. "Extension Advisory Services on Farmer's Climate Change Mitigation Strategies in Misungwi District, Tanzania: Issues and Options". International Journal of Environment and Climate Change 15 (2):365-73. https://doi.org/10.9734/ijecc/2025/v15i24733.*

constraints, reported by around 49 respondents and limited access to climate information also stand out as a significant issue, with a frequency of about 41, and lastly knowledge barriers with 39 respondents were shown as the challenges encountered during dissemination of advisory services to farmers. This study revealed that majority (56.9%) of extension agents reported receiving transport facilities, while 41.5% had access to timely updated information. Though, only 18.5% of respondents indicated receiving regular training. This study concludes that the majority of extension agents have reported that they do not receive sufficient support in their efforts to educate farmers on how to adapt to climate change. The extension agents are not prepared to deal with the complexities of climate change, despite the fact that they rely on personal visits to capture the needs of the farmers. The low level of diversity engagement approaches, the low rates of hands-on training, and the moderate perceptions of comfort in communicating climate information are all indicators that this is the case. In addition, many extension agents believe that the increase of these concerns is caused by resource problems, which include inadequate access to timely information, inadequate training, and inadequate financial resources. This study recommends that the government should allocate enough resources aimed at supporting the extension agents in fulfilling their operations.

Keywords: Extension agents; climate change; farmers; advisory; services.

1. INTRODUCTION

Climate change has emerged as one of the most pressing challenges of the 21st century, significantly impacting agricultural systems worldwide (IPCC, 2014). Climate change is a pressing global challenge that significantly affects smallholder farmers. Extensive assessment done by (Orindi et al 2014) on the expected effects of climate change on agriculture shows that farmers in Sub-Saharan Africa including farmers in Tanzania are particularly vulnerable, in part because they mostly rely on rain-fed agriculture instead of irrigation.

Smallholder farmers, who constitute a significant portion of the global agricultural workforce, are particularly vulnerable to the adverse effects of climate change due to their limited resources and adaptive capacities (FAO, 2016). Climate change affects around 2.5 billion people who rely on agricultural production for a portion or all of their income (Ali et al., 2017).

In Tanzania, a country heavily reliant on agriculture for economic sustenance and employment, the effects of climate change pose a substantial threat to food security and livelihoods, especially to smallholder farmers (Bera, 2021). The agricultural extension agents plays a pivotal role in mediating climate change impacts by providing crucial information and advice to farmers (Adesina & Zinnah, 2019). Agricultural extension agents serves as intermediaries between research institutions, policymakers, and the farming community. These agents are tasked to communicate knowledge, skills, and technologies that empower farmers to adapt to changing climatic conditions (Swanson et al., 2010).

The level of competency of extension agents in professional and technical aspects, enhance good communication and interaction with farmers, which increases farmer technology adoption and performance (Wasihun et al., 2013). Competency encompasses not only a deep understanding of climate change science but also the ability to communicate this knowledge in a way that resonates with the local context and the specific challenges faced by smallholder farmers (Kumar et al., 2019; Salami, 2017). Alemu and Birhanu (2019) emphasize that extension agents with a solid knowledge base in climate-smart agriculture are better equipped to guide farmers in making informed decisions regarding climate change adaptive strategies.

Misungwi District has no exception on this challenge. Smallholder farmers in Misungwi District are experiencing erratic rainfall, prolonged drought, high temperature, crop's pests and diseases. Research highlights the pivotal role of agricultural extension agents in assisting smallholder farmers in adapting to climate change (Schaafsma et al., 2018). However, the effectiveness of this role is contingent on their competences. Misungwi District has 71 extension agents who are assumed to be competent in transferring knowledge and skills to farmers. Nevertheless, smallholder farmers in the district still suffering from negative effect of climate change. Islam et al (2016) highlights that having an adequate

number of well-trained extension agents is essential for effective adaptation efforts among smallholder farmers. While the significance of extension agent's competence in assisting farmers on climate change adaptation has widely been recognized, there is a notable gap in the literature regarding Misungwi extension agent's competences nexus advising farmers to adopt to climate change effects. Therefore, purpose of this study is to investigate the competences of extension agents in advising smallholder farmers to adapt to climate change effect in Misungwi District.

2. METHODOLOGY

The research was carried out in Misungwi District, Mwanza Region in Tanzania which is situated on the shores of Lake Victoria at longitudes 33.0817144 and latitudes -2.8429633. Misungwi District receives an average annual rainfall of 930 mm, with two rain seasons: a short rain season spanning from October to December and a long rain season from March to May. Due to its location along the paved trunk road T8, the district is divided into four areas with 27 wards and 114 villages, making it appropriate for this research as it is involved in intense agricultural practices, hiring relatively many extension agents (71) involved in climate change adaptation. Cross-sectional research design was employed to ensure that data were collected from extension agents at one point in time so that the competencies were quickly identified. The target population was agricultural extension agents in Misungwi District. Convenience sampling was adopted to select the sample because the study targeted agricultural extension agents as they were envisaged to have the best knowledge of climate change adaptation practices due to their responsibilities in advising farmers. Furthermore, convenience sampling was used to access extension agents who could be contacted during the duration of the study from the list of extension agents, only 64 agents were surveyed. A statistical package for social science (SPSS) computer program were used to analyze quantitative data. Descriptive statistics such as frequency counts, means and percentage were employed to explore relationships between competences and advisory outcomes.

3. RESULTS AND DISCUSSION

3.1 Communication Methods for Climate Change Adaptation

The bar chart demonstrates the frequency of various extension methods used by agricultural extension agents in Misungwi District, Tanzania, to disseminate advisory services on climate change adaptation.

Farm visits are the most frequently employed method, with approximately 57 instances. Village or ward farmers meetings, used around 58 times. On-farm demonstrations, with about 46 instances. Telephone consultations (37 instances), while home visits (41 instances) and one-on-one consultations (20 instances). Workshops and training sessions, with fewer than 8 instances, are the least utilized.

The results indicate that farm visits are the predominant extension method, demonstrating its effectiveness in meeting the individual requirements of farmers along with providing customized, practical assistance. This corresponds with the findings of (Maulu et al., 2021), who emphasized that field visits are essential in agricultural extension, enabling agents to directly assess farm conditions, establish trust with farmers, and provide tailored advice.

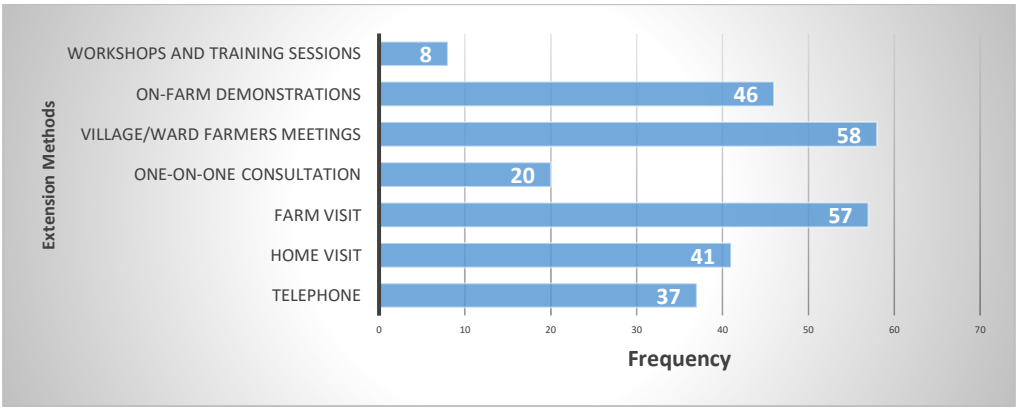

Fig. 1. Extension Methods Used for Dissemination of Advisory Services to Farmers

3.2 Extension Methods, Collaboration, and Perceptions in Climate Change Advisory Services

The results in Table 1 show that the most common method used for identifying farmers' climate change adaptation needs is extension agents visiting farmers (84.6%), followed by training sessions are less frequently used (26.2%), and other methods are rarely employed (1.5%). Regarding the frequency of hands-on training with farmers, only 29.2% of extension agents conduct training frequently, while 36.9% do so occasionally, 32.3% rarely, and 1.5% never. In terms of comfort levels in communicating climate information, the majority of extension agents (56.9%) are moderately comfortable, followed by 27.7% who are very comfortable, 12.3% slightly comfortable, 1.5% not at all comfortable, and 1.5% extremely comfortable. For the perceived impact of advisory services on farmers' adaptation to climate change, 67.7% believe the impact is moderate, 20.0% consider it large, and 12.3% view it as small. Collaboration with other organizations during the dissemination of climate change-related services is evenly split, with 50.8% of extension agents reporting collaboration and 49.2% reporting no collaboration. Among those collaborating, the most common method is providing seeds (72.7%), followed by workshops and training for farmers (63.6%), facilitating extension agents to reach farmers (36.4%), and subsidizing other agricultural inputs (33.3%).

The findings emphasize the essential role of extension agents in linking climate change adaptation strategies to the actual needs of farmers. Direct visits dominate indicating an emphasis on individual interactions that may encourage trust and understanding. The restricted application of various approaches, such as training sessions, indicates a need for more structured and scalable strategies that may engage a larger audience.

3.3 Challenges Encountered During Dissemination of Advisory Services to Farmers

Regarding the challenges encountered during the dissemination of advisory services to farmers, this study observed that majority of the respondents indicated insufficient training on climate change, followed by resource constraints and knowledge barriers. As pointed out by (Raj & Garlapati, 2020) that extension education play a crucial role in assisting farmers to manage the varied effects of climate change by fostering knowledge through the utilization of suitable tools to inform them about various adaptation and mitigation techniques. Lack of proper training prevents extension officers from developing climate change mitigation approaches that suit particular local environmental conditions. Additionally, it creates ineffective advisory services among extension officers which decreases farmers' willingness to follow their recommended mitigation approaches.

Budget allocation for climate change depends on financial assistance from bilateral and multilateral donor agreements, as well as public and private sector funding. The majority of climate financing in most countries is significantly reliant on the international community (Michaelowa et al., 2021). A primary obstacle to climate change adaptation is the absence of an efficient and sustainable financial system to allocate cash for the execution of climate change action plans. Additionally (Antwi-Agyei & Stringer, 2021) pointed that significant obstacles faced by agricultural extension agents in delivering climate change extension services included insufficient transportation resources, absence of suitable extension materials, elevated ratios of extension agents to farmers, and inadequate funding for the implementation of adaptation practices.

3.4 Support Received for Climate Change Mitigation

The results in Table 2 reveal the extent of support received by extension agents for climate change mitigation. A majority (56.9%) of extension agents reported receiving transport facilities, while 41.5% had access to timely updated information. Though, only 18.5% of respondents indicated receiving regular training. Motorcycle maintenance services and fuel, as well as extra duty allowances, were reported by just 12.3% of extension agents. Internet access was also limited, with only 15.4% of respondents indicating they had access. Other forms of support were minimal, with only 4.6% of extension agents reporting receiving any other assistance.

The resurgence of climate change affects the support for extension agents in climate change mitigation, alongside existing structural and resource deficiencies within the agricultural extension system. Despite the availability of adequate transportation choices, extension

Table 1. Summary of Extension Methods, Collaboration, and Perceptions in Climate Change Advisory Services

Variable	Frequency	Percent
Methods used for identification of farmer's climate change adaptation needs		
Extension agent visiting farmers	55	84.6
Farmers calling extension agents	37	56.9
During farmers meetings	53	81.5
During training sessions	17	26.2
Other	1	1.5
Frequency of Hands-on Training with Farmers		
Frequently	19	29.2
Occasionally	24	36.9
Rarely	21	32.3
Never	1	1.5
Comfort Level in Communicating Climate Information		
Not at all comfortable	1	1.5
Slightly comfortable	8	12.3
Moderately comfortable	37	56.9
Very comfortable	18	27.7
Extremely comfortable	1	1.5
Perception on the extent of impact of advisory services on farmers adaptation to climate change		
To a small extent	8	12.3
To a moderate extent	44	67.7
To a large extent	13	20.0
Collaboration with other organization during dissemination of climate change related services		
Yes	33	50.8
No	32	49.2
Methods of collaboration with other organizations during dissemination of climate change related services		
Through workshop and training to farmers	21	63.6
Through providing seeds	24	72.7
Through subsidizing other agricultural inputs	11	33.3
Facilitate extension agents to reach farmers	12	36.4

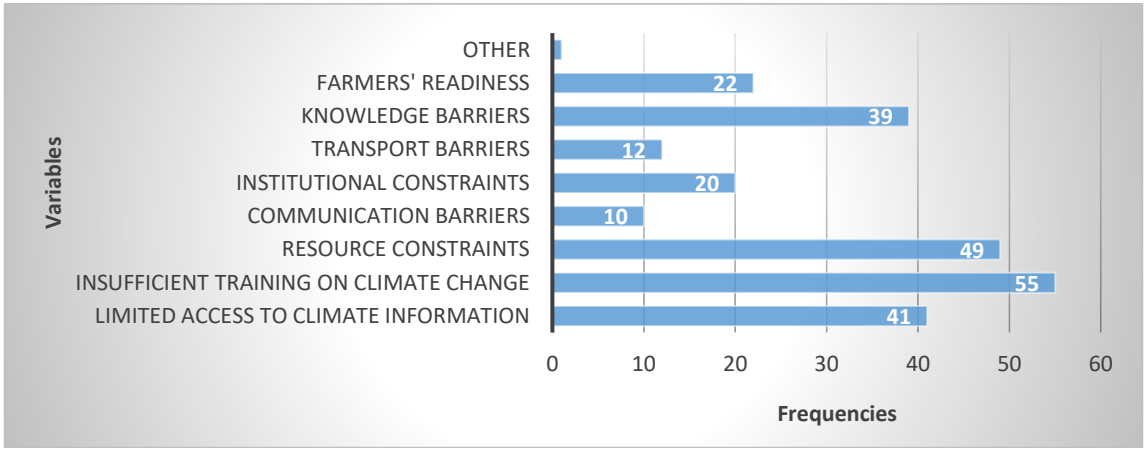

Fig. 2. Challenges Encountered During Dissemination of Advisory Services to Farmers

Table 2. Support Received for Climate Change Mitigation

Support Received by Extension Agents	Responses	
	Yes	No
Regular training	12 (18.5%)	50 (76.9%)
Timely updated information	27 (41.5%)	35 (53.8%)
Transport facility	37 (56.9%)	25 (38.5%)
Motorcycle maintenance services and fuel	8 (12.3%)	54 (83.1%)
Internet access	10 (15.4%)	52 (80.0%)
Extra duty allowance	8 (12.3%)	54 (83.1%)
Other	3 (4.6%)	59 (90.8%)

agents are insufficiently provided with essential resources, such as consistent training, internet access, and financial incentives. This indicates that they are not being fully developed. This imbalance not only limits operating capacity but also obstructs the delivery of prompt and effective advising services to farmers.

The results of this study clearly support the results of (Makamane, 2023), which found that extension agents' inability to provide farmers with effective climate adaptation strategies is greatly hampered by their lack of access to training and up-to-date information.

3.5 Perception of Extension Agents on the Support Received when Advising Farmers Regarding Climate Change Mitigation

The results in Table 3 highlight the perceptions of extension agents regarding the support received for advising farmers on climate change mitigation. On-job training received a mean score of 1.97, with the majority rating it as either poor (41.5%) or very poor (32.3%). Similarly, timely updated information was rated with a mean score of 2.30, as 50.8% of respondents perceived it as poor.

Transport facilities were rated relatively higher, with a mean score of 2.97, and 33.8% and 35.4% of respondents rating it as very good and good, respectively. Nevertheless, motorcycle maintenance services, internet access, and extra duty allowances were rated poorly, with mean scores of 1.91, 1.60, and 1.40, respectively. Over half of the respondents rated internet access and extra duty allowances as very poor (50.8% and 66.2%, respectively).

The overall mean score of 2.02 indicates that the support provided to extension agents is generally perceived as inadequate, which could significantly hinder their effectiveness in advising farmers on climate change mitigation.

The results reveal a troubling state of the support system for extension agents, highlighting significant deficiencies that hinder their ability to properly counsel farmers on climate change mitigation. The pervasive negative views regarding on-the-job training, frequent information updates, and critical resources like as internet access and additional duty allowances indicate a systemic disregard for the fundamental tools necessary for efficient service delivery. Although transportation facilities receive favorable evaluations, the insufficiency of other essential supports undermines the overall effectiveness of extension agents, constraining their capacity to deliver timely and pertinent climate solutions to farmers.

3.6 Adequacy of Support During Delivery of Climate Change Related Services to Farmers

The pie chart illustrates the adequacy of support received by extension agents in delivering climate change-related services to farmers. According to the data, only 32% of respondents perceived the support as adequate, while a significant majority, 68%, reported that the support provided was inadequate.

The results indicates that the majority of extension agents perceive their support as insufficient. This deficiency suggests significant obstacles within the operational framework that supports the delivery of climate change-related services. These variances indicate that disparities exist regarding equity or the quality of advocacy received, frequently influenced by geographical or administrative divisions.

Table 3. Perception of Extension Agents Based on Support Received

Support Received	Very Good	Good	Poor	Very Poor	Mean Score
On-job training	2 (3.1%)	15 (23.1%)	27 (41.5%)	21 (32.3%)	1.97
Timely updated information	2 (3.1%)	22 (33.8%)	33 (50.8%)	7 (10.8%)	2.30
Transport facility	22 (33.8%)	23 (35.4%)	16 (24.6%)	4 (6.2%)	2.97
Motorcycle maintenance service	2 (3.1%)	5 (7.7%)	43 (66.2%)	15 (23.1%)	1.91
Internet access	1 (1.5%)	5 (7.7%)	26 (40.0%)	33 (50.8%)	1.60
Extra duty allowance	0 (0.0%)	4 (6.2%)	18 (27.7%)	43 (66.2%)	1.40
Overall score					2.02

Definition of operation: ≥3 good support, <3 Poor support

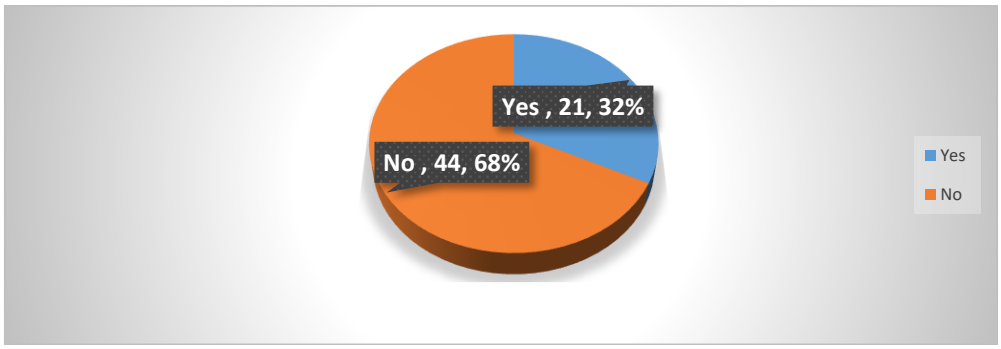

Fig. 3. Extension Agents who adequately supported During Delivery of Climate Change Related Services to Farmers

These deficiencies may lead to a reduction in the effectiveness of advisory services, as extension workers may be unable to provide farmers with the essential tools and information to address climate concerns. The discrepancy between the agents' requirements and the available support suggests the existence of systemic impediments to enhancing resilience and adaptive ability within farming communities.

4. CONCLUSION

This study concludes that the majority of extension agents have reported that they do not receive sufficient support in their efforts to educate farmers on how to adapt to climate change. The extension agents are not prepared to deal with the complexities of climate change, despite the fact that they rely on personal visits to capture the needs of the farmers. The low level of diversity engagement approaches, the low rates of hands-on training, and the moderate perceptions of comfort in communicating climate information are all indicators that this is the case. In addition, many extension agents believe that the increase of these concerns is caused by resource problems, which include inadequate access to timely information, inadequate training, and inadequate financial resources. While it is possible to witness some degree of cooperation across organizations, this degree of cooperation cannot be deemed adequate for satisfying all requirements. This study recommends that the government should allocate enough resources aimed at supporting the extension agents in fulfilling their operations; these resources should then be used in areas like funding for training programs, enhancement of transport facilities, and provision of updated climate information.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during editing of this manuscript. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology.

Details of the AI usage are given below:

1. ChatGPT

ACKNOWLEDGEMENT

My sincerest thanks to everyone who helped finish this study. First and foremost, I would like to thank my supervisor. I am also deeply grateful to the extension agents, who took the time to participate in this study and share their experiences. Without their cooperation and willingness to provide insights, this research would not have been possible. Thank you all for your contributions, which have greatly enriched this research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://pr.sdiarticle5.com/review-history/131070