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Farmers' Experiences with Extension Services in Promoting Sustainable Land Use Practices in Fanteakwa South Municipality

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Abstract:

This study explored farmers' experiences with agricultural extension services in promoting sustainable land use practices in the Fanteakwa South Municipality of Ghana. Guided by participatory extension, social learning, innovation diffusion, and systems theory, the research adopted a qualitative exploratory case study design. Data were collected through focus group discussions with 20 farmers and eight key informants. Thematic analysis revealed that farmers accessed extension messages through group meetings, community information centers, radio programmes, and home visits. While farmers expressed general satisfaction with these methods, they highlighted differing preferences based on accessibility and interaction, with farm visits and group methods valued for their practical and interactive nature. Extension agents promoted practices such as soil fertility management, agroforestry, crop rotation, erosion control, and water conservation. Adoption, however, was constrained by financial limitations, lack of access to credit, and the technical complexity of extension messages. The findings underscore the need for farmer-centered extension approaches that integrate financial support mechanisms, participatory learning, and coordinated stakeholder engagement to enhance adoption and ensure the sustainability of land use practices in farming communities.

Keywords: Agricultural extension services, Farmer perceptions, Knowledge transfer, Sustainable land use practices.

1. Introduction

Agricultural extension services have emerged as critical intermediaries between scientific knowledge and farmer practice in the global push for sustainable agriculture (Priya et al., 2025). With intensifying threats from climate change, soil degradation, and biodiversity loss, extension systems are increasingly tasked with not only enhancing productivity but also fostering resilience and ecological sustainability (Yang et al., 2024; Harvey et al., 2014). Their role is no longer confined to transferring technologies; rather, they are positioned as facilitators of behavioural change, mediators of local and scientific knowledge, and agents of inclusive rural development (Priya et al., 2025).

Extension services are therefore expected to serve as vehicles for disseminating strategies such as conservation agriculture, agroforestry, integrated soil fertility management, and integrated pest management. However, the degree to which these practices are adopted remains inconsistent, underscoring the persistent disconnect between extension objectives and farmer realities (Kwanya et al., 2021). The effectiveness of extension services in bridging the gap between sustainable agricultural innovations and farmer adoption has become a focal point of research and policy (Hameed & Sawicka, 2023).

The complexity of adoption challenges necessitates examining the lived experiences of farmers in their interactions with extension services. Adoption of sustainable practices is shaped not only by access to technical advice but also by socio-economic conditions, institutional capacity, and cultural contexts (Tham-Agyekum et al., 2024; Olabanji & Chitakira, 2025). While extension officers provide the conduit for scientific knowledge, farmers' willingness and ability to adopt recommended practices are mediated by farm size, education, access to resources, and historical experiences with agricultural interventions. This interplay demands that extension services be designed in ways that are participatory, inclusive, and context-specific, rather than reliant on one-way communication models (Lipper et al., 2014).

The role of extension in promoting sustainability has received increasing scholarly attention. Whereas extension services were historically oriented towards increasing yields and output, their focus has broadened to include ecological sustainability, resilience-building, and livelihood diversification (Schaafsma et al., 2018; Mungai et al., 2024). Programmes have promoted agroecological methods and soil health strategies with varying degrees of success. Yet adoption remains uneven across different farmer categories. For example, larger or better-resourced farmers are often better positioned to adopt recommended practices than their smallholder counterparts, who face acute resource constraints. This disparity underscores the limitations of conventional extension approaches and highlights the importance of context-sensitive programming (Lipper et al., 2014).

The literature points to a persistent gap between programme objectives and farmer adoption of sustainable land use practices (Wang et al., 2021). This gap is attributable to a complex set of barriers spanning economic, institutional, and socio-cultural domains. Economically, many sustainable practices demand significant upfront investments or entail temporary reductions in yields before long-term benefits accrue. In resource-constrained contexts, farmers often perceive these practices as risky and impractical without access to credit or risk management strategies. Institutional barriers further complicate adoption. Extension officers are often inadequately trained in participatory approaches and ecological principles, limiting their ability to effectively engage farmers. Moreover, structural challenges such as insufficient logistics, poor monitoring, and performance evaluation frameworks that emphasise quantity over quality contribute to weak service delivery. This creates a situation where extension programs may achieve high coverage rates but minimal behavioural change among farmers. Socio-cultural barriers are equally significant. Traditional extension approaches rooted in one-way communication models often disregard the wealth of indigenous knowledge farmers hold regarding soils, weather, crops, and pests (Radcliffe, 2020). By failing to integrate this knowledge into the design and dissemination of recommendations, extension programs risk alienating farmers and reducing their legitimacy. Furthermore, trust remains a decisive factor in shaping adoption. Farmers are more likely to adopt recommendations when extension agents demonstrate cultural sensitivity, local understanding, and a collaborative spirit (Oyetunde-Usman et al., 2020).

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Existing studies emphasise the critical role of extension services in promoting sustainable land use practices, particularly their capacity to disseminate innovations and improve farmers' technical efficiency (Hameed & Sawicka, 2023; Issahaku & Abdulai, 2020; Asare-Nuamah et al., 2019). While digital platforms are increasingly promoted, insufficient attention has been paid to inclusivity, particularly how gender, age, literacy, and infrastructure access mediate farmers' ability to benefit from these services (Mungai et al., 2024; Zulu et al., 2021). However, persistent challenges such as limited farmer engagement, inadequate training of extension workers, and weak dissemination strategies continue to undermine their effectiveness (Hameed & Sawicka, 2023). While recommendations such as capacity building for extension practitioners (Khwidzhili & Worth, 2020) and the adoption of pluralistic approaches to extension delivery (Danso-Abbeam, 2022) have been proposed, there is limited empirical evidence on how these strategies are operationalised in local contexts. Moreover, the literature provides insufficient insight into farmers' lived experiences of interacting with extension systems, particularly how cultural beliefs, financial constraints, and scepticism shape adoption decisions. This gap highlights the need for context-specific studies that capture both the opportunities and barriers faced by farmers in engaging with extension services for sustainable land use.

The urgency of strengthening extension services is heightened by accelerating climate change impacts and mounting global food security concerns. In Ghana, where agriculture remains central to rural livelihoods and national development, extension systems play a pivotal role in guiding farmers towards practices that simultaneously ensure productivity, resilience, and sustainability. However, the effectiveness of these systems in promoting sustainable land use practices remains poorly understood, particularly within local contexts such as the Fanteakwa South Municipality. Capturing farmers' perceptions, experiences, and satisfaction with extension services in this setting provides valuable insights into the barriers and facilitators of adoption, thereby informing the design of more effective extension models.

The study aims to address these gaps by pursuing the following objectives: to assess farmers' perceptions and satisfaction levels with current extension service delivery methods in promoting sustainable land use practices, identify the types of sustainable land use practices promoted by extension agents in the municipality and to identify the key barriers and facilitators that influence farmers' adoption of sustainable land use practices recommended through extension services in the Fanteakwa South Municipality.

2. Theoretical review and conceptual framework

The four theories that guide this study provide a comprehensive lens for understanding farmers' adoption of sustainable land use practices in the Fanteakwa South Municipality. Agricultural extension has shifted from the traditional Transfer of Technology (ToT) model, which treated farmers as passive recipients of innovations, toward participatory extension, which emphasises farmer agency, co-creation of knowledge, and adaptation to local realities. Grounded in constructivist learning, participatory extension highlights dialogue, experimentation, and mutual problem-solving as essential pathways to sustainability outcomes (Mungai et al., 2024).

In addition, Social Learning Theory explains adoption as a process shaped by peer interactions and collective experiences. Farmers are more likely to adopt practices that they observe being successfully implemented by trusted peers or within their networks. Extension services informed by this theory leverage farmer groups, peer-to-peer exchanges, and facilitation by extension officers to accelerate the spread of innovations (Yang et al., 2024; Ensor & de Bruin, 2022).

Innovation Diffusion Theory (Rogers) further accounts for how new practices spread across farming communities. Adoption is influenced by factors such as relative advantage, compatibility with existing practices, complexity, trialability, and observability of outcomes. In this context, extension agents serve as change agents who establish demonstration plots, encourage small-scale trials, and build trust to reduce uncertainty and promote uptake of sustainable practices (Oyetunde-Usman et al., 2020).

Finally, Systems Theory situates adoption within broader socio-ecological and institutional contexts. It emphasises the interconnectedness

of environmental, social, and institutional factors that shape farmer decision-making. From this perspective, effective extension aligns farm-level decisions with landscape-level sustainability goals and incorporates adaptive management through participatory monitoring and evaluation (Hameed & Sawicka, 2023).

The conceptual framework developed for this study illustrates how these four theoretical perspectives, participatory extension, social learning, innovation diffusion, and systems theory, interact to explain adoption outcomes. Extension delivery methods such as radio, community information centres, group meetings, and home visits are shown as key mechanisms through which farmers gain awareness, knowledge, and motivation. The framework also recognises that adoption is mediated by barriers such as financial constraints, inadequate access to credit, and complexity of extension messages, as well as facilitators including inclusive communication, participatory engagement, and institutional support. Ultimately, the framework demonstrates that the promotion of sustainable land use practices requires a multi-theoretical and multi-dimensional approach that integrates communication methods with systemic enablers and addresses contextual challenges in order to achieve meaningful and lasting adoption among smallholder farmers.

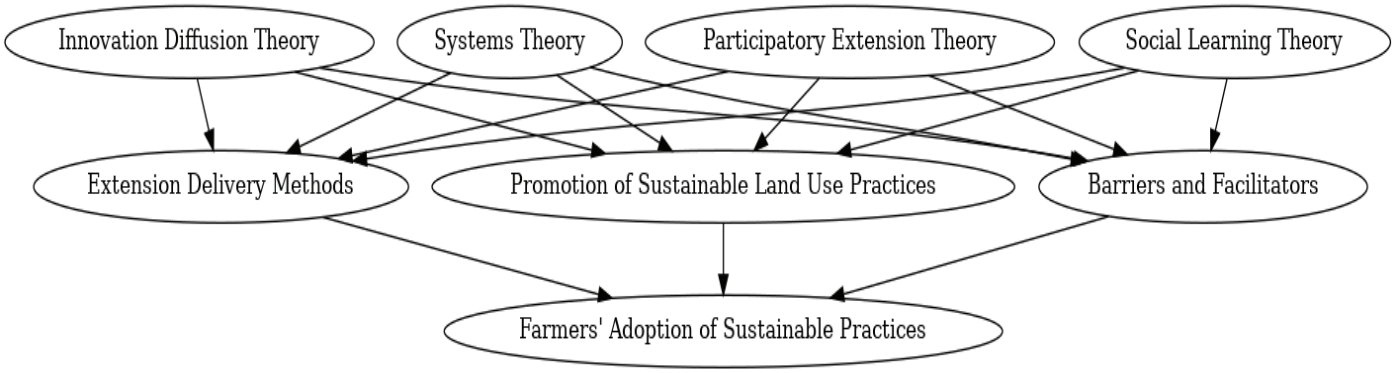

Figure 1: Conceptual framework

3. Methodology

3.1. Study area

The Fanteakwa South District Assembly is one of the 261 Metropolitan, Municipal and District Assemblies in Ghana and forms part of the 33 Municipalities and Districts in the Eastern Region. The Fanteakwa South District Assembly is carved out of the Fanteakwa North District as one of the 38 newly created and upgraded District Assemblies in 2018. Created with LI 2345, the Fanteakwa South District Assembly has its capital at Osino. It was inaugurated on March 15, 2018, alongside 37 other newly created districts. The District lies in the central part of the Eastern Region with a total land area of 803 square kilometers. It shares boundaries with Fanteakwa North District to the north, Kwahu South District to the north-west, East Akim Municipal and Atiwa East District to the south, and Yilo Krobo Municipal and Lower Manya Krobo Municipal to the east. It is bounded to the north by the Volta Lake. The current population of farmers in the Fanteakwa South District is over 86,154, with males being 42,625 and females being 43,529.

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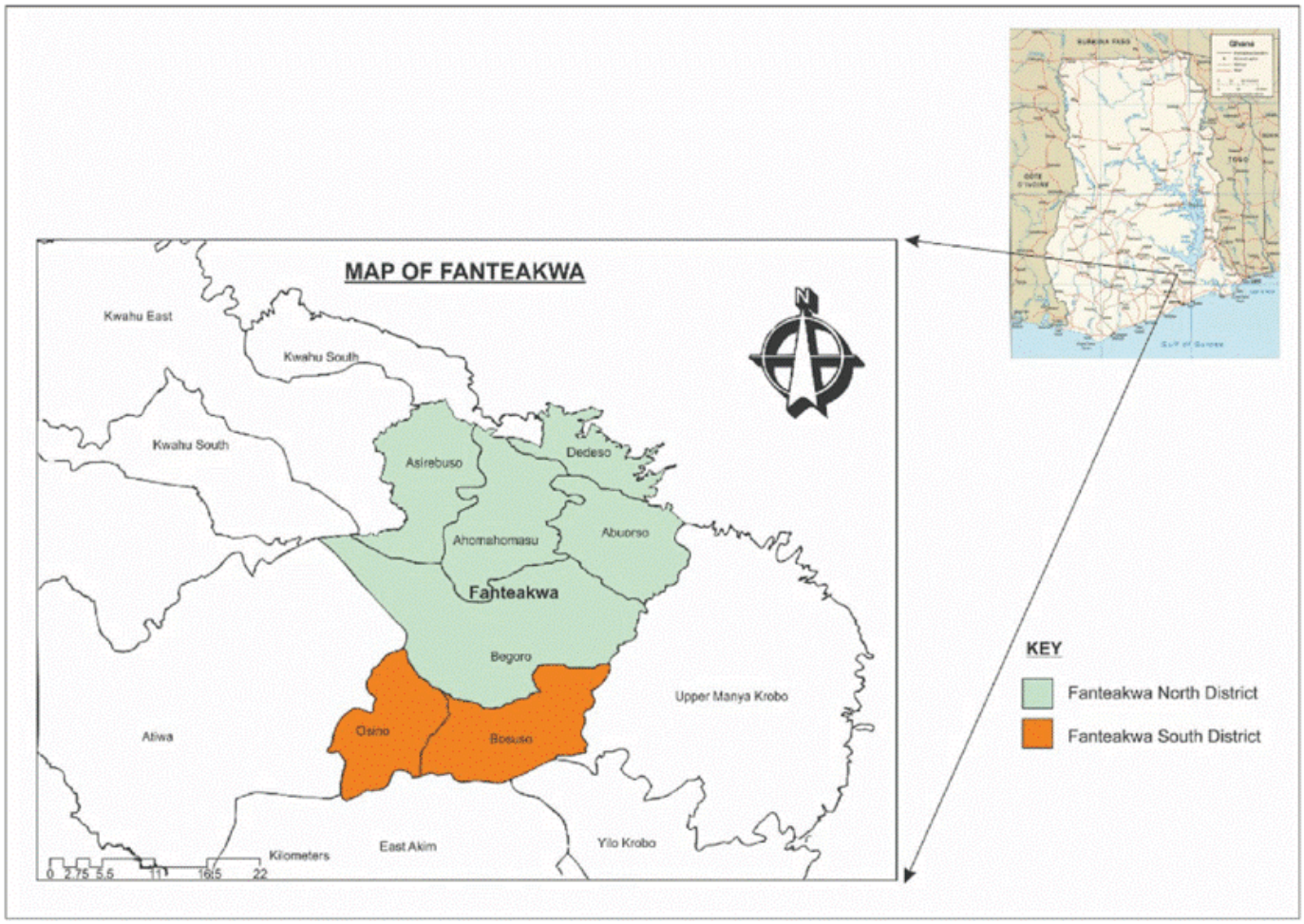

Figure 2: Map of Fanteakwa District

3.2. Study design

This study adopted a qualitative exploratory case study design, which was considered appropriate for understanding farmers' experiences with extension services in promoting sustainable land use practices in the Fanteakwa South Municipality. The exploratory design enabled an in-depth appreciation of how farmers perceived, interpreted, and responded to extension messages, while the case study approach made it possible to situate these experiences within their real-life social, cultural, and economic contexts. Anchored within the interpretivist paradigm, the study recognized that farmers' views and decisions were socially constructed, context-dependent, and best understood through their lived experiences.

3.3. Population

The target population for the study comprised all active farmers in the Fanteakwa South Municipality who had direct experience with agricultural extension services. These included smallholder, medium-scale, and commercial farmers cultivating staple and cash crops. Other relevant stakeholders, such as extension officers, traditional leaders, farmer-based organizations, input dealers, and NGO representatives, also formed part of the population, since their perspectives provided a more comprehensive understanding of how extension services operated within the community.

3.4. Sample size and sampling procedure

A purposive sampling strategy was employed to select respondents with rich and relevant experiences of extension services. A total of twenty farmers, representing different age groups, gender categories, and farm sizes, participated in focus group discussions. In addition, eight key informants were interviewed, comprising three agricultural extension officers, one traditional leader, one representative of a farmer-based organization, one input dealer, one NGO representative, and one successful lead farmer who was regarded as an

opinion leader in the community. This combination ensured diversity of views while capturing both farmer and institutional perspectives. Farmers were identified through community entry processes and referrals from existing participants. Recruitment continued until data saturation was achieved, when no new insights were emerging from the interviews and discussions.

3.5. Data collection procedure

Data collection was carried out through focus group discussions (FGDs) and key informant interviews (KIIs). The FGDs encouraged farmers to share collective experiences, compare perceptions, and reflect on the strengths and weaknesses of different extension delivery methods. Each FGD lasted between forty-five minutes and one hour and was conducted in Twi and Krobo (ethnic groups) to allow free expression. The KIIs lasted between thirty and forty minutes and provided deeper insights into extension delivery strategies, institutional challenges, and possible improvements. All sessions were audio-recorded with consent and supported by field notes.

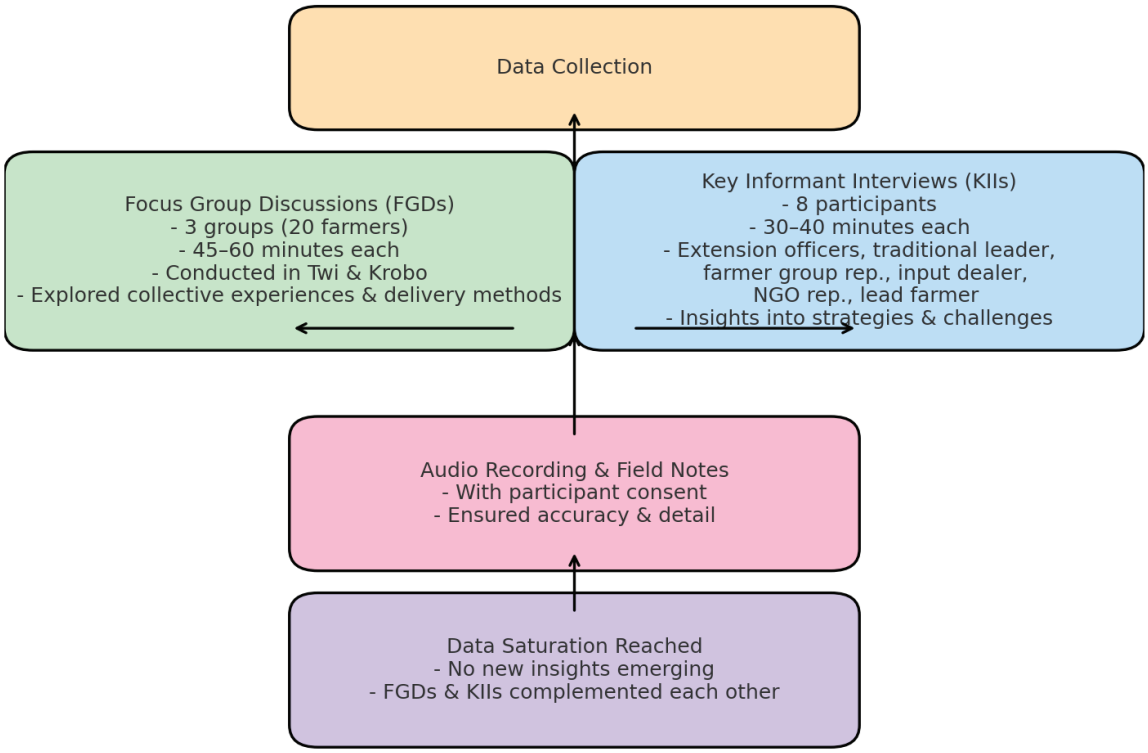

Figure 3: Data collection procedure

3.6. Data collection instruments

Semi-structured interview guides were developed to direct both the focus group discussions and key informant interviews. The farmer guide focused on their experiences with extension delivery methods, their perceptions of effectiveness, the barriers and facilitators they encountered, and their recommendations for improvement. The key informant guide, on the other hand, explored how extension was organized, the constraints faced by officers and institutions, and the ways in which extension services could better serve farming communities. The instruments were pre-tested in a neighboring community to ensure clarity and contextual relevance.

3.7. Data analysis

Data analysis was conducted using thematic analysis, drawing on Braun and Clarke's six-phase framework. First, the transcripts were read repeatedly to ensure familiarity with the data. Initial codes were then generated and grouped into emerging themes. These themes were reviewed, refined, and clearly defined to capture the central issues raised by participants. The themes were organized around the research objectives: farmers' perceptions of extension delivery, the barriers and facilitators to sustainable practice adoption, and their recommendations for improving extension services.

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3.8. Ethical approval

This study was conducted in accordance with established ethical standards for research involving human participants. Prior to data collection, the objectives and procedures of the study were clearly explained to all participants. Informed consent was obtained verbally and/or in writing, and participants were assured of the confidentiality and anonymity of their responses. Participation was entirely voluntary, and respondents were informed of their right to withdraw from the study at any stage without any consequences. All data were stored securely and used solely for academic purposes.

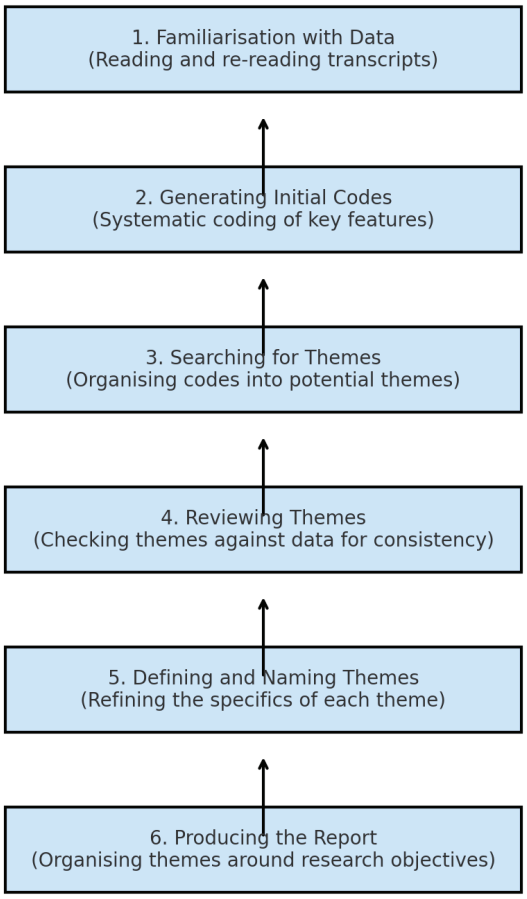

Figure 4: Phases of Thematic Analysis Used in this study (Braun & Clarke, 2006)

Table 1: Interview themes, questions, and theoretical linkages

Theme	Sample Interview Questions	Interesting Farmer Quotes (Field Data)	Link with Theories	No. of Questions
Farmers' perceptions and satisfaction with extension delivery methods	- How do you perceive the current extension service delivery methods? - Which method(s) of extension delivery do you find most effective in promoting sustainable land use practices? - Are there methods you find less helpful or unsatisfactory?	- *"My extension officer uses various methods... to me, the group method is the best way..." (R1)* - *"The community information center... very good... local language is used..." (R5)* - *"The radio is the one I prefer... it can reach a lot of people..." (R10)* - *"Home visits... we get the opportunity to ask questions..." (R11)* - *"The radio is not the best at all... I want to ask questions, but it is always difficult" (R2)*	**Participatory Extension Theory** – highlights the diversity of preferences and participatory communication. **Social Learning Theory** – group learning and interaction influence satisfaction.	4–5

Types of sustainable land use practices promoted.	- What sustainable land use practices have you learned from extension agents? - Which of these practices have you adopted, and why? - What challenges do you face in adopting these practices?	- *"The officers encouraged us to use compost instead of relying too much on chemical fertiliser" (R1)* - *"We were told to plant trees among our cocoa so the land does not lose its strength" - "The extension people told us not to plant maize on the same land every year" (R3)* - *"They showed us how to make ridges across the slope..." (R6)* - *"They talked about water harvesting, but it is not easy... we use barrels" (R10)*	**Innovation Diffusion Theory** – relative advantage, compatibility, and trialability of practices. **Systems Theory** – links farm-level adoption to broader environmental sustainability.	3–4
Barriers and facilitators to adoption	- What challenges prevent you from adopting sustainable land use practices? - What could make it easier for you to adopt these practices? - What role should government or extension services play in supporting adoption?	- *"I don't have the money to buy farming inputs... lack the financial power" (R14)* - *"The incentives given... are not enough" (R13)* - *"Our harvest... is nothing to write home about" (R8)* - *"Government should provide loans..." (R12)* - *"Some of the teachings... are very complicated" (R5)*	**Innovation Diffusion Theory** – complexity as a barrier. **Social Learning Theory** – peers and simplicity enhance adoption. **Systems Theory** – highlights financial, institutional, and ecological constraints.	3–4

Source: Authors' Construct

Table 1 provides a summary of the key themes explored in the interviews, the guiding questions, illustrative farmer quotes, and their theoretical linkages. The themes include farmers' perceptions and satisfaction with extension delivery methods, the types of sustainable land use practices promoted, and the barriers and facilitators to adoption. The table also demonstrates how each theme is connected to the four theoretical perspectives: Participatory Extension Theory, Social Learning Theory, Innovation Diffusion Theory, and Systems Theory, thereby linking farmers' lived experiences to broader conceptual frameworks.

4. Results and discussion

Table 2: Demographic characteristics of farmers (n = 20)

Characteristic	Category	Frequency	Percent (%)
Gender	Male	12	60.0
	Female	8	40.0
Age Group	20–35 years	5	25.0
	36–50 years	9	45.0
	51 years and above	6	30.0
Farm Size	Small (<2 acres)	8	40.0
	Medium (2–5 acres)	7	35.0
	Large (>5 acres)	5	25.0

Source: Field Data, 2025

Table 2 summarises the demographic characteristics of the 20 farmers who participated in the study. The sample was fairly gender-balanced, with males forming 60% and females 40%. Most farmers (45%) were in the 36–50 age group, while 25% were aged 20–35 years and 30% were above 51 years. In terms of farm size, 40% cultivated small farms of less than 2 acres, 35% managed medium farms (2–5 acres), and 25% operated larger farms exceeding 5 acres. These characteristics reflect a diverse but predominantly middle-aged farming population with varying scales of landholding.

Table 3: Categories of key informants (n = 8)

Category	Frequency	Percent (%)
Agricultural Extension Officers	3	37.5
Traditional Leader	1	12.5
Farmer-Based Organisation Rep.	1	12.5
Input Dealer	1	12.5
NGO Representative	1	12.5
Lead Farmer / Opinion Leader	1	12.5
Total	8	100.0

Source: Field Data, 2025

Table 3 presents the categories of the eight key informants who provided expert insights to complement farmers' perspectives. Agricultural

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extension officers made up the largest group (37.5%), while the remaining categories, traditional leader, farmer-based organisation representative, input dealer, NGO representative, and lead farmer/ opinion leader, each accounted for 12.5%. This diversity of informants ensured that multiple institutional and community perspectives were represented in the study.

4.1. Farmers' perceptions and satisfaction levels with current extension service delivery methods in promoting sustainable land use practices

Table 4: Farmers' attitudes towards extension service delivery methods

Attitude category	Frequency (n)	Percent (%)
Satisfied	13	65
Neutral	3	15
Dissatisfied	4	20

Source: Field Data, 2025

NB: *Satisfied* – Farmers expressed approval of one or more delivery methods; *Neutral* – Farmers had no specific preference but welcomed available methods; *Dissatisfied* – Farmers expressed challenges or discontent with certain methods (e.g., lack of interaction on radio, disruptions during group meetings).

Out of the 20 farmers who participated in the focus group discussions, the majority (65%) expressed satisfaction with extension service delivery methods used in promoting sustainable land use practices, while 15% remained neutral and 20% expressed dissatisfaction (Table 4). Generally, the results illustrate that extension delivery methods in Fanteakwa South Municipality are broadly valued, but no single method is without limitations. The diversity of farmer responses suggests that a pluralistic approach combining group meetings, community information centres, radio programmes, and home visits is most effective. This aligns with Oyetunde-Usman et al. (2020), who stressed the importance of varied and responsive extension strategies to meet the diverse needs of smallholder farmers in addressing agricultural challenges. The findings also reflect principles of systems theory, which emphasize that effective extension must integrate multiple communication channels to address the varied socio-ecological and institutional contexts within which farmers operate (Hameed & Sawicka, 2023).

Farmers who expressed satisfaction highlighted the usefulness of group meetings, radio programmes, home visits, and community information centres. For example, one farmer explained: "*My extension officer uses various methods in delivering his messages to us. To me, the group method is the best way I receive extension delivery messages regarding sustainable land use practices.*" This appreciation for group methods reflects Molina et al.'s (2021) conclusion that group meetings foster interaction and collective learning, allowing farmers to share experiences and deepen their understanding of sustainable practices. It also connects with social learning theory, which posits that farmers learn more effectively through observation of peers, group problem-solving, and reinforcement within a social context (Yang et al., 2024). By engaging in groups, farmers not only receive information but also validate its usefulness through the shared experiences of others.

Similarly, another farmer remarked: "*The community information centre used to spread information is very good. I see it as one of the best methods. The local language is used, and it is normally done early mornings and evenings. Most of the farmers are around during this period; thus, they get every relevant information needed in promoting sustainable land use practices.*" This supports the work of Alakpa and Ehigie (2024), who noted that community information centres are most effective when communication is delivered in local languages and at times convenient for farmers. From the perspective of participatory extension theory, this example shows that tailoring messages to farmers' linguistic and cultural contexts enhances ownership and co-creation of knowledge. Rather than top-down transfer, farmers perceive the information as embedded in their realities, making it easier to apply in practice.

Radio was also praised for its wide reach. As one farmer noted, "*The radio is the one I prefer. It can reach a lot of people at the same time. There is a program on the radio on Fridays that addresses challenges farmers go through. They also talk about ways we can practice sustainable land use by farmers.*" The broad reach of radio programmes has similarly been documented in studies (Molina et al., 2021), which highlight their ability to reach large audiences with relevant messages. From an

innovation diffusion perspective, radio functions as a platform for enhancing observability, one of Rogers' key attributes of adoption, by making new practices widely visible and accessible to large numbers of farmers. However, as later findings show, the limited interactivity of radio restricts *trialability* and *feedback loops*, thereby constraining adoption.

Likewise, personalised extension methods were valued, with one farmer noting: "*When the farmers are visited in their homes and farms, it helps a lot. We get the opportunity to ask questions. This approach is very helpful.*" This mirrors the observations of Alakpa and Ehigie (2024), who found that home visits foster trust and allow for clarification, enhancing farmers' learning experience. In theoretical terms, home visits exemplify the facilitator role described in participatory extension theory, where extension agents act as co-learners who adapt knowledge to farmers' circumstances rather than imposing pre-packaged solutions. They also embody the change agent role in innovation diffusion theory, as effective adoption depends on the interpersonal trust and cultural sensitivity extension officers bring to their interactions.

Neutral respondents (15%) demonstrated flexibility, as captured in the statement: "*I welcome what is available to help me with my farming and having information on sustainable land use practices within our community.*" This neutral stance suggests that while these farmers do not strongly prefer a particular method, they remain open to the available channels. Tham-Agyekum et al. (2024) also argue that the effectiveness of extension delivery can vary across individuals, depending on their priorities, circumstances, and level of access. Neutral responses illustrate the systems perspective, where adoption outcomes are not solely determined by extension strategies but also by the interaction of household resources, institutional arrangements, and broader socio-economic dynamics.

By contrast, 20% of farmers expressed dissatisfaction, particularly with radio and group methods. One farmer explained: "*The radio is not the best at all. Well, though it can reach a lot of people at the same time, farmers cannot ask questions when needed. Sometimes I want to ask questions, but it is always difficult. They allow listeners to call, but I have never had the chance to speak to them. It has been my problem all this time.*" This concern is echoed in Molina et al. (2021), who reported that the one-way communication format of radio limits opportunities for engagement and immediate clarification. From the lens of participatory extension theory, such dissatisfaction highlights the limitations of linear, top-down communication models that fail to create spaces for dialogue and co-learning. Another farmer added, "*The group method is not all that helpful. There are always farmers causing problems at meetings, disrupting the extension agent's effort to disseminate information to us. Others act in an intimidating manner, preventing others from asking relevant questions.*" These challenges reflect broader concerns in the literature that group meetings, while beneficial for collective learning, can sometimes be undermined by group dynamics and dominance issues. In terms of social learning theory, this suggests that not all group environments foster positive learning; peer influence can also create negative dynamics if dominant individuals inhibit participation. From a systems perspective, such challenges demonstrate that extension delivery cannot be divorced from the social structures and power relations that shape community interactions.

4.2. Types of sustainable land use practices promoted by extension agents

Table 5: Types of Sustainable land use practices promoted by extension agents

Sustainable practice	Number of farmers (n=20)	Percent (%)
Soil fertility management	17	85
Crop rotation/intercropping	14	70
Erosion control	11	55
Agroforestry	10	50
Water conservation	8	40
Integrated pest management	7	35

Source: Field data, 2025

The findings revealed that extension agents in Fanteakwa South Municipality actively promoted a diverse range of sustainable land use practices. Out of the 20 farmers who participated in focus group discussions, soil fertility management (85%) emerged as the most emphasised practice, followed by crop rotation/intercropping (70%), erosion control (55%), agroforestry (50%), water conservation (40%), and integrated pest management (35%). These

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results align with Yeboah (2021) and Quayson and Kwadzo (2021), who emphasise that farmers in Ghana and other parts of Africa are increasingly adopting integrated soil fertility management and indigenous land management techniques as viable approaches to sustainable agriculture. The range of practices reflects the logic of systems theory, which stresses that sustainable land management requires a holistic set of interventions rather than isolated actions. By promoting multiple practices, extension agents encourage farmers to address soil fertility, water, biodiversity, and pest control in an integrated manner.

Farmers consistently highlighted soil fertility management practices such as composting, mulching, and the judicious use of organic manure. One farmer explained: "The officers encouraged us to use compost instead of relying too much on chemical fertiliser. They even showed us how to prepare it with crop residues and animal droppings, and I have tried it on my maize farm". This observation resonates with Quayson and Kwadzo (2021) and Yeboah (2021), who found that farmers in semi-arid Ghana widely recognise composting and animal manure as effective strategies for maintaining soil fertility. The popularity of composting illustrates innovation diffusion theory's concept of relative advantage, as farmers see it as a cheaper and more sustainable alternative to chemical fertilisers. At the same time, the practical training by extension agents reflects participatory extension theory, where farmers are not passive recipients but active co-learners in knowledge application.

Agroforestry was also frequently promoted, with farmers reporting sensitisation to planting shade trees on farms to prevent soil degradation and maintain biodiversity. One participant shared: "We were told to plant trees among our cocoa so that the land does not lose its strength. Before, I used to cut down all the trees, but now I leave some of them". The promotion of agroforestry echoes findings by Lahmar et al. (2012), who noted that integrating trees into farming systems enhances resilience and long-term soil health. This shift demonstrates social learning theory, as farmers change their behaviour after observing both the ecological benefits and the collective uptake of agroforestry in their communities. It also resonates with systems theory, since trees interact with soils, crops, and microclimates, producing multiple benefits across the farming system.

Crop rotation and intercropping were identified by 70% of farmers as strategies for improving soil health and reducing pest infestations. As one farmer stated: "The extension people told us not to plant maize on the same land every year. I tried groundnut after maize, and the harvest was better the following season". This supports existing evidence that rotating maize with legumes enhances nitrogen fixation and improves yields (Quayson and Kwadzo, 2021). The fact that farmers experiment with different crop sequences reflects innovation diffusion theory's trialability and observability, as they can test the practice on a small scale and observe results within one season. It also reflects participatory extension principles, as extension officers and farmers work together to adapt rotations to local conditions rather than prescribing a one-size-fits-all solution (Lahmar et al., 2012).

Erosion control measures were mentioned by more than half (55%) of the farmers, who had adopted contour ploughing and cover cropping. A farmer noted: "They showed us how to make ridges across the slope. I did it on my cassava farm, and I realised the rain did not wash away the soil like before". These findings underscore the role of extension in improving awareness of soil conservation practices, which are critical in addressing the challenges of land degradation in Ghana. Adoption of such measures reflects social learning theory, as farmers gain confidence when they witness visible outcomes on their own or neighbours' farms. Moreover, from a systems perspective, erosion control practices have wider environmental benefits beyond individual plots, including watershed protection and reduced downstream flooding (Firoozi & Firoozi, 2024).

Water conservation practices, although promoted, were adopted by only 40% of farmers. Simple techniques such as rainwater harvesting and small-scale irrigation were discussed, though adoption was limited by financial constraints. As one respondent explained: "They talked about water harvesting, but it is not easy for us to get tanks. Some of us use barrels to collect rainwater, but it is not enough". This reflects the fact that financial barriers often limit the uptake of water-saving technologies, even when farmers understand their benefits. Low adoption here is explained by innovation diffusion theory's compatibility and complexity dimensions: although farmers appreciate the benefits, the practice is costly and technically demanding in

relation to their resources. A participatory extension approach could help bridge this gap by identifying low-cost, community-driven alternatives that fit farmers' realities.

Finally, integrated pest management (IPM) was promoted to a smaller extent (35%), particularly as part of broader training on sustainable land use. Farmers acknowledged that while IPM reduces reliance on chemical pesticides, adoption remained low due to limited access to biological control inputs and knowledge gaps. The limited uptake illustrates innovation diffusion theory, as IPM tends to score low on trialability and observability compared to simpler practices like mulching or crop rotation. From a social learning perspective, the lack of visible peer demonstrations reduces confidence in IPM. This is where participatory extension becomes vital, since collaborative experimentation and farmer field schools could bridge the knowledge gap and make IPM practices more accessible (Tham-Agyekum et al., 2025).

4.3. Barriers to the adoption of sustainable land use practices

Table 6: Barriers to adoption of Sustainable land use practices as reported by farmers

Barrier	Frequency	Percent (%)
Financial constraints (input costs)	9	45.0
Limited access to credit facilities	6	30.0
Complexity of extension messages	5	25.0

Source: Field Data, 2025

A central barrier identified by farmers was limited financial capacity to invest in sustainable land use practices. Several participants noted that the cost of farming inputs remained a major impediment: "I would love to adopt these sustainable land use practices, but I don't have the money to buy farming inputs to help me. I lack the financial power. This has hampered my farming over the years". Similarly, another farmer observed: "The incentives given by the authorities are not enough. But, because of money issues, I can only buy a few to support my farming practices for sustainable land usage". These sentiments reflect the broader economic reality of smallholder farmers, who operate on limited resources and struggle to meet the upfront costs associated with improved practices. One farmer explained: "We do peasant farming in this area. Our harvest for the year is nothing to write home about. Hence, making enough money to buy items and maintain sustainable land use practices. The initial investment costs for transitioning to sustainable land use practices often exceed the immediate financial capacity of smallholder farmers, creating a significant adoption gap". Similar findings are reported in other contexts, where high input costs and limited profitability act as deterrents to adoption (Kaine & Wright, 2022).

From the lens of innovation diffusion theory, these financial limitations reduce the perceived relative advantage of adopting new practices. Even when farmers recognise the long-term benefits, the high upfront costs make them appear less attractive compared to conventional methods. At the same time, systems theory reminds us that adoption barriers are not purely individual challenges but arise from structural weaknesses in the farming and financial systems. Without interventions that address credit, input supply, and market access simultaneously, farmers' capacity to adopt sustainable land use practices will remain constrained (Gregg, 2021).

Closely linked to financial limitations is the restricted access to credit facilities. Farmers emphasised the importance of financial support mechanisms that could enable them to procure inputs: "I think the government should provide loans for the farmers so they can have access to some of the farm inputs". Another farmer added: "We need some economic relief so farmers can have access to credit facilities". This finding aligns with broader evidence that inadequate access to rural credit remains a structural constraint in developing countries, as collateral requirements, cumbersome loan conditions, and high interest rates frequently exclude smallholders from formal financial systems. Consequently, without improved financial inclusion, the capacity of farmers to embrace sustainable practices will remain limited. From a participatory extension perspective, this calls for the design of farmer-centred financial innovations, such as cooperative credit schemes or savings groups, that can be developed with farmer input and ownership. When farmers are involved in shaping such mechanisms, the likelihood of uptake and sustainability increases.

Another key barrier was the complexity of extension messages and technical recommendations. Some farmers described difficulties in comprehending the information provided by extension officers:

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"Some of the teachings by the extension agents are very complicated. I don't understand some of the things they say, making the adoption of some of the sustainable land use practices very difficult. I sometimes improvised to make sure I am doing the right thing in connection with sustainable land use practices". This reveals a disconnect between the technical framing of extension messages and the realities of farmers' knowledge systems and capacities. Similar concerns have been raised in studies that highlight how the effectiveness of extension is undermined when messages are not simplified or contextualised for end-users (Alakpa & Ehigie, 2024; Oyetunde-Usman, 2020).

The improvisation by farmers indicates adaptive resilience but also underscores the need for extension agents to employ social learning approaches, where farmers learn together through observation, discussion, and mutual problem-solving rather than top-down instruction. When farmers observe peers successfully applying simplified practices, their confidence in trying the same increases, which reinforces innovation diffusion through trialability and observability. Finally, through the lens of systems theory, these communication challenges highlight that technical knowledge, farmer literacy levels, and cultural contexts are interconnected parts of the agricultural knowledge system. Effective adoption, therefore, requires interventions that bridge these gaps in a coordinated way.

5. Conclusion

The study set out to examine farmers' experiences with extension services in promoting sustainable land use practices in the Fanteakwa South Municipality. The findings showed that farmers accessed extension information through diverse channels, including farm visits, group meetings, community information centers, and radio programs. While interactive methods such as farm visits and group demonstrations were praised for their practical value, some farmers expressed dissatisfaction with radio programs because they provided limited opportunities for direct interaction and feedback.

Barriers to adoption included financial limitations, lack of access to credit, and the technical complexity of extension messages. Farmers often lacked the resources to purchase the inputs required to implement recommended practices, and some struggled to fully understand the technical language used by extension officers. On the other hand, adoption was facilitated by trust in extension officers, peer-to-peer learning, practical demonstrations, and support mechanisms such as subsidies and input supply. Farmers further emphasized the importance of participatory methods that recognize their indigenous knowledge and local farming realities.

The findings highlight the need for extension services to prioritize farmer-centered approaches that go beyond knowledge transfer. Extension officers must develop strong facilitation and communication skills, including the use of local languages and context-appropriate examples, to make technical recommendations more accessible. At the same time, the results show that economic constraints remain a critical barrier, suggesting that extension services should be integrated with financial support mechanisms such as input subsidies, microcredit schemes, and market access facilitation. Moreover, the multiplicity of actors involved in extension delivery underscores the importance of collaboration and coordination to avoid mixed messages and to build a more coherent extension system.

The study recommends the creation of a coordinated farmer-centered extension platform that unites key stakeholders to deliver consistent messages, integrate local knowledge with scientific advice, and provide practical support to enhance the adoption of sustainable land use practices.

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