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Dynamics of agricultural extension delivery services to rice farmers in Ghana

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ABSTRACT

The delivery of agricultural extension services has evolved over the years, responding to changes in the agricultural landscape. The study aimed to assess these dynamics in Juaben Municipality, Ghana. Using a sample of 255 rice farmers selected using the multistage sampling technique, descriptive and inferential statistics were used to analyse the data. Farmers perceived that the information provided to them was of high quality, relevant, and effective. Farmers had a positive attitude, high aspirations, and collaborated highly towards extension delivery. Farmers were neutral on government and non-governmental organisation roles but acknowledged significant farmer organisation involvement in extension services. Lack of machinery or inadequate equipment for demonstration was the main challenge facing rice farmers in accessing extension delivery services. Extension services should prioritize the provision of timely and evidence-based guidance to address the evolving needs of rice farmers.

1. Introduction

The delivery of agricultural extension services has evolved over the years, responding to changes in the agricultural landscape and emerging challenges. This evolution has led to the development of dynamic agriculture extension delivery services [1]. The dynamics of agricultural extension delivery refer to the various factors that affect the provision of agricultural extension services. It encompasses all the interactions, relationships, and processes that influence the delivery of extension services. This includes factors such as the availability of resources, the capacity of extension agents, the level of farmers' awareness and participation, the quality of communication channels, the policy and regulatory environment, and the socio-economic context of the municipality [2]. Understanding the dynamics of agricultural extension services for rice farmers is important for improving the effectiveness and efficiency of extension services. By identifying the key factors that affect the provision of extension services, it is possible to design interventions and strategies that address the specific challenges and opportunities [2,3].

Agricultural extension delivery is a system of providing information, advice, and support to farmers to help them improve their agricultural practices and increase their crop yields. It can take many forms, including training programmes, workshops, field demonstrations, and one-on-one consultations with agricultural experts. The goal of agricultural extension delivery is to help farmers adopt new technologies and best practices, increase their productivity and income, and improve their overall standard of living [4].

In many countries, there is a dedicated government agency responsible for coordinating agricultural extension services at the

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national level. These agencies work with local governments, NGOs, and other organisations to provide training, support, and advice to farmers in their area. Private sector organisations, such as seed and fertiliser companies, also play an important role in agricultural extension delivery by providing farmers with access to new technologies and inputs [3]. The delivery of agricultural extension services has shifted from the traditional top-down approach, where extension agents impart knowledge and skills to farmers, to a more participatory approach, where farmers are involved in the decision-making process. This participatory approach recognises farmers' knowledge and skills and encourages them to become active participants in their own development [5].

Despite the importance of agricultural extension services for improving the productivity and profitability of rice farming, there is limited information on how the services are being played out. The lack of access to extension services makes it difficult to develop evidence-based policies and programmes aimed at improving access to extension services and increasing productivity and profitability in the sector [6]. As a result, many farmers are unable to realise the full potential of their land and resources, which can lead to food insecurity, poverty, and environmental degradation. The goal of agricultural extension delivery is to address these challenges by providing farmers with the knowledge, skills, and resources they need to improve their agricultural practices and increase their productivity and income [7].

In their study [5], conducted an analysis of the dynamics pertaining to the delivery of agricultural extension services across the value chain. The authors argue convincingly for the implementation of an extension policy that promotes a fair equilibrium and fosters competition within value chain operations [8]. employed district-level data from India to examine the dynamics of service delivery and agricultural development within the country. The researchers discovered that advancements in agricultural and rural sector performance can be achieved without the need for more infrastructure facilities. Instead, the key lies in effectively utilising the existing infrastructure resources [2,9]. observed notable advancements in the proportion of male and female farmers who were able to avail themselves for extension services. Additionally, the perceived quality of these services received high ratings. There has also been an increase in the variety of extension messages, with a particular emphasis on topics such as market access and nutrition. Furthermore, the utilisation of cost-effective tools, such as radio programming and community or group meetings, as sources of agricultural information, witnessed a significant rise [6]. Lastly, there was an observed expansion in crop diversification among the farmers. Investigating the dynamics of agricultural extension delivery to rice farmers in Ghana represents a novel area of study. This research aims to accomplish the following objectives: 1) evaluate rice farmers' perception of the quality, relevance, and effectiveness of extension information disseminated to them; 2) examine rice farmers' attitudes, beliefs, and aspirations regarding agricultural extension services; 3) assess farmers' perception of the roles and responsibilities of various stakeholders; and 4) determine the primary obstacles encountered by rice farmers in accessing agricultural extension services.

Understanding the dynamics of extension delivery in agriculture is crucial for several reasons, and it holds significant relevance in the context of agricultural development, sustainability, and the well-being of farming communities. By understanding the dynamics of extension delivery, policymakers and agricultural practitioners can tailor their approaches to enhance farmers' knowledge and skills. This, in turn, contributes to improved agricultural productivity through the adoption of modern and effective farming practices. Knowledge of extension dynamics allows for the promotion of sustainable agricultural practices. By providing farmers with information on environmentally friendly techniques, resource conservation, and organic farming, extension services play a pivotal role in fostering sustainability in agriculture. The agricultural landscape is constantly evolving due to factors such as climate change, technological advancements, and market dynamics. Understanding the dynamics of extension delivery helps in adapting and responding to these changes, ensuring that farmers are equipped to face new challenges and capitalise on emerging opportunities. Policymakers and extension service providers can use insights into extension dynamics to formulate informed policies and design effective programmes. This includes allocating resources strategically, identifying areas for improvement, and addressing challenges faced by farmers in accessing extension services.

2. Theoretical framework

Agricultural extension services play a pivotal role in disseminating knowledge, information, and technology to farmers and fostering sustainable agricultural practices. The diffusion of innovation theory by Ref. [10] provides a foundational framework for understanding how new ideas and practices are adopted within a social system. In the context of agricultural extension, this theory suggests that the successful adoption of innovations depends on factors such as the perceived quality of information, relevance to farmers' needs, and effective communication channels. Farmers' attitudes and aspirations are integral components influencing their engagement with extension services. The theory of planned behaviour [11] posits that attitudes, subjective norms, and perceived behavioural control shape individuals' intentions and haviors. In the agricultural context, positive attitudes towards extension services, coupled with high aspirations, are likely to contribute to increased participation and the successful implementation of recommended practices. Moreover, collaboration among farmers aligns with social capital theory [12], emphasising the value of social networks and cooperation in achieving common goals.

The roles of various stakeholders, including the government, non-governmental organisations, and farmer organisations, are crucial in shaping the landscape of extension services. The stakeholder theory [13] posits that organisations should consider the interests of all stakeholders to ensure long-term success. Farmer organisations, in particular, play a vital role in facilitating communication and collaboration. The collective action theory [14] further supports the idea that collective efforts, as seen through farmer organisations, can enhance the efficiency and effectiveness of extension services. The identified challenges, such as the lack of machinery and inadequate equipment, align with the resource-based view [15], emphasising the importance of tangible and intangible resources for organisational success.

Integrating these theoretical perspectives, the research framework aims to assess the interplay between the quality, relevance, and

effectiveness of agricultural extension services, farmer attitudes, aspirations, collaboration, and the roles of different stakeholders. By grounding the study in these theoretical foundations, the research seeks to provide a comprehensive understanding of the dynamics influencing the delivery of extension services in Juaben Municipality and offer insights for sustainable improvements in the agricultural sector.

3. Methodology

The study was conducted in Juaben municipality. Juaben Municipal is one of the forty-three districts in the Ashanti Region, Ghana. Originally, it was formerly part of the Ejisu-Juaben-Bosomtwe District, until the northeast part of the district was split off to create Juaben Municipal District on March 15, 2018; thus, the remaining part has been renamed as Ejisu Municipal. The Juaben Municipality occupies a land area of 364 674 area (365 sq. km.) and lies in the central part of Ashanti Region within latitudes 115 °N and 145 °N and longitude 615 °W and 700 °W. The choice of Juaben as the location for the study on agricultural extension services was based on the fact that within Ashanti region, it is known for its numerous rice farming activities. Practically, we also considered the area for the purposes of accessibility, data availability, and cooperation from local authorities. The decision to focus on rice farmers was because rice farming is a crucial economic activity in Juaben, contributing significantly to the local economy. Focusing on rice farmers allowed us to understand the dynamics of extension services in an agriculturally significant sector. Rice is a staple food for many communities and so studying rice farmers becomes important for assessing food security issues and ensuring sustainable agricultural practices to meet local food needs.

The study was a cross-sectional study. A cross-sectional study is a type of research design in which data is collected from many different individuals at a single point in time. The study population included small-scale rice farmers in Juaben municipality. Small-scale farmers, as defined by Nakashima and Ishikawa (2016), are individuals who cultivate their fields using manual and traditional techniques. These farmers typically work on family-run farms that span 1–2 ha of land. The sample population of this study was 1200 rice farmers. The sample size was obtained using Yamane's formula since the population size was known. Therefore, the sample size for the study was 255 rice farmers. Two (2) sample techniques were used in the study. Purposive sampling technique was used to select ten (10) rice producing areas from the operational areas based on the volume of rice produced. We adopted simple random sampling in selecting thirty (30) rice farmers from each community. Only primary data was used for this study. The primary data was obtained from respondents using structured questionnaires. Farmers were visited in their fields and homes in order to aid the collection of the data. Informed consent was obtained from all the respondents for the study. They were assured of confidentiality and anonymity. The questionnaire was reviewed by other experts in the field of agricultural extension before they were administered.

Data was analysed using descriptive statistics (mean, standard deviation, frequency, percentage) and inferential statistics (kendall's coefficient of concordance). To assess rice farmers' perception of the quality, relevance, and effectiveness of information delivered by the agricultural extension services, a five-point likert scale, thus, 1–1.49 = Strongly agree, 1.50–2.49 = Agree, 2.5–3.49 = Neutral, 3.50–4.49 = Disagree, 4.50–5.00 = Strongly disagree [16]. We calculated a mean index by combining the values of the various statements under each indicator into a single representative value. The mean index thus represents the average value across the various indicators. A lower mean index indicated a positive outcome and vice versa. In this study, we defined quality of extension information as the accuracy, reliability, objectivity, completeness and trustworthiness of information delivered by agricultural extension services. High-quality information is free from errors, biases, and misleading elements. We defined relevance of extension information as the timeliness, importance, significance and applicability of agricultural information to the rice farming situation. We also defined effectiveness of information as the ability of information to achieve its intended purpose or desired outcomes. Effective information meets the needs of the rice farmers and facilitates informed decision-making [17–19].

In assessing rice farmers' attitudes, beliefs, and aspirations towards agricultural extension services, a five-point likert scale, thus, 1–1.49 = Strongly agree, 1.50–2.49 = Agree, 2.5–3.49 = Neutral, 3.50–4.49 = Disagree, 4.50–5.00 = Strongly disagree [16]. We calculated a mean index by combining the values of the various statements under each indicator into a single representative value. The mean index thus represents the average value across the various indicators. A lower mean index indicated a positive outcome and vice versa. In this study, we defined attitudes as rice farmers' feelings, beliefs, and evaluations toward various aspects of agricultural extension services, including farming practices, technologies, policies, and market conditions. Attitudes can influence decision-making, adoption of new practices, and overall satisfaction with the farming profession. We defined aspirations as farmers' hopes, goals, and ambitions for the future of their farming operations. These aspirations can include economic goals, sustainability objectives, lifestyle preferences, and community contributions. We also defined collaboration as the cooperative efforts among farmers, agricultural stakeholders, and community members to achieve common goals. Collaboration can take various forms, such as knowledge sharing, joint projects, and partnerships, aiming to enhance productivity, sustainability, and overall success in agriculture [19–21].

In assessing rice farmers' perception of the roles and responsibilities of different stakeholders, a five-point likert scale, thus, 1–1.49 = Strongly agree, 1.50–2.49 = Agree, 2.5–3.49 = Neutral, 3.50–4.49 = Disagree, 4.50–5.00 = Strongly disagree [16]. We calculated a mean index by combining the values of the various statements under each indicator into a single representative value. The mean index thus represents the average value across the various indicators. A lower mean index indicated a positive outcome and vice versa. In this study, we considered three key stakeholders; government, NGOs and farmer organisations.

To identify and rank the key challenges faced by rice farmers in accessing agricultural extension services, we created a list of challenges and asked farmers to rank in order of severity. We then applied the Kendall's Coefficient of Concordance to analyse their constraints.

4. Results and discussion

In Table 1, there is a slightly higher percentage of male participants (63.5%) compared to female participants (36.5%). The higher percentage of male respondents reflect the sex dynamics common in many agricultural settings. Historically, agriculture has often been perceived as a male-dominated sector due to traditional gender roles and access to resources. The largest age group among respondents fall within the 31–45 years range (43.9%) who represent the core working age group in the agricultural sector. This age group might include both experienced farmers and those who have transitioned into farming as a second career, influenced by changing economic conditions [22]. Most respondents have completed Basic School education (40%). This could be attributed to the fact that agriculture has been a traditional livelihood in many regions, where formal education might not have been a primary focus [23]. All things being equal, the level of formal education is expected to positively affect the farmer's ability to access extension information as well as improve their knowledge on rice production technologies, trade and marketing information. Their literacy level will also boost their capacity to utilise information, which will improve rice production [21].

The majority of respondents identify as Christians (57.6%) and married (74.9%). The prevalence of married participants suggests that the family structure and responsibilities could play a significant role in their agricultural activities. A substantial proportion of respondents (51%) have been engaged in farming for 10 years and above, indicating that majority of the farmers are experienced and capable of managing their farms. The distribution of farm sizes indicates that a higher percentage of respondents have farms in the above 10 acres category (39.6%). This suggests that larger farm sizes might be common among the participants, which could influence production levels. The high percentage of respondents acquiring land through inheritance (70.6%) aligns with research indicating that

Table 1
Sample characteristics.

Variables	Frequency	Percent
Sex		
Male	162	63.5
Female	93	36.5
Age		
16–30	25	9.8
31–45	112	43.9
46–60	87	34.1
Over 60	31	12.2
Education		
Basic	102	40
Secondary	70	27.5
Tertiary	13	5.1
Non-Formal	70	27.5
Religion		
Christian	147	57.6
Muslim	62	24.3
Traditional	23	9.0
None	23	9.0
Marital status		
Married	17	74.9
Single	191	9.0
Divorced	23	6.7
Widowed	24	9.4
Number of years of farming		
1–3	20	7.8
4–6	43	16.9
7–9	62	24.3
10 and above	130	51.0
Estimated size of rice farm(acres)		
1–3	82	32.2
6–10	72	28.2
Above 10	101	39.6
Land acquisition		
Purchased	15	5.9
Inheritance	180	70.6
Rent	60	23.5
Number of household members		
1–3	26	10.2
4–6	73	28.6
7–9	47	18.4
10 and more	109	42.7
Membership of agricultural group		
Yes	131	51.4
No	124	48.6

Source: Field Data (2023)

land inheritance is a common practice in rural areas, leading to intergenerational land transfers and continuity of agricultural activities [24]. Larger household sizes could reflect the extended family structure common in many rural communities. According to Ref. [25], farming activities may be dependent on the family labour. Most of the farmers belong to agricultural group (51.4%), which could help in accessing information and benefits they derive from being a part of the group.

The need for quality, relevance and effectiveness of agricultural information is a basic necessity of the farming community in agricultural system. It plays an important role in enlightening them, raising their level of knowledge and eventually helping them with their decision-making process regarding farming activities [26]. In Table 2, the assessment of information quality among rice farmers reveals positive perceptions, with accuracy being highly valued (mean = 1.75). Respondents believe that the information is validated by experts in rice farming (mean = 2.14) and aligns with their previous knowledge and experience in the field (mean = 2.14). The alignment with their existing understanding is an encouraging sign for the relevance of extension services. It also enhances the overall

Table 2
Perception of quality, relevance and effectiveness.

Perceptions	Strongly Agree: Freq. (Percent)	Agree: Freq. (Percent)	Neutral: Freq. (Percent)	Disagree: Freq. (Percent)	Strongly Disagree: Freq. (Percent)	Mean	Std. Dev.
Quality (Mean Index = 2.24)							
It is accurate	122 (47.80)	91 (35.70)	27 (10.60)	10 (3.90)	5 (2.00)	1.75	0.935
It is validated by experts in the field of rice farming	60 (23.50)	130 (51.00)	35 (13.70)	27 (10.60)	3 (1.20)	2.14	0.941
It is consistent with my previous knowledge and experience in rice farming	70 (27.50)	104 (40)	54 (21.20)	27 (10.60)	0	2.14	0.935
It is supported by scientific evidence	45 (17.60)	123 (48.20)	57 (22.40)	27 (10.60)	3 (1.20)	2.29	0.920
It covers a wide range of topics relevant to rice farming	60 (23.50)	108 (42.40)	42 (16.50)	34 (13.30)	11 (4.30)	2.33	1.123
Is based on up-to-date research findings	46 (18.00)	104 (40.80)	74 (29.00)	23 (9.00)	8 (3.10)	2.38	0.980
It is presented in a clear and understandable manner	43 (16.90)	113 (44.30)	59 (23.10)	33 (12.90)	7 (2.70)	2.41	0.999
It is unbiased and free from personal opinions	37 (14.50)	111 (43.50)	77 (30.20)	27 (10.60)	3 (1.20)	2.41	0.886
Relevance (Mean Index = 2.22)							
It helps me overcome the common obstacles in rice farming	65 (25.50)	133 (52.20)	36 (46.10)	21 (8.20)	0	2.05	0.854
It reflects the current trends and issues in the rice farming industry	65 (25.50)	123 (48.20)	52 (20.40)	6 (2.40)	9 (3.50)	2.10	0.928
It is practical and actionable in my rice farming activities	65 925.50)	101 (39.60)	68 (26.70)	21 (8.20)	0	2.17	0.906
It supports the adoption of best practices in rice farming	56 (22.00)	128 (50.20)	49 (19.20)	11 (4.30)	11 (4.30)	2.18	0.973
It is highly relevant and valuable to my rice farming endeavors	61 (23.90)	117 (45.90)	49 (19.20)	15 (5.90)	13 (5.10)	2.19	1.006
It considers my local context and conditions of rice farming	58 (22.70)	122 (47.80)	47 (18.40)	3 (1.20)	25 (9.80)	2.26	1.111
It is directly applicable to my rice farming practices	32 (12.50)	127 (49.80)	74 (29.00)	22 (8.60)	0	2.32	0.803
It addresses the specific challenges faced by rice farmers in my region	49 (19.20)	110 (43.10)	62 (24.30)	22 (8.60)	12 (4.70)	2.36	1.043
It addresses the environmental and sustainability aspects of rice farming	37 (14.50)	132 (51.80)	49 (19.20)	27 (10.60)	10 (3.90)	2.37	0.971
Effectiveness (Mean Index = 2.34)							
It has improved my rice farming knowledge and skills	58 (22.70)	114 (44.70)	60 (23.50)	23 (9.00)	0	2.19	0.891
It has enhanced my pest and disease management practices	53 (20.80)	131 (51.40)	50 (19.60)	12 (12.70)	9 (3.50)	2.20	0.945
It has positively influenced my decision-making process in rice farming	63 (24.70)	109 (42.70)	45 (17.60)	38 (14.90)	0	2.24	0.977
It is helpful in addressing the specific challenges I face as a rice farmer	58 (22.70)	117 (45.90)	41 (16.10)	39 (15.30)	0	2.24	0.974
It has positively impacted my rice farming productivity and yields	67 (26.30)	92 (36.10)	56 (22.00)	25 (9.80)	15 (5.90)	2.31	1.134
It has increased my awareness of innovative techniques and technologies in rice farming	41 (16.10)	109 (42.70)	71 (27.80)	34 (13.30)	0	2.38	0.910
It has encouraged me to adopt sustainable rice farming practices	48 (18.80)	105 (41.20)	57 (22.40)	45 (17.60)	0	2.39	0.998
It has improved my understanding of soil fertility and nutrient management in rice farming	40 (15.70)	115 (45.10)	54 (21.20)	21 (8.20)	25 (9.80)	2.53	1.156
It is valuable in optimizing water and irrigation practices for rice cultivation	13 (5.10)	133 (52.80)	71 (27.80)	33 (12.90)	5 (2.00)	2.55	0.854

Overall Perception Index: 2.09.
NB: 1–1.49 = Strongly agree, 1.50–2.49 = Agree, 2.5–3.49 = Neutral, 3.50–4.49 = Disagree, 4.50–5.00 = Strongly disagree.
Source: Field Data (2023)

Table 3
Farmers' attitudes, aspirations and collaboration.

Perceptions	Strongly Agree: Freq. (Percent)	Agree: Freq. (Percent)	Neutral: Freq. (Percent)	Disagree: Freq. (Percent)	Strongly Disagree: Freq. (Percent)	Mean	Std. Dev.
Attitudes (Mean Index: 2.30)rowhead							
I believe agricultural extension services play a vital role in supporting the success of rice farmers	111 (43.50)	20 (7.80)	36 (14.10)	85 (33.30)	3 (1.20)	1.98	0.931
I trust the recommendations and advice given by agricultural extension services and consider them reliable sources of information for my rice farming activities	44 (36.90)	29 (11.40)	51 (20.00)	71 (27.80)	10 (3.90)	2.27	1.099
I appreciate the efforts made by agricultural extension services in providing valuable information and guidance to improve rice farming practices	99 (38.80)	43 (16.90)	57 (22.40)	56 (22.00)	0	2.33	0.997
I believe that agricultural extension services contribute significantly to the overall development and growth of the rice farming community	124 (48.60)	42 (16.50)	37 (14.50)	39 (15.30)	13 (5.10)	2.47	1.097
I value the support and assistance provided by agricultural extension professionals in addressing the challenges faced by rice farmers	96 (37.60)	42 (16.50)	72 (28.20)	40 (15.70)	5 (2.00)	2.49	1.003
Aspirations (Mean Index: 2.25)rowhead							
I hold the belief that agricultural extension services have a positive impact on the quality and marketability of rice produce	164 (64.30)	6 (2.40)	41 (16.10)	40 (15.70)	4 (1.60)	2.04	0.757
I believe that adopting the recommended practices shared by agricultural extension services can enhance the productivity and profitability of rice farming	157 (61.60)	17 (6.70)	37 (14.50)	41 (16.10)	3 (1.20)	2.15	0.799
I believe that active engagement with agricultural extension services can lead to continuous learning and improvement in rice farming practices	153 (60.00)	15 (5.90)	45 (17.60)	39 (15.30)	3 (1.20)	2.16	0.785
I have faith in the effectiveness of agricultural extension services in addressing the environmental and sustainability concerns associated with rice farming	113 (44.30)	32 (12.50)	45 (17.60)	65 (25.50)	0	2.17	0.947
I am convinced that the expertise and knowledge of agricultural extension professionals can significantly contribute to overcoming the obstacles faced by rice farmers	142 (55.70)	18 (7.10)	52 (20.40)	43 (16.90)	0	2.18	0.791
I trust that agricultural extension services provide accurate and up-to-date information that aligns with the specific needs and challenges of rice farmers	94 (36.90)	53 (20.80)	52 (20.40)	48 (18.80)	8 (3.10)	2.50	1.111
I am confident that agricultural extension services can help rice farmers adapt to changing market demands and seize new opportunities	120 (47.10)	21 (8.20)	74 (29.00)	25 (9.80)	15 (5.90)	2.54	0.987
Collaboration (Mean Index: 2.39)							
I aspire to actively participate in the training and capacity-building programs organized by agricultural extension services	4 (1.60)	145 (56.90)	10 (3.90)	41 (16.10)	55 (21.60)	2.05	0.787
I have a strong desire to collaborate and exchange knowledge with other rice farmers through agricultural extension platforms	130 (51.00)	24 (9.40)	43 (16.90)	58 (22.70)	0	2.13	0.874
I aspire to make the most of the resources and support provided by agricultural extension services to improve my rice farming skills	110 (43.10)	20 (7.80)	38 (14.90)	72 (28.20)	15 (5.90)	2.20	1.113
I am keen to explore innovative approaches and technologies suggested by agricultural extension services to enhance my rice farming outcomes	129 (50.60)	35 (13.70)	46 (18.00)	45 (17.60)	0	2.27	0.919
I am committed to incorporating the recommendations and best practices shared by agricultural extension services into my rice farming operations.	127 (49.80)	37 (14.50)	42 (16.50)	29 (11.40)	20 (7.80)	2.58	1.112
I have a strong aspiration to achieve long-term sustainability and profitability in my rice farming endeavors with the help of agricultural extension services.	120 (47.10)	52 (20.40)	58 (22.70)	18 (7.10)	7 (2.70)	2.65	0.973
I am determining to actively engage in agricultural extension services	103 (40.40)	65 (25.50)	77 (30.20)	4 (1.60)	6 (2.40)	2.87	0.895

Overall Mean Index: 2.31.
NB: 1–1.49 = Strongly agree, 1.50–2.49 = Agree, 2.5–3.49 = Neutral, 3.50–4.49 = Disagree, 4.50–5.00 = Strongly disagree.
Source: Field Data (2023)

effectiveness of extension services, contributing to the positive perception of information quality. Agricultural programmes should enhance existing agricultural technologies since farmers' awareness of the technology significant affect their perception to the relevance of the agricultural technology [27]. The overall mean of 2.24 indicates that, on average, rice farmers perceive the information provided through these services to be of good quality. Such positive perceptions are crucial as they enhance the trustworthiness of the information, indicating that the extension services effectively cater to farmers' informational needs by ensuring factual accuracy, expert validation, and alignment with existing knowledge [27].

For relevance, farmers perceived that the extension services help them overcome common obstacles encountered in rice farming (Mean = 2.05). This suggests that the extension services are addressing practical challenges faced by farmers, providing them with solutions to enhance their farming practices. The acknowledgment of the relevance of extension services in addressing common obstacles is indicative of their utility and responsiveness to the immediate needs of rice farmers. Farmers believe that the information provided reflects current trends and issues in the rice farming industry (Mean = 2.10). This indicates that the extension services are up-to-date and aligned with the dynamic nature of the agricultural sector. Keeping farmers informed about current trends and issues enables them to stay abreast of industry developments, potentially enhancing their ability to adapt to changing conditions and adopt best practices. Farmers generally find the information practical and actionable in their rice farming activities (Mean = 2.17). This shows that farmers find the guidance provided through extension services to be not only relevant but also applicable to their day-to-day rice farming activities. The overall mean of 2.22 suggest that farmers find the information practical, relevant, and tailored to their local conditions. This comprehensive view underscores the relevance of the extension services in addressing the multifaceted needs of rice farmers, promoting the practical application of knowledge, and contributing to the overall improvement of rice farming practices in the specific local context. Overall, the positive perceptions of relevance reflect the success of extension services in meeting the informational needs of farmers and enhancing the practicality of their agricultural activities [26].

For effectiveness, farmers perceived that extension services have improved their rice farming knowledge and skills, suggesting a positive educational impact (Mean = 2.19). This suggests that the educational components of the extension services are successfully enhancing the technical proficiency of farmers, empowering them with valuable insights and know-how to optimize their farming practices. Farmers believe that extension services have enhanced their pest and disease management practices, indicating a positive influence on crop protection (Mean = 2.20). This indicates a tangible and beneficial impact on crop protection, reflecting the effectiveness of the services in providing practical solutions and guidance to mitigate challenges related to pests and diseases. The positive influence on pest and disease management is crucial for sustaining crop health and, consequently, improving overall productivity. Farmers perceive that extension services have positively influenced their decision-making processes in rice farming, indicating informed choices (Mean = 2.24). This suggests that the information and support provided through extension services contribute to informed decision-making among farmers. Informed decision-making is essential for adapting to changing agricultural conditions, optimizing resource use, and ultimately achieving better outcomes in rice farming [27].

The overall mean of 2.34 suggest that extension services have a positive impact on various aspects of rice farming, from knowledge acquisition to improved productivity and sustainability. From knowledge acquisition and skill development to improved pest and disease management practices and informed decision-making, the findings suggest that extension services play a vital role in enhancing the overall productivity and sustainability of rice farming. This holistic positive impact underscores the effectiveness of extension services as a valuable resource for farmers, contributing to their capacity building and promoting sustainable agricultural practices [6,26].

Table 3 presents rice farmers' attitudes toward agricultural extension services. On average, farmers believe that agricultural extension services play a vital role in supporting the success of rice farmers. This indicates recognition of the importance of extension services (mean = 1.98). This indicates a recognition among farmers of the crucial role extension services play in their agricultural endeavors. The positive attitudes suggest that farmers value the support provided by extension services as instrumental to their success, reflecting an appreciation for the overall contribution of these services to the rice farming sector. Farmers trust the recommendations and advice given by agricultural extension services and consider them reliable sources of information for their rice farming activities (mean = 2.27). The high level of confidence in the information provided underscores the trustworthiness and credibility attributed to extension services. This trust is a vital component for effective knowledge transfer and adoption of recommended practices, as farmers are more likely to implement advice they consider reliable. Farmers generally appreciate the efforts made by agricultural extension services in providing valuable information and guidance to improve rice farming practices. This reflects a positive attitude toward extension services (mean = 2.33). This positive attitude reflects a sense of gratitude and acknowledgment of the role played by extension professionals in enhancing the knowledge and skills of farmers. Appreciation for the efforts made by extension services suggests that farmers not only recognize the value of the information but also appreciate the commitment and dedication of extension professionals in delivering meaningful support. The overall mean of 2.30 suggest that rice farmers have a positive attitude towards extension services. This positive attitudes, as highlighted by Ref. [28], is crucial as it can influence farmers' behavioral intent and actual adoption behavior. The findings suggest that fostering positive attitudes is integral to the success of extension programmes, encouraging farmers to engage actively with the information and recommendations provided, ultimately contributing to the improvement and sustainability of rice farming practices.

Table 3 outlines the aspirations of rice farmers concerning agricultural extension services, offering valuable insights into their expectations and beliefs. On average, farmers express a positive belief that these services have a beneficial impact on the quality and marketability of rice produce (Mean = 2.04). This reflects an anticipation among farmers for improved product quality and positive market outcomes as a result of their engagement with extension services. The expectation of enhanced product quality underscores the perceived value of these services in contributing to the overall competitiveness of their rice farming activities in the market. Furthermore, farmers believe that adopting recommended practices from agricultural extension services can lead to increased

productivity and profitability in rice farming (Mean = 2.15). This indicates an aspiration for improved efficiency and income generation, emphasising the economic goals that farmers associate with their engagement in extension programs. The positive aspiration for increased productivity aligns with the broader goal of achieving sustainable and economically viable rice farming practices [29]. In addition, farmers express a strong aspiration for continuous learning and improvement in rice farming practices through active engagement with agricultural extension services (Mean = 2.16). This commitment to lifelong learning highlights a proactive approach

Table 4
Farmers perception on the roles and responsibilities of stakeholders.

Perceptions	Strongly Agree: Freq. (Percent)	Agree: Freq. (Percent)	Neutral: Freq. (Percent)	Disagree: Freq. (Percent)	Strongly Disagree: Freq. (Percent)	Mean	Std. Dev.
Government (Mean Index: 2.75)							
They provide financial support and resources for effective agricultural extension services	37 (14.50)	113 (44.30)	57 (22.40)	43 (16.90)	5 (2.00)	2.47	0.999
They coordinate and implement agricultural extension programs for maximum impact	24 (9.40)	102 (40.00)	84 (32.90)	33 (12.90)	12 (4,70)	2.64	0.982
They establish policies and regulations that promote the development and sustainability of agricultural extension services	34 (13.30)	119 (46.70)	64 (25.10)	28 (11.00)	10 (3.90)	2.45	0.987
They provide adequate training and capacity-building opportunities for agricultural extension professionals	0	113 (44.30)	89 (34.90)	53 (20.80)	0	2.76	0.773
They create an enabling environment for collaboration among stakeholders in delivering agricultural extension services	17 (6.70)	117 (45.90)	77 (30.20)	42 (16.50)	2 (0.80)	2.58	0.865
They prioritize the inclusion of marginalized and small-scale farmers in their agricultural extension initiatives	38 (14.90)	105 (41.20)	81 (31.80)	20 (7.80)	11 (4.30)	2.45	0.983
They regularly evaluate and monitor the effectiveness and impact of agricultural extension services	32 (12.50)	79 (31.00)	97 (38.00)	29 (11.40)	18 (7.10)	2.70	1.071
NGOs (Mean Index: 2.97)							
NGOs play a vital role in filling gaps in agricultural extension services, particularly in reaching underserved or marginalized farmer groups	42 (16.50)	57 (22.40)	78 (30.60)	46 (18.00)	32 (12.50)	2.89	1.242
NGOs provide specialized knowledge, technical expertise, and innovative approaches to agricultural extension	35 (13.70)	68 (26.70)	81 (31.80)	35 (13.70)	37 (14.10)	2.88	1.224
NGOs collaborate with government agencies and farmer organisations to ensure coordinated and comprehensive agricultural extension support	20 (7.80)	65 (25.50)	87 (34.10)	38 (14.90)	45 (17.60)	3.09	1.192
NGOs facilitate knowledge exchange and experiential learning among farmers through their agricultural extension programs	31 (12.20)	52 (20.40)	87 (34.10)	66 (25.90)	19 (7.50)	2.96	1.118
NGOs adapt and respond to the evolving needs and challenges of farmers in their agricultural extension intervention	17 (6.70)	58 (22.70)	100 (39.20)	51 (20.00)	29 (11.40)	3.07	1.072
NGOs prioritize sustainability and long-term impact in their agricultural extension initiatives to ensure lasting benefits for farmers	47 (18.40)	38 (14.90)	93 (37.50)	37 (14.50)	40 (15.70)	2.94	1.289
NGOs advocate for the interests and rights of farmers in agricultural extension policy and decision-making processes.	28 (11.00)	57 (22.40)	92 (36.10)	53 (20.80)	25 (9.80)	2.96	1.125
Farmer Organisations (Mean Index: 2.11)							
They represent the interests and voice the needs of farmers in agricultural extension service delivery	47 (18.40)	95 (37.30)	93 (36.50)	20 (7.80)	0	2.34	0.867
They foster peer learning and knowledge-sharing among farmers through their agricultural extension initiatives	64 (25.10)	95 (37.30)	49 (19.20)	33 (12.90)	14 (5.50)	2.36	1.152
They participate in the design and implementation of agricultural extension programs to ensure their relevance and effectiveness	37 (14.50)	98 (38.40)	74 (29.00)	30 (11.80)	16 (6.30)	2.57	1.073
They engage with government agencies and NGOs to advocate for improved agricultural extension support	33 (12.90)	93 (36.50)	83 (32.50)	42 916.50)	4 (1.60)	2.57	0.969
They prioritize capacity-building and empowerment of their members through agricultural extension activities	30 (11.80)	103 (40.40)	75 (29.40)	30 (11.80)	17 (6.70)	2.62	1.054
They promote inclusive and equitable access to agricultural extension services	41 (16.10)	97 (38.00)	70 (27.50)	34 (13.30)	13 (5.10)	2.53	1.071
They farmer-to-farmer extension approaches, leveraging the expertise and experiences within the farming community	14 (16.10)	109 (42.70)	66 (25.90)	39 (15.30)	0	2.40	0.937

NB: 1–1.49 = Strongly agree, 1.50–2.49 = Agree, 2.5–3.49 = Neutral, 3.50–4.49 = Disagree, 4.50–5.00 = Strongly disagree.
Source: Field Data (2023)

among farmers to stay informed about evolving agricultural techniques and technologies. The aspiration for continuous improvement indicates a recognition of the dynamic nature of agriculture and a willingness to adapt to new knowledge and practices. The overall mean of 2.25 suggests a consistently positive aspiration among rice farmers towards extension services. This collective positive outlook reflects the perceived value that farmers attach to extension services in helping them achieve their goals in rice farming. The aspirations for improved product quality, increased productivity, profitability, and a commitment to continuous learning underscore the multifaceted benefits that farmers anticipate from their engagement with agricultural extension services.

The findings reveal that rice farmers exhibit positive perception towards collaboration with agricultural extension services. A notable aspect is their eagerness to participate in training and capacity-building programmes (mean = 2.05), underscoring a commitment to continuous learning and skill development. This proactive stance indicates that farmers recognize the importance of staying informed about new agricultural practices and technologies, aligning with the dynamic nature of the farming industry. The aspiration to engage in training programmes reflects a desire for personal and professional growth, emphasising the role of extension services in facilitating knowledge transfer. Moreover, farmers express a strong desire to collaborate and exchange knowledge with their peers through agricultural extension platforms (mean = 2.13). This highlights the value they place on community-based learning and the significance of shared experiences among farmers. The aspiration to collaborate with peers through extension services indicates a recognition of the collective wisdom within the farming community, fostering an environment where knowledge and best practices are exchanged for mutual benefit. Furthermore, farmers aspire to utilise the resources and support provided by extension services (mean = 2.20) to improve their rice farming skills. This reflects a proactive approach to leveraging available resources for skill enhancement, emphasising the practical application of knowledge gained through extension services. The desire to utilise extension resources demonstrates farmers' readiness to implement recommended practices and adopt new techniques to enhance the overall efficiency and productivity of their rice farming activities [21,30].

Table 4 provides insights into the perceived roles of different entities, namely the government, non-governmental organisations (NGOs), and farmer organisations, in the realm of agricultural extension services. A perception index of 2.75 indicates that there is a moderate level of trust and confidence in the government. This implies that farmers hold a moderate level of faith in government-led initiatives and support in the context of agricultural extension services. The moderate perception aligns with the findings of [31], who expressed a general consensus regarding the efficacy of government programmes aimed at supporting farmers and promoting agricultural productivity. While moderate, this level of trust indicates a recognition of the government's potential role in contributing to agricultural development.

A perception index of 2.97 indicates that there is also a moderate level of trust toward NGOs. This suggests that farmers have a moderate level of confidence in the effectiveness of non-governmental organisations involved in agricultural extension services. The moderate trust in NGOs may stem from the recognition of their role in complementing government efforts and providing additional support and expertise to farmers. In an article written by Ref. [32] it was contended that NGOs in Sub-Saharan Africa (SSA) have historically shown limited involvement in agricultural development. This can be attributed to a lack of engagement from donors and certain organisational characteristics of NGOs that are not well-suited to the specific demands of this field, such as a long-term focus and specialized knowledge and experience.

A perception index of 2.11, in contrast, indicates that farmer organisations enjoy a high level of trust. This high level of trust implies that farmers view farmer organisations as effective and reliable entities for addressing their specific needs and providing valuable support in the context of agricultural extension services. The strong trust in farmer organisations may be attributed to their proximity to the farming community, understanding of local challenges, and direct involvement in farmers' interests. Being close to the local farming context allows these organisations to have a direct understanding of the challenges and opportunities faced by farmers. This closeness enables them to tailor their services and support to meet the specific needs of the local agricultural community. Secondly, the strong trust in farmer organisations may stem from their direct involvement in farmers' interests. Farmer organisations often work collaboratively with farmers, engaging in advocacy, capacity-building, and providing a platform for collective decision-making. This direct involvement fosters a sense of partnership and shared goals, reinforcing the trust that farmers place in these organisations. Additionally, farmer organisations may have established a track record of effectively addressing farmers' concerns and delivering tangible support. The high levels of trust that farmers have expressed may be a result of past successful collaboration and fruitful

Table 5
Challenges faced by farmers in accessing agricultural extension services.

Challenges	Mean	Rank
Lack of machinery/equipment to demonstrate	7.12	1st
Lack of trust in information provided	6.71	2nd
Limited financial resources	6.21	3rd
Geographic location	6.17	4th
Lack of relevant materials in offices and libraries	5.66	5th
Poor knowledge sharing culture	5.62	6th
Inadequate number of extension agents	4.91	7th
Lack of awareness of information sources	4.71	8th
Language barrier	4.23	9th
Inadequate credit facilities	3.65	10th
N: 255; Kendall's W: 0.614; Chi-Square: 6811.593; Df: 11; Asymp. Sig.: 0.000		

Source: Field Data (2023)

outcomes. Successful initiatives, community projects, and visible impacts on farmers' livelihoods enhance the credibility and reliability of farmer organisations in the eyes of the farming community.

Table 5 suggests that limited access to machinery hampers the farmers' ability to learn and adopt new techniques. This was ranked first with a mean of 7.12. A significant challenge is the lack of confidence in the information that extension services provide. It implies that farmers may question the reliability or applicability of the information they receive, which can hinder their willingness to adopt recommended practices. It was ranked second with a mean of 6.71. Many farmers have limited financial resources to invest in agricultural extension programmes, making it difficult for them to access valuable information and training. Limited resources can influence farmers' ability to engage with extension services effectively and implement recommended practices. It was ranked with a mean of 6.21. Addressing these challenges is crucial for improving the delivery of extension services and enhancing farmers' capacity to adopt sustainable and efficient farming practices. According to Karim et al. (2016), sufficient knowledge of agricultural extension services reduces different cultivation problems. This finding is in line with the findings of [33], who stated that barriers to assessing agriculture extension services were connected with a lack of information services, an inadequate number of extension agents, a lack of credit facilities, and a lack of awareness of information sources.

5. Conclusions

Rice farmers hold positive perceptions of key aspects of agricultural extension services. They view the quality of the information provided as generally good, indicating belief in accuracy and clarity. Farmers also perceive the information as practical, relevant, and tailored to their local conditions, reflecting its suitability for effective knowledge transfer. Furthermore, farmers believe that agricultural extension services have a positive impact on various facets of rice farming, including knowledge acquisition, improved productivity, and sustainability, underscoring the significant role of extension services in their success and farming development. These collective perceptions highlight the pivotal role that agricultural extension services play in enhancing rice farmers' knowledge and productivity in the agricultural sector. Rice farmers in the study exhibit positive perceptions across various dimensions related to agricultural extension services. Their attitudes towards extension services are highly positive, reflecting a recognition of the crucial role these services play in supporting their success and the broader development of rice farming. In terms of aspirations, farmers express high expectations for the positive impact of extension services on the quality, productivity, and sustainability of their rice farming practices. Additionally, farmers display a positive perception of collaboration, indicating their willingness to actively engage with extension services, collaborate with fellow farmers, and maximise available resources to enhance their rice farming skills and outcomes. These collective perceptions underscore the significant role that agricultural extension services hold in the eyes of rice farmers, reflecting their positive outlook, aspirations for improvement, and readiness to collaborate for the advancement of their rice farming endeavors. While government and NGOs receive low degrees of trust and confidence, farmer organisations are perceived as having comparatively higher trust levels by rice farmers in the context of extension service delivery. Foremost among the challenges is the lack of necessary machinery and equipment for effective demonstration of agricultural practices.

Given that farmers perceive the information provided as high in quality, relevance, and effectiveness, it is essential to continue delivering accurate and up-to-date information. Extension services should prioritize the provision of timely and evidence-based guidance to address the evolving needs of rice farmers. The positive attitudes and high collaboration levels among rice farmers are encouraging. Extension programmes should continue to nurture these attributes, as they contribute to a receptive and engaged farming community. Farmers should be encouraged to actively participate in knowledge-sharing and skill-building activities. While farmers were neutral about the role of government and non-government organisations, efforts should be made to engage these entities more effectively in the delivery of extension services. Collaboration with government agencies and NGOs can help bridge resource gaps and broaden the reach of extension programmes. The study also emphasizes the significant role that farmer organisations play in providing extension services. These organisations should be further empowered and supported to continue their contributions to knowledge dissemination and skill transfer. The identified challenge of a lack of machinery and inadequate equipment for demonstrations should be addressed by providing access to modern farming equipment and machinery, which can enhance the practical aspects of extension services and improve farmers' understanding and adoption of new technologies.

Data availability statement

Data will be made available upon request.

CRediT authorship contribution statement

Princess Mariam Danjumah: Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Maxwell Toah Asiamah:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis. **Enoch Kwame Tham-Agyekum:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Sadiq Abubakar Ibraham:** Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Lordina Kumiwaah Mensah:** Visualization, Validation, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization.

Declaration of competing interest

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