

Cocoa Farmers' Participation in Public and Private Agricultural Extension Delivery in Amenfi Central District, Ghana

Enoch Kwame Tham-Agyekum¹⁾, Fred Ankuyi²⁾, Prince Asiedu³⁾*, Bright Juantoa⁴⁾, Goddea Asiedu Abourden⁵⁾, John-Eudes Andivi Bakang⁶⁾, Akua Yeboah Oduro-Owusu⁷⁾

^{1,4,5,6,7)} Department of Agricultural Economics, Agribusiness and Extension, Kwame Nkrumah University of Science and Technology, Kumasi-Ghana.

²⁾ Department of Agricultural Economics and Extension, University of Cape Coast, Ghana.

³⁾ Development Studies, Faculty of Social and Educational Sciences, University of Passau, Germany

*Corresponding Author

Email: princeasiedu127@gmail.com

Abstract

Agricultural extension and knowledge management have become key blocks in driving sustainable food systems and rural development, especially in periods of dealing with the complexities surrounding climate change and sustainable food systems in localised systems. This study assessed cocoa farmers' participation in public and private agricultural extension services in Ghana. Using descriptive and inferential statistics and collecting data from 385 farmers, the study reveals that private extension services stand out in various indices: access to information (3.72), communication (3.96), and support and follow-up (3.45), while public extension services excel in social and environmental impact (3.54), and knowledge transfer (3.86). Intricate extension programme dynamics also reveal a clear preference for private extension in citizen power (23.6% vs. 7.3%), delegated power (33.2% vs. 8.6%), and partnership (39.2% vs. 13.5%). Using the binary probit regression model, this study examines how various socio-economic factors influence farmers' participation in extension programmes. Results indicate that key determinants for participation in public extension include gender, level of education, land size, availability of labour, and access to credit. Conversely, factors influencing participation in private extension programmes include membership in farmer groups, land ownership, land size, the availability of labour, and access to credit. Policymakers and extension workers can make extension services more useful and open to everyone by focusing on these socioeconomic factors and creating programmes that meet the unique needs and limitations of various farmer groups. This will ultimately lead to higher agricultural productivity, better livelihoods, and better rural development.

Keywords: Agricultural Extension, Food Systems and Knowledge Management, Cocoa Farmers, Participation

INTRODUCTION

The Millennium Development Goals (MDGs) focused on enhancing food security and reducing hunger by primarily concentrating on increasing agricultural productivity, especially in the crop sector. This approach stems from recognising agriculture as a significant driver of economic growth in many developing economies, particularly in sub-Saharan Africa (Danso-Abbeam et al., 2018). Ghana heavily relies on agriculture, with around 60% of its population deriving their primary livelihood from this sector (Wongnaa et al., 2021). The sector employs approximately 42% of the workforce and is predominantly composed of smallholder farmers. These farmers, constituting about 90% of the sector, typically operate on less than two hectares of land, using traditional farming methods and inputs (Ghana Statistical Service, 2012).

To achieve meaningful productivity growth in the agricultural sector, Asfaw et al. (2012) argued that it is imperative to develop and disseminate improved agricultural technologies to these smallholder farmers in rural areas. Rural farmers encounter various challenges that, when addressed, can bring about a transformation in their behaviour, knowledge, capabilities, and skills (Nnadi et al., 2013). Typically, this kind of transformation is facilitated through both informal and formal institutions (Rickards et al., 2018). Extension services can be described as the primary means through which farmers gain insights into the reasons for change, the benefits

of change, the outcomes that can be achieved, and the uncertainties associated with change (Asiedu-Darko, 2013).

Agricultural extension services play a multifaceted role in transforming farming communities. They enhance farmers' skills, facilitate technology dissemination, and drive shifts in farmers' attitudes (Khan et al., 2012). Furthermore, they contribute to community development by fostering social and human capital, enhancing market access, and promoting sustainable natural resource management (Bonye et al., 2012). Participation in agricultural extension programmes in Ghana correlates with improved welfare and increased income (Danso-Abbeam et al., 2018). These services also support the adoption of soil improvement technologies, such as chemical fertilisers, highlighting their pivotal role in agriculture (Emmanuel et al., 2016). Extension education equips farmers with practical knowledge to tackle daily challenges (Asiedu-Darko, 2013). Notably, extension services extend beyond technology transfer to encompass broader community development, including the development of human and social capital, market access, knowledge and skills enhancement, sustainable resource management, and the organisation of producer and farmer groups (Swanson, 2008). In cases of market failures and discouraging production conditions, extension services provide effective solutions (Danso-Abbeam et al., 2018). These services have evolved to encompass not only productivity and technology but also farmers' technical and managerial skills through training, coaching, and facilitation (Danso-Abbeam et al., 2018). They foster capacity building in good agricultural practices, connect value chain participants, and integrate value addition, addressing food insecurity and rural poverty while actively engaging farmers in the agricultural knowledge and information system (Christoplos & Kidd, 2000).

In Ghana, the public sector has historically offered traditional agricultural extension services. However, recognising the practical limitations such as rising costs, resource constraints, and evolving perspectives on the government's role in extension services, there has been a noteworthy shift. This transformation has paved the way for private-sector entities and non-governmental organisations (NGOs) to actively participate in delivering agricultural extension services. It has become increasingly apparent that private agricultural extension services hold the potential to complement the existing public service system. This calls for an essential synergy between the private and public sectors (Farrington & Deshingkar, 2003; Quaye et al., 2019).

This collaboration takes the form of public-private partnerships (PPPs), a cooperative arrangement involving one or more of the public and private sectors in a long-term commitment. Within these partnerships, both public and private entities pool their resources and expertise to provide services that benefit the general public. In this shared journey, both parties assume potential risks and rewards to ensure the effective delivery of services. The public side of a PPP typically comprises government bodies like ministries, municipalities, departments, or state-owned enterprises. On the private front, partners can be either international or local entities, including investors and businesses with financial or technical acumen relevant to the project. Furthermore, PPPs often encompass non-governmental organisations (NGOs) and community-based organisations (CBOs), representing stakeholders directly impacted by the project (Mangani, 2019; IFAD, 2011).

These PPPs are primarily geared towards enhancing agricultural practices, promoting responsible input utilisation, empowering farmers through increased crop knowledge, and fostering the exchange of international expertise. They also focus on efficient natural resource management. This approach brings forth novel dynamics in power structures, the formation of strategic alliances, the creation of developmental opportunities, and more streamlined work processes. Moreover, PPPs open up avenues for enhancing the long-term effectiveness of agricultural technologies. By adopting this model, PPP initiatives deliver a plethora of advantages. They contribute to higher technology adoption rates among farmers and facilitate

the sharing of resources and skills within the farming community. They actively contribute to poverty reduction by providing technologies and knowledge to small-scale farmers, ultimately leading to enhanced competitiveness and improved market positioning due to the bolstered competencies of the agricultural community (Ferroni & Castle, 2011; Spielman & Grebmer, 2004; Ferroni & Castle, 2011).

Numerous studies investigating the quality and effectiveness of public and private extension services have consistently found that farmers tend to perceive private extension services as superior to their public sector counterparts (Ali, 2013; Naeem & Hassan, 2014; Mengal et al., 2012; Rana et al., 2013; Onyenkazi & Gana, 2021). Additionally, certain studies have assessed the necessity of PPPs in agricultural extension, research, and development to enhance food security (Raidimi et al., 2017). These researchers concluded that both the private and public research and extension sectors play significant roles in sustaining food production. They further emphasised that PPPs in agricultural extension are increasingly recognised as an effective mechanism for enhancing public service provision and implementing development programs. In their comparison of private and public extension services, Farooq et al. (2020) observed that both sectors employed similar extension teaching methods for information dissemination. However, the private sector outperformed the public sector in terms of providing commodities, offering technical assistance, and advocating for farmers. In a similar vein, Sylla et al. (2019) found that farmers generally had a higher level of appreciation for private extension services in comparison to public extension services, even though both groups expressed a baseline level of satisfaction with the services they received. Thus, there are many documents concerning what is known about the quality and effectiveness of public and private extension as well as its impact on food production. However, the body of empirical evidence does not match the level of farmer participation, particularly in Ghana's agricultural sector. Furthermore, public and private sector extension organisations exhibit disparities in terms of their characteristics, approaches to extension services, operational methods, organisational structures, the spectrum of agricultural advisory services they offer, and their efficacy in enhancing farmers' livelihoods.

Consequently, it becomes imperative to assess the extent of farmers' engagement in the initiatives and activities of these organisations. Therefore, the study aims to assess farmers' participation in public and private extension services in the Amenfi Central District. Specifically, the study: (i) identifies farmers' perceptions about public and private agricultural extension programmes; (ii) assesses farmers' participation in public and private extension services; and (iii) determines the factors that influence farmers' participation in public and private extension services.

RESEARCH METHODS

The study was conducted in the Amenfi Central District. The Amenfi Central District is situated in the central part of the Western Region, located between latitudes 5°20'N and 6°7'N and longitudes 2°9'W and 2°27'W. It covers an estimated land area of 1,845.9 square kilometers and encompasses 131 communities. To its north, it shares boundaries with Bibiani Anhwiaso Bekwai Municipality, Sefwi Wiawso Municipality, and Upper Denkyira West District. The north-western border is with Aowin Municipal, while it is bordered to the south by Prestea Huni-Valley Municipal. To the east, it shares borders with Amenfi East Municipal, and to the west, it is adjacent to Amenfi West Municipal. As of the 2021 population and housing census, the district had a population of 119,117 residents, comprising 63,212 males and 55,905 females (<https://ghanadistricts.com/Home/District/196>).

A descriptive survey design was chosen for this study. The target population for this study is all cocoa farmers in the Amenfi Central District. Given the unknown population size for the study, we applied Cochran's (1977) formula to determine the sample size, resulting in a sample size of 385. The technique of multi-stage sampling was used to collect data from the 385 cocoa farmers in the district. The multi-stage sampling procedure was used because the target population structures were large and dispersed across the entire district (David and Sutton, 2004). At the first stage of the multi-stage sampling procedure, Amenfi Central District was randomly selected. In the second stage, four (4) communities within the district were randomly selected. The third stage used simple random sampling to select individual cocoa farmers. The study utilised simple random sampling to avoid bias and give equal and independent chances to all participants. The communities and the number of respondents selected were: Manso Amenfi (100), Pensanom (94), Anakum (92), and Achichire (99).

Primary data was obtained from respondents using a well-structured questionnaire through a face-to-face interview. A questionnaire is a series of questions provided to respondents to solicit their understanding or perceptions of a subject matter (DeFranzo, 2012). The research instrument was developed based on previous research and guidance from experts in the field. David and Sutton (2004) emphasised that survey questions should be pre-tested on a test group of cases from the target population to ensure their reliability. Pilot testing was conducted with 25 farmers from Achichire in the same district, leading to refinements in the questionnaire structure and questions' clarity. The reliability of the instrument was assessed using the Cronbach alpha test, and the coefficients for different sections ranged from 0.80 to 0.89, indicating reliability.

The researchers obtained the consent of the respondents orally to participate in the study. The researchers were committed to ensuring the utmost confidentiality of the respondents' opinions. Five field assistants helped obtain the data between July and August of 2023. The content of the questionnaire was thoroughly explained to the field assistants to ensure that each one of them had a complete appreciation and understanding of the research instrument and the purpose of the study. The chosen field assistants possessed the following qualities: fluency in the local language, familiarity with the selected communities, qualification and training as extension officers with the Ghana Cocoa Board, and a recommendation from their immediate supervisors as credible and committed employees. During the survey, the researchers visited a subset of the sampled farmers to validate the data and capture additional data. The finalized research instruments were examined to detect and rectify errors and unfinished sections. The collected data were coded with the aid of a codebook to facilitate the transformation of the responses into numerical data for computer analysis. For analysis, the coded data were entered into Statistical Package for Social Science (SPSS) Version 21. The data were cleansed by employing descriptive statistics to identify coding inconsistencies. During the analysis, SPSS was utilised.

Descriptive statistics, including means, standard deviations, frequencies, and percentages, were used to analyse the demographic characteristics of farmers. A five-point Likert scale ranging from strongly disagree-1 (one) to strongly agree-5 (five) was used to analyse farmers' perceptions of public and private agricultural extension programmes (Lindner et al., 2003). To assess farmers' level of participation in public and private extension services, Arnstein's ladder of participation was used. The ladder was used to evaluate the level at which farmers are involved in decision-making processes related to the development and implementation of extension services. Arnstein (1969) delineated eight levels of participation, which encompass manipulation, therapy, informing, consultation, placation, partnership, delegated power, and, ultimately, citizen control. The bottom rungs of Arnstein's participation ladder (manipulation and therapy) are categorized as non-participation, wherein proponents primarily persuade the general public or beneficiaries to accept a proposed action. The middle rungs (informing, consultation, and placation) are seen as varying degrees of tokenism, where there is a significant emphasis on providing information but

limited to no opportunities for the public to voice concerns or influence the decision-making process. The primary objective of the middle rung is often to merely meet legal requirements rather than foster genuine public participation in decision-making. The upper rungs, which include partnership, delegation, and citizen control, facilitate an increasing degree of public influence over decision-making. At these levels, the general public, or beneficiaries, and planning agencies are regarded as equal partners, jointly formulating solutions to identified problems. Arnstein advocates for the highest stage, where participants in an intervention exercise complete control throughout the entire process, from its inception to its conclusion. Farmers were asked to indicate their perception of their level of participation on a three-point Likert scale (disagree-1, neutral-2, agree-3) (Lindner et al., 2003). From the Likert scores, the minimum and maximum scores a respondent (a farmer) could get were 8 (eight) and 24, respectively. Based on the total score obtained, the respondents were categorized into two groups: no participation (0) for a farmer whose scores are less than 50.49% of the total scores, and participation (1) for a farmer whose scores are more than 50.50% (Jack et al., 2020).

To determine the factors that are related to farmers' participation in public and private extension services, the binary probit model was used. It is a statistical method used for modelling the relationship between one or more independent variables and a binary outcome. The binary probit model was conducted twice, for participation in public and private extension services. The data structure has a binary dependent variable; thus, participation was coded as 0 or 1 for each category of public and private extension services. It also has a set of independent variables, such as gender, religion, marital status, membership in a farmer group, land ownership, source of farm labour, access to credit, age, years of education, household size, farming experience, and farm size. The Binary Probit Model models the probability of the binary outcome variable ($Y = 1$) as a function of the independent variables. It uses the standard normal distribution's cumulative distribution function (CDF), also known as the probit function. The model can be expressed as:

$$\Phi(\beta_0 + \beta_1X_1 + \beta_2X_2 + \dots + \beta_n \cdot X_n) = P(Y = 1)$$

 $\Phi()$ represents the cumulative distribution function of the standard normal distribution.
 $\beta_0, \beta_1, \beta_2, \dots, \beta_n$ are coefficients for the independent variables (X_1, X_2, \dots, X_n).
 $P(Y = 1)$ is the probability of the binary outcome variable being 1.

RESULT AND DISCUSSION

Demographic Characteristics of the Farmers

Table 1 offers a comprehensive overview of the demographic characteristics and key statistics related to the farmers in the study.

Table 1: Demographic Characteristics of Farmers

Discrete Variable	Frequency	Percentage
Gender		
Males	280	72.70
Females	105	27.30
Religion of respondent		
Christian	329	85.50
Non-Christians	56	14.50
Marital status		
Married	247	64.16
Not married	138	35.84
Membership in farmer group		
Yes	295	76.60

No		90		23.40
Land ownership				
Others		252		65.40
Own land		133		34.60
Source of farm labour				
Hired labour		216		56.10
Others		169		43.90
Access to credit				
Yes		201		52.2
No		184		47.8
Continuous Variable	Min	Max	Mean	Std. Dev
Age	23	81	48.34	13.05
Years of Education	0	32	5.64	6.22
Household size	1	33	6.11	3.15
Farming experience	1	51	19.73	11.41
Farm size	1	30	6.13	5.81

Source: Field Data, 2023

The gender distribution reveals that 72.70% of the respondents are male, while 27.30% are female. In line with this study, Ankuyi et al. (2023) contend that gender imbalances may mirror wider societal norms and perceptions regarding gender roles within the agricultural and farming sectors. For instance, in certain cultures, it is customary for men to be engaged in agricultural work, while women are traditionally assigned domestic responsibilities. This division of roles may result in fewer women pursuing agricultural careers and having limited opportunities to engage in farming activities.

In terms of religion, 85.50% are Christians, with the remaining 14.50% following other faiths. Given the diverse religious beliefs within the farming community, extension services and agricultural development programmes need to exhibit sensitivity towards the religious and cultural backgrounds of the farmers. A comprehension of the prevailing religious beliefs can aid in customising extension activities to align with the local culture, ensuring they are culturally appropriate and demonstrate respect for local customs and traditions.

Regarding marital status, the data reveals that 64.16% of farmers are married, while 35.84% are not. This observation aligns with previous studies conducted by Asamoah and Owusu-Ansah (2017). Furthermore, the research uncovered that 76.60% of the participants are members of farmer groups, while 23.40% are not associated with any such organizations. This indicates a strong presence of collective action and cooperation among the farmers. Farmer groups can provide various benefits, including access to resources, shared knowledge, and collective bargaining power. This suggests that many farmers recognise the advantages of joining such groups and actively participate in them. Land ownership highlights that 65.40% of farmers do not own the land they cultivate, while 34.60% have land ownership. Understanding the prevalent land tenure systems in the agricultural community is crucial. Sharecropping and leasing arrangements may affect the degree of control farmers have over their land and influence their incentives to invest in sustainable agricultural practices.

Regarding labour sources, 56.10% rely on hired labour, with the remaining 43.90% using other means. This suggests that farmers in the district rely significantly on external labour sources for agricultural activities. This may indicate that farmers require additional hands to meet their farming needs. This also indicates that farmers have to bear an extra cost related to farming because labourers usually expect to be paid. In terms of credit access, 52.2% of respondents have access to credit, while 47.8% do not. This signifies that a substantial portion of farmers can access financial resources to support their agricultural activities. This can be crucial for making

investments, purchasing inputs, and improving overall farm productivity. When examining continuous variables, the age of farmers ranges from a minimum of 23 to a maximum of 81, with an average age of 48.34 years. The findings agree with Ankuyi et al. (2023), who found the mean age of cocoa farmers to be 49 years. The range of educational attainment spans from 0 to 32 years, with an average of 5.64 years, highlighting the relatively low educational level among cocoa farmers (Asamoah and Owusu-Ansah, 2017). Household size varies from a minimum of 1 (one) to a maximum of 33 members, with an average household size of 6 (six), which indicates farmers have a family size (Denkyira et al., 2017). The average farming experience is 19.73 years, and farm sizes range from 1 (one) to 30 acres, with an average farm size of 6.13 acres. This suggests that there is a broad spectrum of experience levels among cocoa farmers.

Farmers’ Perceptions of Agricultural Extension Programmes

Table 2 presents the farmers' perceptions of agricultural extension programs, offering insights into various aspects related to their experiences and the effectiveness of extension programmes.

Table 2: Farmers’ perceptions of agricultural extension programmes

Perception Statements	Public	Private
Access to Information (Mean Index=3.13; 3.72)		
I have easy access to the latest agricultural information through extension services.	3.11	3.42
The extension services help me stay informed about market trends.	3.12	4.42
Information provided by the extension services is easily understandable.	3.14	4.53
I receive timely updates on pest and disease management.	3.14	4.59
Extension services contribute to my knowledge of modern farming practices.	3.16	1.63
Training and Education (Mean Index=2.79; 2.87)		
The extension programs offer valuable training opportunities for farmers.	3.17	2.59
I feel adequately trained to implement new farming techniques.	3.19	3.63
Extension services have improved my understanding of sustainable farming.	4.19	1.69
The training materials provided are useful for practical application.	2.19	2.70
Extension programs have improved my ability to effectively address and resolve farming-related challenges	1.20	3.72
Communication (Mean Index=3.62; 3.96)		
Extension agents communicate information clearly and understandably.	4.23	4.79
I am satisfied with the level of communication between extension services and farmers.	3.24	3.78
Extension agents actively seek feedback from farmers to improve communication.	3.30	3.74
I believe that extension services respond promptly to my inquiries and feedback.	4.00	3.73
The extension services use multiple channels (e.g., meetings, mobile apps) for effective communication.	3.33	3.77
Knowledge Transfer (Mean Index=3.86; 3.31)		
The extension services effectively transfer scientific knowledge to practical farming.	3.62	3.02

I feel that the knowledge gained from extensions has improved my decision-making.	4.63	3.98
Extension services help bridge the gap between research findings and practical farming.	4.91	3.20
I am confident in applying the knowledge acquired through extension programs.	2.11	3.48
Extension services promote continuous learning and adaptation on my farm.	4.20	2.85
Resource Access (Mean Index=3.91; 2.924)		
The extension services assist in accessing essential farming resources (e.g., seeds, and fertilizers).	4.11	2.89
I receive guidance on cost-effective resource management through extension programs.	4.16	2.81
Extension services have helped me access financial resources and credit facilities.	4.35	2.78
I can rely on extension services for support in acquiring modern farming equipment.	4.22	2.82
Extension programs facilitate connections to reliable suppliers and markets.	2.74	3.32
Support and Follow-up (Mean Index=3.23; 3.45)		
Extension agents provide ongoing support even after training sessions.	4.23	3.26
I receive assistance in troubleshooting specific farming challenges.	3.15	3.05
Extension services maintain open channels for inquiries and concerns.	3.01	3.01
I feel comfortable seeking help from extension agents when needed.	3.03	4.00
Extension services continuously evaluate and adapt to farmers' needs.	3.01	4.01
Social and Environmental Impact (Mean Index=3.54; 3.03)		
Extension programs encourage environmentally sustainable farming practices.	3.79	2.63
I feel that my participation in extension services benefits the local community.	3.90	2.42
Extension programs promote social cohesion and knowledge-sharing among farmers.	3.06	3.76
My farm's environmental impact has improved due to extension program guidance.	3.42	2.48
Extension services emphasize ethical and responsible farming practices.	3.52	3.84
Impact and Outcomes (Mean Index=3.67; 4.01)		
I have observed increased crop yields due to extension services.	3.34	3.18
Extension programs have positively affected my farm's profitability.	3.22	4.52
My livelihood has improved thanks to the knowledge gained from extensions.	4.28	2.79
I believe extension services contribute to sustainable farming practices.	3.24	4.87
My participation in extension programs has enhanced the well-being of my family.	4.21	4.68

Source: Field Data, 2023

Farmers perceive private extension services more positively in terms of access to information, scoring them significantly higher than public services (3.72; 3.13). This suggests that private extensions may have more effective information dissemination strategies or better content accessibility, which are crucial for informed decision-making in agriculture. It is

essential to ensure that extension programmes are effectively communicating the benefits of modern farming practices. Clear and persuasive communication can lead to a more positive perception among farmers. The neutral perception regarding access to the latest agricultural information highlights the importance of timely and relevant information dissemination. Extension services need to ensure that farmers have access to up-to-date knowledge and technologies. As stated by Zwane et al. (2014), extension services aim to furnish land users and farmers with relevant agricultural knowledge, empowering them to achieve enhanced, sustainable, and economic development. Therefore, agricultural extension continues to be a global approach to rural development, aiding farmers in identifying their challenges, facilitating the discovery of effective solutions, and motivating them to implement these solutions (Anaeto et al., 2012).

Farmers' perceptions of training and education offered by both public and private extension services are fairly similar, with slightly better ratings for private services (2.87; 2.79). This indicates that farmers have a neutral perception of this aspect, implying that there is room for improvement in enhancing the quality and effectiveness of training programs. To shift this neutral perception towards a more positive one, ongoing evaluation of the training and educational components of extension services is crucial. Collecting feedback from farmers and measuring the practical impact of the knowledge they receive can inform improvements. Farmers' neutral perception might also indicate the need for greater emphasis on the practical application of the knowledge imparted. Extension programmes could focus on helping farmers translate knowledge into real-world problem-solving on their farms. Engaging the farming community in the design and implementation of training and education programmes can foster a sense of ownership and relevance. Involving farmers in decision-making can help align the content with their actual needs. To effectively communicate the advantages and applicability of extension services' education, communication strategies must be effective. Farmers need to understand how the knowledge will improve their farming practices and overall outcomes. According to the findings, Maoba (2016) discovered that farmers thought extension services' training was exceptionally effective.

Private extension services receive notably higher scores for communication, indicating that farmers find them more effective in terms of interacting and sharing information (3.96; 3.62). This demonstrates the importance of clear and efficient communication channels for agricultural extension programs. This is a positive sign, as effective knowledge dissemination is essential for keeping farmers informed about the latest agricultural techniques, technologies, and best practices. The positive perception of communication also implies that farmers value the knowledge and information provided through extension services. Communication through extension services can also foster a sense of community and collaboration among farmers. It provides a platform for sharing experiences, learning from one another, and collectively addressing challenges.

Public extension services are perceived more favourably for knowledge transfer (3.86; 3.31), suggesting that they might excel in disseminating practical agricultural knowledge. Private extensions might need to focus on improving their knowledge transfer methods to compete effectively in this area. Effective knowledge transfer contributes to building the capacity of farmers. It equips them with the tools to make informed decisions, adopt modern farming techniques, and adapt to changing agricultural landscapes and challenges. This suggests that farmers believe that extension services are valuable sources of information and learning. Again, the finding implies that extension services are fulfilling their core function of knowledge transfer. They bridge the gap between research findings, best practices, and the farming community. This is vital for disseminating up-to-date information and empowering farmers with the skills and knowledge needed to enhance agricultural practices. The effective transfer of knowledge not

only benefits individual farmers but also has broader implications for the community and food security. Communities with well-informed farmers are more resilient in the face of agricultural uncertainties and can contribute to local food security. Contrary to the findings, Mcharo (2013) indicated that farmers hold the belief that agricultural extension services are not successful in transferring knowledge.

Farmers have a very positive perception of resource access through public extension services (3.91), while private extensions receive a somewhat lower score (2.92). This reflects the perceived challenges farmers face in accessing resources through private extensions, which could be a critical area for improvement. These resources may include financial support, credit facilities, and other essential elements required for agricultural activities. Effective resource access can have far-reaching implications for the well-being of the farming community. It can contribute to poverty alleviation, economic growth, and overall community development. The positive perception reflects that farmers acknowledge the role of extension services in empowering them economically. Access to resources is a key driver for improved agricultural productivity and income stability. Consistent with the research results, Kassem (2014) discovered that agricultural extension services were ineffective in alleviating farmers from poverty and delivering essential resources.

Private extension services are perceived slightly more positively in terms of support and follow-up (3.45), which suggests they might excel in providing assistance and guidance to farmers after initial training or intervention. Public extensions need to strengthen this aspect to meet farmers' expectations (3.23). Effective feedback utilisation and a commitment to translating input into programme improvements are crucial for meeting the evolving needs of the farming community and maintaining the engagement and satisfaction levels observed. It is therefore essential for extension services to establish a feedback utilisation system that not only collects input from farmers but also acts on the feedback to enhance the quality and relevance of their services. Effective support and follow-up mechanisms should encompass community engagement and participation, where farmers have a say in programme design and implementation. Extension services should view feedback as a valuable resource for continuous improvement. This includes refining training, content, and delivery methods to better meet the evolving needs of farmers. Ensuring transparency in how feedback is handled and demonstrating accountability in implementing changes can enhance trust and belief in the adaptation process.

Farmers have a more positive perception of the social and environmental impact of public extension services (3.54). This underscores the role of public extensions in contributing to broader social and environmental goals in agriculture but also highlights an area where private extensions can aim to make a greater impact (3.03). This implies that for public extension services, extension programmes play a crucial role in fostering community development, economic growth, and poverty alleviation. Extension services are seen as catalysts for community development by strengthening the social fabric and improving living conditions. They can foster environmental stewardship within the community. Unlike the research outcomes, Ali et al. (2012) indicated that extension services were not successful in enhancing farmers' net income and production. Conversely, Onwuka et al. (2017) demonstrated that effective extension services improved productivity and farmers' income.

Private extension services receive notably higher scores for their impact and outcomes (4.01), indicating that they are perceived as more effective in delivering tangible results in agriculture. Public services still receive positive feedback (3.67), but this comparison highlights the strengths of private extensions in terms of practical outcomes. These findings underscore the vital role of extension services in positively affecting agricultural productivity, profitability, livelihoods, and the broader well-being of farming communities, emphasising the need for continued support and investment in such programmes for rural development.

Farmers’ Participation in Public and Private Extension Programmes

Table 3 presents data on farmers' participation in both public and private extension.

	Public Extension			Private Extension		
	Disagree	Neutral	Agree	Disagree	Neutral	Agree
Citizen Power	293 (76.1%)	64 (16.6%)	28 (7.3%)	190 (49.4%)	104 (27.0%)	91 (23.6%)
Delegated Power	292 (75.8%)	60 (15.6%)	33 (8.6%)	176 (45.7%)	81 (21.0%)	128 (33.2%)
Partnership	188 (48.8%)	145 (37.7%)	52 (13.5%)	100 (26.0%)	134 (34.8%)	151 (39.2%)
Placation	122 (31.7%)	194 (50.4%)	69 (17.9%)	72 (18.7%)	142 (36.9%)	171 (44.4%)
Consultation	110 (28.6%)	112 (29.1%)	163 (42.3%)	53 (13.8%)	128 (33.2%)	204 (53.0%)
Informing	89 (23.2%)	118 (30.6%)	178 (46.2%)	76 (19.7%)	95 (24.7%)	214 (55.6%)
Therapy	78 (20.3%)	112 (29.1%)	195 (50.6%)	69 (17.9%)	114 (29.6%)	202 (52.5%)
Manipulation	109 (28.3%)	47 (12.2%)	229 (59.5%)	111 (28.8%)	52 (13.5%)	222 (57.7%)

Source: Field Data, 2023

In terms of citizen power, more farmers agree with private extension (23.6%) compared to public extension (7.3%). Citizen power represents the highest level of participation in Arnstein's ladder of participation, where farmers have full control and decision-making authority in extension activities. It signifies a genuine partnership between farmers and extension agents. This result suggests that a substantial portion of farmers participating in private extension services perceive a more equitable and inclusive approach where they have a strong say in decision-making and programme implementation. Again, a much smaller proportion of farmers participating in public extension services perceive themselves as having full control and decision-making authority in the extension process. The significant difference in agreement between private and public extension programmes regarding citizen power highlights a noteworthy gap in the level of farmer participation. The private extension appears to be more successful in involving farmers at a higher level of engagement. The discrepancy may reflect farmers' preferences and experiences. Those engaged in private extension might find the approach more collaborative and farmer-centric, while those in public extension might feel less engaged in decision-making. This finding may also suggest that private extension programmes are more effective in implementing participatory approaches, which can lead to better adoption of knowledge and practices by farmers. The higher level of agreement with citizen power in private extension programmes compared to public extension programmes suggests variations in the extent of farmer participation. This has implications for the effectiveness and inclusivity of different extension approaches and may provide insights for policy and programme improvements in both the public and private sectors.

Farmers also favour delegated power more in private extension (33.2%) than in public extension (8.6%). Delegated power signifies that farmers have been given a certain degree of control, management, and decision-making authority in extension activities. While it falls short of full citizen power, it represents a significant level of participation. The finding suggests that a substantial portion of farmers participating in private extension services perceive themselves as having a significant say in decision-making and programme management. In contrast, a smaller proportion of farmers participating in public extension services feel that they have a meaningful

degree of control and decision-making authority in the extension process. Farmers in private extension programmes seem to perceive themselves as more empowered and influential in shaping extension activities. This may contribute to a higher level of satisfaction and effectiveness in private extension services. The higher level of agreement with delegated power in private extension programmes compared to public extension programmes suggests a notable difference in the perceived degree of farmer participation and influence. This difference has implications for the effectiveness and empowerment of farmers and may guide public extension programme enhancements to increase farmer involvement and empowerment.

Private extension outperforms public extension in partnership, with 39.2% of farmers agreeing to a partnership approach, while only 13.5% agree with public extension. Partnership represents a collaborative approach where farmers and extension agents work as equal partners in planning, implementing, and managing extension activities. It signifies a higher degree of cooperation and shared decision-making. The result suggests that a substantial portion of farmers participating in private extension services perceive themselves as engaged in a true partnership with extension agents. Farmers in private extension programmes seem to perceive themselves as more actively involved in collaborative decision-making and planning with extension agents. In contrast, a smaller proportion of farmers participating in public extension services feel that they are working in partnership with extension agents. The higher level of agreement with a partnership approach in private extension programmes compared to public extension programmes suggests a significant difference in the perception of collaborative and participatory elements. This finding has implications for the effectiveness and collaboration of different extension approaches and may offer insights for public extension programme enhancements to increase the level of partnership and collaboration with farmers.

Compared to a public extension (17.9%), a private extension favours the placation level more (44.4%). Placation represents a level of participation where farmers may have some decision-making authority, but the choices they are given are limited. It is a level that falls short of genuine partnership and full decision-making power. The findings demonstrate that a sizable portion of farmers using private extension services believe they have some influence, but only within predetermined boundaries set by extension agents or the program. In contrast, a smaller proportion of farmers participating in public extension services feel they have some decision-making authority but are still within predefined boundaries. The higher level of agreement with the placation level in private extension programmes compared to public extension programmes suggests a significant difference in the perception of participation and influence boundaries.

Consultation is more favoured in private extensions (53.0%) than in public extensions (42.3%). Consultation signifies a level of participation where farmers are consulted and their input is considered in the development and implementation of extension services. It reflects a higher degree of involvement in decision-making. The results imply that there is a notable difference in the perception of the degree of farmer engagement in decision-making among private and public extension services. The discrepancy in perceptions of participation implies that private extension programmes are perceived as offering a more participatory environment where farmers have a say in programme development and implementation.

Both public (46.2%) and private (55.6%) extension programmes offer more information to farmers, with private extension having a slight advantage. "Informing" implies that farmers are provided with information about extension services, but they may not have significant input into the development or implementation of these services. It reflects a more one-way flow of information from extension agents to farmers. Private extension holds a slight advantage in terms of higher agreement with "informing." This may be due to more effective communication and knowledge-sharing mechanisms in private programs. The findings indicate that both public and

private programmes tend to emphasise the provision of information to farmers, with a relatively limited emphasis on farmer input into programme development and implementation.

The therapy level is relatively similar in both public (50.6%) and private (52.5%) extension programs. The "therapy" level suggests that farmers perceive the extension services as providing not just information but also a level of emotional or psychological support. This support might include counselling, advice, reassurance, dialogues, discussions, and problem-solving activities. The similarity in the "therapy" level preference implies that farmers in both public and private extension programmes value consultative and problem-solving interactions with extension agents. They see value in dialogues and discussions as part of the extension process.

Manipulation has the highest level of agreement for both public (59.5%) and private (57.7%) extension programmes, with similar levels of agreement. The "manipulation" level signifies that farmers feel that they have little to no real participation in decision-making processes during extension activities. They might perceive that extension agents primarily convince them to accept proposed actions without considering their input. These findings suggest that farmers in both private and public extension programmes feel that their involvement in decision-making is limited. The high agreement with "manipulation" suggests that farmers may not feel genuinely involved in decision-making processes and may perceive that extension agents push them to accept proposed actions. The high level of agreement with the "manipulation" level in both public and private extension programmes highlights a shared perception among farmers of manipulative elements in their interactions with extension agents. This perception calls for increased transparency and efforts to involve farmers more genuinely in decision-making processes in both types of extension programmes.

In general, private extension has a higher level of agreement in various forms of participation, such as citizen power, delegated power, partnership, placation, consultation, and informing. Public extension, on the other hand, has a higher level of agreement in therapy, while manipulation is relatively similar in both public and private extensions. Overall, private extension programmes seem to be more favoured by farmers in terms of different participation levels, although both public and private extensions show the highest agreement in manipulation. Farmers' preferences may reflect their experiences and perceptions of the effectiveness and inclusivity of the different extension approaches.

Factors Influencing Farmers' Participation in Public and Private Extension Services

Table 4 presents the results of a regression analysis that investigates the factors influencing farmers' participation in public and private extension. Under public extension services, sex, years of formal education, land size, source of labor, and access to credit were the variables influencing cocoa farmers' perception of participation in public extension services. Membership of farmers' groups, land ownership, land size, source of labor, and access to credit were the variables influencing cocoa farmers' perception of participation in private extension services.

Table 4: Factors Influencing Farmers' Participation in Public and Private Extension Services

Variables	Public Extension		Private Extension	
	Coef.	Std. Err.	Coef.	Std. Err.
Age	.019	.012	.003	.012
Gender	.609**	.274	-.318	.281
Religion	-.364	.229	.260	.257
Marital Status	-.208	.152	.047	.158
Years of Formal Education	-.039***	.014	.012	.015
Household Size	-.032	.034	-.002	.034

Farming Experience	-.018	.014	-.012	.014
Membership of Farmer Groups	-.040	.243	.871***	.244
Land Ownership	-.036	.092	-.188**	.092
Farm Size	-.087***	.019	.078***	.019
Source Of Labour	.679***	.276	-.544**	.284
Access to Credit	.420**	.215	-.763***	.214
Constant	30.461*	17.642	42.462***	11.321
Log-likelihood	-864.674		-896.299	
Wald (13)	85.21		54.61	
Prob >	0.000		0.000	
Observations	385		385	

*** p<0.01, ** p<0.05, * p<0.1

Source: Authors' Construct, 2023

In the context of public extension services, sex was found to be significant at 5% and had a positive relationship with farmers' participation in public extension. This implies that male farmers are more inclined to participate in public extension services compared to their female counterparts. In many societies, traditional gender roles and cultural norms can influence the division of labour within the agricultural sector. Men may be more commonly seen as primary decision-makers and farm managers, while women are often engaged in unpaid domestic or subsistence work. These cultural norms can affect the willingness and ability of women to participate in extension services. The results are consistent with those of Manfre et al. (2013), who found that male farmers had a greater level of involvement in public extension programmes.

The result shows a negative influence of years of education on participation in public extension services. This indicates that cocoa farmers with higher levels of education are less likely to participate in public extension programs. One plausible explanation for this trend is that well-educated farmers might already have access to advanced agricultural techniques through alternative sources such as research and academic institutions, reducing their reliance on traditional extension services. Interestingly, this finding contradicts that of Zwane et al. (2014), who argued that farmers with higher formal education levels are more likely to view public extension services positively and actively engage with them.

The result shows a negative influence of land size on participation in public extension services. This means that cocoa farmers with larger land holdings are less likely to actively participate in public extension programs. Managing a larger cocoa farm can be more time-consuming, leaving farmers with limited time to engage in extension programs. These farmers might prioritise their daily farm operations over attending extension-related events or training sessions. Conversely, public extension services may encounter difficulties, including logistical limitations, when conducting on-site farm visits. This statement opposes the findings of Bryan et al. (2019), who discovered that farmers with larger land holdings have the essential resources required to efficiently put into practice the guidance offered by public extension services, resulting in increased involvement.

The source of labour exhibited a statistically significant correlation with farmers' involvement in public extension services. This suggests that cocoa farmers relying on hired labour are more likely to participate in public extension services. Farmers with hired labour may be more motivated to invest in their farm's development, given the employment of additional labour. They may see extension services as a means to improve their business and potentially increase their income. Hired labour can help with farm tasks, which may free up time for the farmer to participate in extension activities. In contrast, farmers who rely solely on their labour might find it challenging to spare time for such activities. This result is consistent with earlier

research by Schoneveld et al. (2019), which claimed that farmers who rely on particular sources of labor are more likely to view public extension services favorably.

Furthermore, access to credit exhibited a statistically significant correlation with farmers' involvement in public extension services. This positive correlation suggests that farmers who have access to credit are more likely to view public extension services as favourable and actively engage with them. The fact that farmers who have access to financial resources through credit sources are more likely to seek expert advice and support from extension services and are more empowered to make investments in their farms may help to explain this observation. As a result, this financial access contributes to their positive perception and active participation in these programs. Sylla et al. (2019) emphasised the essence of access to credit having a positive correlation with farmers' perceptions of participating in public extension services.

From the standpoint of private extension services, membership in farmer groups was found to be statistically significant, indicating a strong positive relationship with cocoa farmers' participation in private extension services. This suggests that cocoa farmers who are members of farmer groups are more likely to have a favourable view of private extension services and actively engage with them. Being part of these groups likely provides farmers with a sense of shared knowledge and support, encouraging their positive perception and active involvement in private extension programs. This finding aligns with studies by Falola et al. (2013), who emphasised that farmers' membership groups are more willing to participate in extension programmes.

Additionally, land ownership revealed a negative relationship with cocoa farmers' participation in private extension services. This suggests that cocoa farmers who own land are less likely to have a positive view of private extension services and actively engage with them. Land-owning farmers might have made substantial investments in their farms, which could lead to a sense of attachment and confidence in their practices. They may be less inclined to consider private extension services as valuable contributors to their farming activities. This result contradicts the findings of Akrofi-Atitanti et al. (2018), who emphasised that land ownership has a positive effect on farmers' perceptions of participating in extension programmes.

Land size had a significant influence on cocoa farmers' participation in private extension services. This implies that cocoa farmers with larger landholdings are more likely to view private extension services as favourable and actively engage with them. Larger farms may require more intensive management and optimization. Farmers with larger land holdings may be more motivated to seek private extension services as a means to increase efficiency, reduce costs, and enhance productivity. Larger landholdings often involve more complex and diverse agricultural operations. Farmers may recognise that private extension services can provide specialised expertise and tailored solutions to address the specific challenges they face. The outcome is consistent with the findings of Afriyie-Kraft et al. (2020), who observed that larger land holdings among cocoa farmers have a positive impact on their participation in extension programmes.

Furthermore, the choice of labour source was found to have a significant negative influence on cocoa farmers' participation in private extension services. This implies that cocoa farmers who depend on hired labour are less likely to participate in private extension services. One possible explanation for this negative correlation is that some farmers may believe that their current labour practices suffice, reducing their motivation to seek external support.

Finally, access to credit had a negative influence on cocoa farmers' participation in private extension services. This suggests that cocoa farmers who have access to credit are less inclined to actively participate in private extension services. Cocoa farmers who have access to credit may feel financially secure and capable of investing in their farms without seeking external support. They might believe that they have the necessary resources to manage their operations independently. Farmers with access to credit may already have financial commitments related to

their credit arrangements. This could limit their willingness to allocate additional resources to participate in private extension services, which may be viewed as an extra expense. Farmers with credit access may perceive private extension services as providing limited value compared to the financial resources they already possess. This perception can deter them from active participation. This finding contradicts the research conducted by Sylla et al. (2019), who highlighted that access to credit has a positive relationship with farmers' perceptions of their participation in public extension services.

CONCLUSION

Navigating cocoa farmers' engagement in extension services, this conclusion unveils dynamics, emphasising tailored strategies and collaborative initiatives for sustainable impact in food systems. In the culmination of the study, the figures affirm the prowess of private extension in access to information, communication, support, and follow-up, among other key categories. Conversely, public extension excels prominently in social and environmental impact and knowledge transfer. These nuances extend to participation dynamics, with clear farmer preferences for private extension in citizen power, delegated power, and partnership. Notably, placation and consultation levels also favour private extensions. These findings underscore the imperative for tailored strategies and collaborative initiatives in concluding efforts for sustainable agricultural development. Demographic and socioeconomic factors, including sex, education, land size, labour source, group membership, land ownership, and credit access, distinctly shape farmers' engagement in both private and public extension services. These influences highlight the need for targeted strategies that acknowledge and address the diversity within farming communities. As we chart the course for sustainable agricultural development, recognising and catering to these demographic nuances will be instrumental in crafting extension programmes that resonate with the specific needs and circumstances of farmers, fostering inclusivity and effectiveness in both private and public agricultural extensions. These findings inform policy and agricultural programme development aimed at enhancing farmers' participation and improving the effectiveness of extension services to support sustainable cocoa farmers in growing ecosystems. It is therefore recommended that the government and relevant agricultural agencies proactively promote and facilitate PPPs in response to farmers' demonstrated preference for private extension services and their potential to complement public initiatives. By fostering these partnerships, both sectors can combine their strengths to deliver more comprehensive and effective extension services, leveraging private sector expertise and resources while ensuring alignment with public sector goals and standards. Further, to enhance the impact of extension programmes, target-oriented services to address the specific needs of farmers, particularly challenges like land ownership, access to credit, and marketing opportunities for cocoa farmers, are essential. A critical focus should be placed on bridging the gap between knowledge acquired through extension programmes and its practical application in farming through practical training sessions, demonstrations, and problem-solving exercises. Robust feedback mechanisms must be established within extension services to allow farmers to provide input, suggestions, and concerns, with a clear demonstration of responsiveness to underscore the significance of farmers' opinions and experiences. Moreover, extension agents should undergo training encompassing not only technical agricultural aspects but also effective communication skills, ensuring clear and understandable interactions between chain actors and farmers, ultimately leading to more successful knowledge transfer and cooperation.

REFERENCES

- Afriyie-Kraft, L., Zabel, A., & Damnyag, L. (2020). Adaptation strategies of Ghanaian cocoa farmers under a changing climate. *Forest Policy and Economics*, 113, 102115. <https://doi.org/10.1016/j.forpol.2020.102115>
- Akrofi-Atitianti, F., Ifejika Speranza, C., Bockel, L., & Asare, R. (2018). Assessing climate-smart agriculture and its determinants of practice in Ghana: A case of the cocoa production system. *Land*, 7(1), 30. <https://doi.org/10.3390/land7010030>
- Ali, A. S., Altarawneh, M., & Altahat, E. (2012). Effectiveness of agricultural extension activities. *American Journal of Agricultural and Biological Sciences*, 7(2), 194-200.
- Anaeto, F. C., Asiabaka, C. C., Nnadi, F. N., Ajaero, J. O., Aja, O. O., Ugwoke, F. O., ... & Onweagba, A. E. (2012). The role of extension officers and extension services in the development of agriculture in Nigeria. *Journal of Agricultural Research*, 1(6), 180-185.
- Ankuyi, F., Tham-Agyekum, E. K., Ankrah, D., Oduro-Owusu, A. Y., Bakang, J-E. A., Boansi D., & Asirifi, S. (2023). Beyond certification: Investigating the nexus between compliance with sustainable agriculture standards and livelihood assets of certified smallholder cocoa farmers in Ghana. *Cogent Food & Agriculture*, 9:1, 2256556. <https://doi.org/10.1080/23311932.2023.2256556>
- Asamoah, M., & Owusu-Ansah, F. (2017). Report on land tenure & cocoa production in Ghana, a cocoa Research Institute of Ghana and World Cocoa Foundation Collaborative Survey, Ghana.
- Asfaw, S., Shiferaw, B., Simtowe, F., & Lipper, L. (2012). Impact of modern agricultural technologies on smallholder welfare: Evidence from Tanzania and Ethiopia. *Food policy*, 37(3), 283-295. <https://doi.org/10.1016/j.foodpol.2012.02.013>
- Asiedu-Darko, E. (2013). Agricultural extension delivery in Ghana: A case study of factors affecting it in Ashanti, Eastern and Northern regions of Ghana. *Journal of Agricultural Extension and Rural Development*, 5(2), 37-41.
- Bonye, S. Z., Alfred, K. B., & Jasaw, G. S. (2012). Promoting community-based extension agents as an alternative approach to formal agricultural extension service delivery in Northern Ghana. *Asian Journal of Agriculture and Rural Development*, 2(393-2016-23897), 76-95. <https://doi.org/10.22004/ag.econ.197944>
- Bryan, E., Chase, C., & Schulte, M. (2019). Nutrition-sensitive irrigation and water management. <https://hdl.handle.net/10568/103404>
- Christoplos, I., & Kidd, A. (2000). Guide for monitoring, evaluation and joint analyses of pluralistic extension support. Guide for monitoring, evaluation and joint analyses of pluralistic extension support.
- Cochran, W. G. (1977). Sampling techniques. John Wiley & sons.
- Danso-Abbeam, G., Ehiakpor, D. S., & Aidoo, R. (2018). Agricultural extension and its effects on farm productivity and income: insight from Northern Ghana. *Agriculture & Food Security*, 7(1), 1-10. <https://doi.org/10.1186/s40066-018-0225-x>
- David, M. & Sutton, C. D. (2004). *Social Research: The Basics*. London Sage Publication.
- Defranzo, S. E. (2012). Why Use Demographic Questions in Surveys? Snap Surveys.
- Emmanuel, D., Owusu-Sekyere, E., Owusu, V., & Jordaan, H. (2016). Impact of agricultural extension service on adoption of chemical fertilizer: Implications for rice productivity and development in Ghana. *NJAS: wageningen journal of life sciences*, 79(1), 41-49. <https://doi.org/10.1016/j.njas.2016.10.002>
- Falola, A., Ayinde, O. E., & Agboola, B. O. (2013). Willingness to take agricultural insurance by cocoa farmers in Nigeria. *International Journal of Food and Agricultural Economics (IJFAEC)*, 1(1128-2016-92004), 97-107. <https://doi.org/10.22004/ag.econ.156837>

- Farooq, M. Z., Siddiqui, B. N., Masud, K., Khan, M. R. A., Ali, M., Rayit, A., ... & Naeem, G. (2020). Comparison between public and private extension services for sugarcane production in Muzaffargarh District, Punjab, Pakistan. *Journal of Agricultural Extension and Rural Development*, 12(1), 1-5.
- Farrington, J., & Deshingkar, P. (2003). Ensuring access to extension for women and vulnerable groups. *South Asia*, 6, 8.
- Ferroni, M., & Castle, P. (2011). Public-private partnerships and sustainable agricultural development. *Sustainability*, 3(7), 1064-1073. <https://doi.org/10.3390/su3071064>
- Ghana Statistical Service. (2012). 2010 Population and housing census summary, report of final results. Ghana: Accra.
- IFAD. (2011) Private-Sector Strategy: Deepening IFAD's engagement with the private sector
- Jack, C.; Adenuga, A.H.; Ashfield, A.; Wallace, M. Investigating the Drivers of Farmers' Engagement in a Participatory Extension Programme: The Case of Northern Ireland Business Development Groups. *Sustainability* 2020, 12, 4510. <https://doi.org/10.3390/su12114510>
- Kassem, H. S. (2014). Effectiveness of different agricultural extension methods in providing knowledge and skills in disease prevention: a case of smallholder poultry production systems in Dakhalia governorate of Egypt. *Asian J Agric Ext Econ Sociol*, <https://doi.org/10.9734/AJAEES/2014/7010>
- Khan, M. Z., Nawab, K., Ullah, J., Khatam, A., Qasim, M., Ayub, G., & Nawaz, N. (2012). Communication gap and training needs of Pakistan's agricultural extension agents in horticulture. *Sarhad J. Agric*, 28(1), 129-135.
- Lindner, M. D., Gribkoff, V. K., Donlan, N. A., & Jones, T. A. (2003). Long-lasting functional disabilities in middle-aged rats with small cerebral infarcts. *Journal of Neuroscience*, 23(34), 10913-10922. <https://doi.org/10.1523/JNEUROSCI.23-34-10913.2003>
- Manfre, C., Rubin, D., Allen, A., Summerfield, G., Colverson, K. and Akeredolu, M., 2013. Reducing the gender gap in agricultural extension and advisory services. *Modernizing Extension and Advisory Services Discussion Paper United States Agency for International Development*.
- Maoba, S. (2016). Farmers' perception of agricultural extension service delivery in Germiston Region, Gauteng Province, South Africa. *South African Journal of Agricultural Extension*, 44(2), 167-173. <http://dx.doi.org/10.17159/24133221/2016/v44n2a415>
- Mcharo, A. C. (2013). Perception of farmers on perceived effectiveness of agricultural extension agents in knowledge transfer to maize growers in Kilindi District. Master Dissertation. Morogoro: Sokoine University of Agriculture.
- Mengal, A. A., Mallah, M. U., Mirani, Z. A., & Siddiqui, B. N. (2012). An analysis of public and private agricultural extension services in Balochistan, Pakistan. *Pakistan J. Agric. Res*, 25(4).
- Naeem, M. R., & Hassan, M. Z. Y. (2014). Comparative analysis of public and NGO sector's role in improving rural livelihoods in the Punjab, Pakistan. *Int. J. Agr. Ext.*, 02(01), 01–04.
- Nnadi, F. N., Chikaire, J., & Ezudike, K. E. (2013). Assessment of indigenous knowledge practices for sustainable agriculture and food security in Idemili South Local Government Area of Anambra State, Nigeria. *Journal of Resources Development and Management*, 1.
- Onwuka, F. N., Otaokpukpu, J. N., & Okonkwo, C. J. (2017) Effectiveness of extension services in enhancing the productivity, income and welfare of women farmers cooperatives in Kajuru local government area of Kaduna State. *Int J Econ Bus Manag*, 3:86–100

- Onyenkazi, H. A., & Gana, A. K. (2021). Comparative assessment of public and private extension programmes in Etche Local Government Area of Rivers State of Nigeria. *African Journal of General Agriculture*, 5(2).
- Quaye, W., Fuseini, M., Boadu, P., & Asafu-Adjaye, N. Y. (2019). Bridging the gender gap in agricultural development through gender-responsive extension and rural advisory services delivery in Ghana. *Journal of Gender Studies*, 28(2), 185–203. <https://doi.org/10.1080/09589236.2017.1419941>
- Raidimi, E. N., & Kabit, H. M. (2017). Agricultural extension, research, and development for increased food security: the need for public-private sector partnerships in South Africa. *South African Journal of Agricultural Extension*, 45(1), 49-63.
- Rana, A. S., Reddy, G. P., & Sontakki, B. S. (2013). Perceived service quality of agricultural organizations comparative analysis of public & private sector. *International Journal of Advanced Research in Management and Social Sciences*, 2(1), 286-295.
- Rickards, L., Alexandra, J., Jolley, C., & Frewer, T. (2018). Final report: review of agricultural extension. Australian Centre for International Agricultural Research (ACIAR)(Accessed 2 May 2020).
- Schoneveld, G. C., Ekowati, D., Andrianto, A., & Van Der Haar, S. (2019). Modelling peat-and forestland conversion by oil palm smallholders in Indonesian Borneo. *Environmental Research Letters*, 14(1), 014006. <https://doi.org/10.1088/1748-9326/aaf044>
- Spielman, D. J., Hartwich, F., & Grebmer, K. (2010). Public–private partnerships and developing-country agriculture: Evidence from the international agricultural research system. *Public Administration and Development*, 30(4), 261-276. <https://doi.org/10.1002/pad.574>
- Swanson, B. E. (2008). Global review of good agricultural extension and advisory service practices (Vol. 82). Rome: Food and Agriculture Organization of the United Nations.
- Sylla, A. Y., Mahama Al-Hassan, R., Egyir, I. S., & Anim-Somuah, H. (2019). Perceptions about quality of public and private agricultural extension in Africa: Evidence from farmers in Burkina Faso. *Cogent Food & Agriculture*, 5(1), 1685861. <https://doi.org/10.1080/23311932.2019.1685861>
- Zwane, E. M., Groenewald, I. B., & Van Niekerk, J. A. (2014). Critical factors influencing the performance of extensionists in Limpopo Department of Agriculture in South Africa. *South African Journal of Agricultural Extension*, 42(1), 49-61