UNIVERSITY FOR DEVELOPMENT STUDIES

EFFECTS OF AGRICULTURAL EXTENSION SERVICES ON YIELD OF MAIZE FARMERS IN NORTH EAST REGION OF GHANA: IMPLICATION FOR CURRICULUM DEVELOPMENT

BY

HASSAN AMADU

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THIS THESIS IS SUBMITTED TO THE DEPARTMENT OF AGRICULTURE AND COMSUMER SCIENCE EDUCATION, FACULTY OF AGRICULTURE, FOOD AND CONSUMER SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF PHILOSOPHY DEGREE IN AGRICULTURE SCIENCE EDUCATION.

AUGUST, 2024

DECLARATION

I, Hassan Amadu, author of this work titled, "Effects of Agricultural Extension Services on Yield of Maize Farmers in Northeast Region of Ghana: Implication for Curriculum Development", declare that this thesis is my original work and has never been submitted for any certificate at any institution. The sources of information used in this work have been duly acknowledged and cited. The work was entirely completed by me under the able supervision of my supervisor and other senior members of the department to ensure it meets all standards and the requirements of the academic community.

Candidate's signature…… Date…5/3/25…

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Supervisor's declaration

I declare that the thesis preparation was supervised in compliance with the standards for thesis supervision established by the University for Development Studies.

Supervisor's signature…… Date…5/3/25…

Supervisor's Name: **Dr. Amadu Musah Abudu**

ABSTRACT

Agriculture extension service plays a crucial role in the agriculture sector of Ghana. However, farmers may not have the right knowledge and information to explore the full benefit of these services because it is not well captured in the current curriculum. This research investigated the effects of agricultural extension services on the yield of maize farmers in the north east region of Ghana and its implication on curriculum development

The study used a quantitative research method with a cross-sectional survey approach. Using a purposive sampling technique with the Cochran sample determination formula, a total of (306) maize farmers were sampled from 1000 registered maize farmers in the region across three purposively selected districts (East mamprusi, Mamprugu moagduri and the Bunkpurugu-Nakpanduri districts, for each of these cluster, 102 maize farmers were randomly selected to make up the total of 306 farmers. The entire population of agriculture science teachers (67) and agriculture extension officers (51) were also interviewed. The study offers policymakers the needed information on the current state of agriculture extension services in the region. It will contribute to the body knowledge of information on agricultural extension services and how it affects the development of educational curricula.

Some of the key findings indicated that; the intervention of extension services generally improved maize yield by 71.3%. However, there is a significant variation of responses regarding the current curriculum, not offering respondents practical experience with a p-value of 0.045, and that learning is more theoretical with a p-value less than 0.001. Respondents again disagreed that there are links between students and extension departments in the country with p-value 0.13. Biological and technological factors as well as the educational level of the farmer were found to be significantly associated with the yield of farmers with p-values less than 0.001, 0.002, and 0.004 respectively. The study concluded that extension service intervention positively affected the maize yield of farmers. The study concluded that communication is a major challenge affecting the extension officers in the discharge of their duties. It is recommended that the curriculum be revised taking into account the concerns and experiences of both farmers and the extension officers to enhance the effectiveness of the extension delivery system in Ghana.

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DEDICATION

I dedicate this thesis to my family (Kapinta's family) especially my late dad Amadu Kapinta who has always been my source of inspiration to take up this journey, for the unflinching support and encouragement specially got me through this study. To my beautiful wife Rakia Hassan, thank you for granting me the space in your room to burn the midnight candles for this entire academic process, and thank you for your love and understanding. Your love and support have always been a motivation to explore and realize my set goals. For these sacrifices and guidance, I will be forever grateful. I dedicate this work as a sign of gratitude and appreciation to my lovely family.

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LIST OF ABBREVIATION

ACDEP	Association of Church Development Projects
CBOs	Community-Based Organizations
DAE	Department of Agriculture Education
DAES	Directorate of Agriculture Extension Services
DALRD	Department of Agriculture, Land, and Rural Development
DDEE	Demand Driven Extension Education
EA	Extension Agent
FAO	Food and Agriculture Organization
FFS	Farmer Field Schools
GSS	Ghana Statistical Service
IFAD	International Fund for Agriculture Development
IFPRI	International Food Policy Research Institute
MOFA	Ministry of Food and Agriculture
NCCE	National Communication for Civic Education
OBE	Outcome Based Education
SSA	Sub-Saharan Africa
TBP	Theory of Planned Behavior
UES	Unified Extension System
UN	United Nations
UNESCO	United Nations Education Scientific and Cultural Organization
SDG	Sustainable Development Goals

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The role agricultural extension services play in providing valuable information to farmers cannot be overstated. These services come in handy in helping farmers keep up with global trends in agriculture by expediting the transfer of knowledge and offering helpful guidance (Norton & Alwang, 2020). By providing access to such important information, farmers are often empowered to make better and well-informed decisions regarding their farming practices, leading to a boost in their productivity and increased economic gain.

Ghana's economy is based mainly on agriculture, which employs 40% of the workforce and accounts for a sizable portion of the GDP (Nyantakyi-Frimpong, Arku, & Inkoom, 2016). Despite its significance, Ghana's agricultural output has been dropping due to several factors, including soil degradation, climate change, and restricted access to agricultural extension services (Bellon, Kotu, Azzarri & Caracciolo, 2020).

Agriculture remains a potent means of attaining sustainable development and mitigating poverty in the twenty-first century, especially in developing nations like Ghana, Nigeria, Mali, Senegal, Kenya, and Bangladesh (Bellon et al., 2020; Nyantakyi-Frimpong et al., 2016). In addition to increasing productivity, agricultural development will increase farm incomes and the connections between agricultural and non-farm initiatives to reduce poverty. According to Banson, Nguyen and Bosch (2016) the agricultural industry directly supports around 86 percent (or 2.5 billion people) of the rural population. One of the most crucial elements of this growth facilitation is agricultural extension, which is essential to agricultural production and rural development

programs (Banson et al. 2016). A good extension service will have sufficient extension personnel, regular visits from the extension agents, and valuable, high-quality guidance (Banson et al., 2016; Owusu et al., 2016). Researchers and politicians are interested in how agricultural extension programs often known as agricultural (or rural) advisory programs, operate in various nations (Wigboldus et al., 2016).

Agricultural extension services are not only important locally but worldwide as well. The service is heavily concentrated in developing countries, which helps in the advancement of the role of these services in positively influencing rural lives. Major countries like China have a vast number of extension agents who assist the farming community with comprehensive support and knowledge. Similarly, India, Indonesia, and Ethiopia have a significant number of extension agents present, indicating the broad prevalence of these services in the mentioned countries (Swanson & Davis, 2014).

Nations like India and China, have created agricultural extension networks to help them achieve their national goals for food safety (Fan, 2015). Again, agricultural extension plays a critical role in assisting low-income rural farmers in gaining access to technology.

Public agricultural extension in China is approached top-down (Smith & Siciliano, 2015). A systemic approach to defining farmer needs and targeting all farmers for public extension services are crucial requirements for an inclusive public extension in China. According to Huang et al. (2022), these features have improved service providers' (extension agents') understanding of the services farmers want. China's public agricultural extension network is one of the top, organizations in the world for knowledge and information transmission (Smith & Siciliano, 2015).

Participatory extension initiatives have taken the place of the linear top-down "technology transfer" model in Australia and New Zealand since 1960 (Huang, 2022). According to Ma & Abdulai (2016), this strategy has been effective thus, it is linked to high rates of practice adoption, a favorable effect on output and earnings, better capacities and expertise, and strong peer reinforcement. A study has revealed that Bangladesh is an agrarian republic with a population of 161.4 million (Chadwick et al., 2015). According to Brown et al. (2018), the everyday lives of millions of Bangladeshis depend on agriculture. Over the past forty years, the economic significance of agriculture has steadily declined; yet the sector nevertheless contributed more than 14% of the country's GDP in 2015–2016. This number has fallen, from 46.7 percent in 1980–81 to 24.1 percent in 2000–2001 (Brown et al., 2018). However, the agriculture industry continues to serve greatly in propelling Bangladesh's economy forward (Chadwick, 2015).

There has been a global increase in the number of extension programs in recent years. These programs aim to help increase agricultural productivity by providing farmers with the latest knowledge in agricultural technology (Lampach, Phu & Van, 2018). With access to innovative approaches, extension agents have a direct impact on farmers by providing valuable guidance on improved management practices and the optimal use of various resources, such as seeds, fertilizers, and pesticides. Through this provision of advice, farmers can maximize their benefits and achieve improved productivity (Houngbo et al., 2020). Extension agents play a key role in helping farmers adopt more efficient and modern production methods through personalized interactions and practical support. By introducing sustainable farming practices, resource conservation techniques, and the use of appropriate machinery and equipment, these agents help farmers streamline their operations and increase productivity (Alhassan et al., 2020). Extension programs effectively bridge the gap between agricultural research and on-the-ground applications by actively engaging farmers

and providing the necessary information and guidance to improve agricultural practices and productivity (Lampach et al., 2018).

Improving agricultural productivity in Sub-Saharan Africa (excluding South Africa) presents a significant challenge, with around 62% of the population relying on agriculture as their primary source of livelihood (Danso-Abbeam et al., 2018a). The region's agricultural production has struggled to keep pace with population growth over the years, making the promotion of smallholder farming's productivity, profitability, and sustainability an essential approach to uplifting communities from poverty. According to Ma & Abdulai (2016), the reason why rural farmers in Tanzania and Ethiopia only have a few hectares of land to farm may be due to a lack of credit, a lack of access to the commodity market, and a lack of extension contacts.

Improved agricultural technologies capable of enhancing productivity are necessary for agricultural productivity development in smallholder agriculture (Keba, 2020).

Therefore, it is critically necessary to apply and utilize the productive function of agriculture extension in a precise and effective manner (Fiaz, 2018). The Ministry of Food and Agriculture (MoFA) in Ghana offers agricultural extension services through a network of extension agents stationed in different districts throughout the nation (Panetto et al., 2020). However, it is uncertain if these services, especially in Ghana's northeast, are effective in encouraging the adoption of better agricultural methods and raising agricultural production. The majority of households in Ghana's Northeast Region depend on agriculture as their primary source of income (Adjei et al., 2017). Despite the sector's significance for the neighborhood economy, local farmers face several challenges that lower their output and profitability. These challenges include access to extension

services, pests and diseases, poor soil fertility, limited access to agricultural inputs, and climate change (Adjei, 2017; Agyeman et al., 2022).

For providing a mediocre, out-of-date extension facility, Ghana's agriculture sector is frequently criticized. Despite this, 84 percent of the extension's expenses go into salary payment, leaving no money for travel, curriculum creation, or in-service training. Only 1.5 percent of the budget goes into extension initiatives like farmer training and demonstrations (Panetto, 2020). According to Fiaz (2018), there are financial and human resource shortages at Ghanaian organizations in charge of providing agricultural, livestock, and fisheries extension services. The bulk of farmers' primary information demands under their jurisdiction is frequently unmet by sub-district level officers and their field personnel (Kwapong et al., 2020). The lack of a distinct farmer group is one of the issues with Ghana's agricultural extension programs.

Once more, it is evident that farmers with large farm sizes receive more extension services than small farms do (Uddin et al., 2016). According to Baloch & Thapa (2018), there is a shortage of extension workers in rural, underdeveloped, and marginalized areas of Asian nations like Bangladesh and India, and the majority of extension officers are forced to work overtime and engage in non-extension practices and tasks, putting advisory work at risk and, in some cases, making it ineffective. The agricultural extension service program in Ghana has reportedly seen a lot of modifications recently, according to (Afrad et al., 2019). The study also discovered a few issues, including the fact that farmers were unable to benefit from extension programs because they lacked the necessary information, as well as the reluctance of extension sector staff members and their lack of technical expertise. Providing agricultural extension services is one strategy to solve some of these issues and raise farmers' productivity and profitability in Ghana's Northeast Region. According to Kassem et al., (2021), agricultural extension services are intended to give

farmers the information, tools, and resources they need to enhance their farming techniques and boost production. There is a need to restructure the agriculture curriculum to include strategies to help meet farmer's needs. It is not well known, nevertheless, how effective agricultural extension services are at raising farmers' yields in Ghana's North East Region.

In formal education, the curriculum is made up of a sequence of classes and their subject matter that are taught at a school or university (Kassem, 2021). In addition, the curriculum addresses the full range of formative experiences and actions, both inside and outside of educational institutions, including unplanned, undirected encounters as well as ones that are purposefully organized to shape adults into contributing members of society (Deji et al., 2021). All co-curricular and curricular activities as well as those that take place both inside and outside of the classroom, are included (Shimali et al., 2021). The essential characteristics of a successful curriculum are the advancement of social comprehension, a means of maximizing personal growth, building experience, providing educational goals, maintaining balance among all other goals, and use of effective learning opportunities and resources (Deji, 2021). The growth of agriculture and rural areas depends heavily on professionals in agricultural extension education. According to higher education syllabi, these professionals require the right education and training to succeed (Shimali et al., 2021). Demographic changes in society, shifts in agriculture setup, and changes in rural development have made it difficult to sustain the relevance of agricultural and extension education curricula (Antwi-Agyei & Stringer, 2021). Hence, the study aims to investigate the impact of agricultural extension services on the yield of farmers in the Northeast Region of Ghana and to explore what implications it will have on curriculum development.

1.2 STATEMENT OF THE PROBLEM

This study seeks to investigate the effects of agriculture extension services in enhancing crop yields of maize farmers in the Northeast Region. Poverty is most prevalent within the rural population in Ghana, especially among households whose main income source is farming, this is largely attributed to low productivity in the agricultural sector (IFAD, 2014). However, farmers in the region face numerous challenges that hinder their productivity and profitability. These challenges include poor soil fertility, limited access to agricultural inputs, pests and diseases, climate change, and limited access to extension services (World Bank, 2019).

Offering agricultural extension services is one of the numerous strategies to solve some of these issues and raise the profitability and productivity of farmers in Ghana's northeast region.

According to Banerjee et al. (2015), agricultural extension services are intended to provide farmers with needed knowledge, requisite skills, and the resources needed to improve their farming practices and increase their yield but there is limited information on the effectiveness of agricultural extension services in the North East Region of Ghana.

Danso-Abbeam et al. (2018) in a study indicated that “the lack of information on the effective performance of agricultural extension services in the North East Region of Ghana creates a significant knowledge gap which makes it difficult for policymakers, extension workers, and other stakeholders to design and implement effective agricultural extension programs that can contribute to sustainable agriculture, food security, poverty reduction, and economic growth in the region” Researchers have worked severally on the effects agricultural extension services have on the yield of farmers especially in Ghana.

A study by Antwi-Agyei et al. (2021) titled "Improving the Effectiveness of Agricultural Extension Services in Supporting Farmers to Adapt to Climate Change: Insights from North eastern Ghana" revealed that the absence of suitable extension materials, high extension agent-to-farmer ratios, insufficient funding to implement adaptation measures, and lack of access to transportation were the main obstacles faced by agricultural extension workers in providing climate change extension. They concluded that, while promoting the use of audiovisuals in extended delivery, periodic workshops for extension workers in agriculture regarding the utilization of ICT to deliver services to farmers should be arranged. Regular evaluations of the capacity-building requirements of extension agents ought to strengthen these initiatives.

Another study by Mamponya et al., (2013) on "The role of extension services in climate change adaptation in Limpopo province, South Africa" found that most of these farmers lack the resources, technology, funding, and extension services necessary to effectively adapt to the problems posed by climate change. It was concluded that for extension agents to provide farming communities with pertinent information regarding climate change adaptation, government policies must support their training.

Similarly, Emmanuel et al. (2016) examined the "impact of agricultural extension services on the adoption of chemical fertilizer; implication for rice productivity in northern Ghana" and outlined in their finding that the availability of agricultural extension services to rural farmers promotes the adoption of soil improvement technologies, use of chemical fertilizer and increases the yield of rice.

However, none have been able to look at what implications this will have on curriculum development, this is of great concern as this leaves a huge gap between reforming our existing

curriculum to be able to address the current service needs of farmers in the field, especially in the north east region of Ghana (Sgroi et al., 2022).

Therefore, the main problem addressed in this study is the lack of information on the impact of agricultural extension services on the yield of farmers in the North East Region of Ghana. Specifically, the study seeks to investigate the effects of agricultural extension services on the yield of maize farmers in the North East Region of Ghana and to explore the implications for curriculum development. By addressing the gaps in the current extension services and proposing improvements to the curriculum, this study ultimately seeks to contribute to the enhancement of total agricultural output and food security in the North East Region of Ghana (Alhassan et al., 2020).

1.3 OBJECTIVES OF THE STUDY

1.3.1 The main objective of this study is to assess the effects of agricultural extension services on the yield of farmers in the North East Region of Ghana and to explore its implications on curriculum development.

1.3.2 Specific objectives

Specifically, the study sought to:

1. Assess the current state of agricultural extension services in the Northeast Region of Ghana.
2. Determine the factors affecting the yield of maize farmers in the Northeast Region of Ghana.

3. Investigate the effects of agricultural extension services on the yield of farmers in the North East Region of Ghana.

4. Explore the implications of the study for curriculum development in agricultural extension services at the Senior High School level in the North East Region of Ghana.

1.4: RESEARCH QUESTIONS

1.4.1 Main research question

What are the effects of agricultural extension services on the yield of maize farmers in the North East Region of Ghana and its implications on curriculum development?

1. What is the current state of agricultural extension services in the North East Region of Ghana?

2. What are the factors affecting the yield of maize farmers in the North east Region of Ghana?

3. What are the effects of agricultural extension services on the yield of farmers in the North east Region of Ghana?

4. What are the implications of the study for curriculum development in agricultural extension services at the Senior High School level in the North east Region of Ghana?

1.5 SIGNIFICANCE OF THE STUDY

With agriculture being their primary economic activity, the majority of the population of Ghana lives in rural areas and a great percentage of the food produced in the country is produced in rural areas. However, these residents' living conditions are usually not good. A significant strategy for achieving this is a methodically planned and implemented extension services approach to quicken

the speed of agricultural advancement for adequate returns as a means of raising crop output. According to Anang et al. (2020), transferring improved agricultural technology to farmers is one important goal of agriculture extension services, focusing on their particular extension information needs. Another goal is to help the farmer access microfinance and have simple access to the market, which will help them increase their productivity and raise their standard of living.

The study's findings will highlight the importance of elements that affect rural Ghanaians' access to extension services, such as production data, post-harvest storage data, and marketing information on farmers' output. They will be able to do this and, appreciating the value of better agricultural practices will be in a position to appropriately employ their current and future resources to support other extension services (Anang & Asante, 2020).

For the agricultural industry in Ghana's North east Region, the study's findings have several important ramifications. In the first place, the research will offer policymakers, extension personnel, and other stakeholder's important information on the condition of the region's agricultural extension services at the moment. Effective extension programs that cater to the unique requirements of local farmers may be created and implemented using the information available.

Again, the study will add to the body of knowledge on agricultural extension services in Ghana, especially in the North east Region. The information gap about how extension services affect the crop production of local farmers will be filled in part by this. In addition, the study will shed light on the elements that influence the success of agricultural extension services in the region.

Moreover, the study will provide empirical information on the relationship between agricultural extension services and yield among farmers in the North east Region. This information may be used to make educated decisions about how to allocate resources for extension programs.

Additionally, this study will have an impact on how agricultural extension agencies in Ghana's northeast build their curricula. The study's conclusions will aid in determining the areas that should be prioritized in the curriculum to increase the efficacy of agricultural extension services.

The initiative is essential because it will provide meaningful information that can be used to improve the production and financial performance of farmers in northeast Ghana. This will consequentially contribute to the body of knowledge and information on Ghana's agricultural extension services and affect the development of educational curricula.

1.6 SCOPE OF THE STUDY

In-depth research on the numerous extension services and productivity strategies put into place globally was included in the report. It considered several initiatives, strategies, and projects carried out in Ghana and particularly the Northern Region. The researcher has also made contact with journals, articles, and conference papers about extension services, livelihoods, and productivity. Geographically, the research took a comprehensive look at demand-driven extension requirements in the agricultural sector and the effects it has on yield over the entirety of Ghana, with a focus on the mostly agrarian Northern Region. The different efforts and projects aimed at boosting productivity that have been launched around the nation were also examined in the research. The North east region has been chosen as the focus of its investigation, with a few districts of interest.

1.7 ORGANIZATION OF THE STUDY

This research was divided into five sections. Specifically, the background of the study, the statement of the problem, the objectives, the research questions, the significance of the study, and the organization of the study are all covered in Chapter One. The second chapter contains a review of related literature on the impact of agricultural extension services on the yield of maize farmers and explores what implications it will have on curriculum development. The study methodology provided in Chapter Three includes topics such as the target population, sample size and sampling process, research instrument, and data collection techniques. Results and discussions of the study make up the fourth chapter and chapter five present the summary of findings, conclusions, and suggestions.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter focuses on topics like the study's theoretical framework, a review of agriculture extension services in Ghana and beyond, different kinds of extension services, and the implications for curricula. It is mostly devoted to associated literature that is consistent with the study's objectives. The researcher through this chapter reviewed relevant works of other authors that are about agricultural extension communication channels, adoption of agricultural extension technologies, the importance of agricultural extension service to maize farmers, the impact of extension on maize yield, the organizational structure of extension service in Africa, key policy interventions towards agricultural extension, challenges farmers faced in accessing agricultural extension services and harmonizing agricultural extension and curriculum.

2.1 CONCEPTUAL FRAMEWORK OF THE STUDY

Figure 2.1 is a conceptual framework modified from the Wheelers curriculum model. It illustrates the various components of an effective agriculture program and its relationship to the educational curriculum.

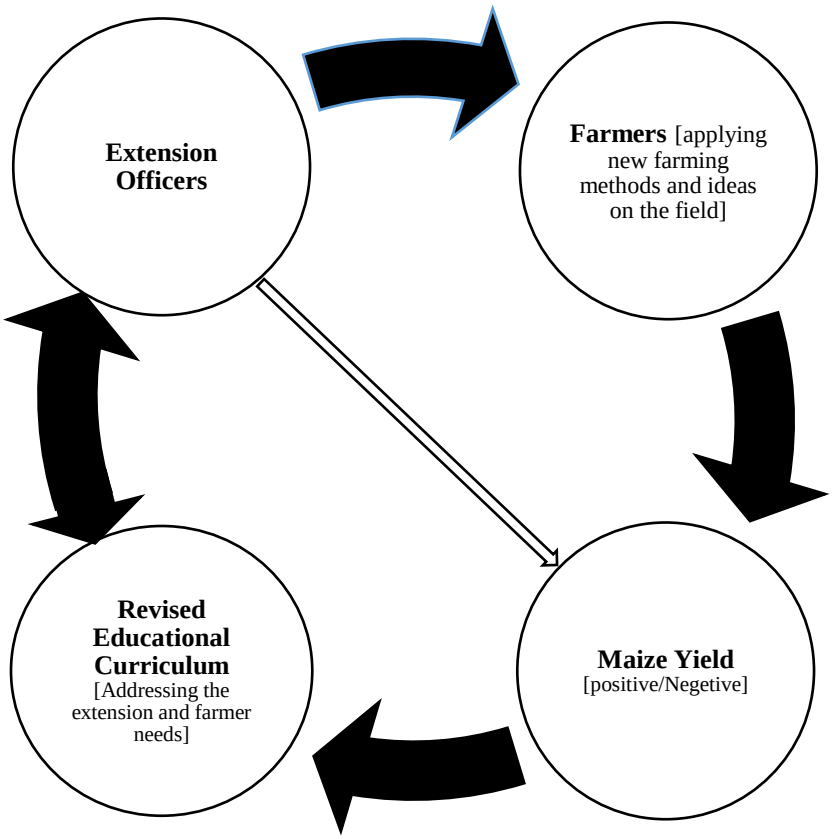

Figure 2.1: Conceptual framework modified from Wheeler curriculum model

Source: Field Survey, 2023

This specific design places a strong emphasis on the idea of development in continuous order, demonstrating how assessment is not the last step in the creation of a curriculum but rather can be used to better future stages and objectives. According to Bhuttah et al. (2019), the Wheelers model best exemplifies continuity and flexibility in the curriculum being produced.

The objective of this framework is to create a learner-centered extension delivery approach system that meets the needs of farmers to produce the best learning and farming experience.

This is in line with the claim made by Bhuttah et al. (2019) that "the goals of a curriculum development models are based on the need of people as individual as well as society level." The

conceptual structure described above is divided into three sections: the independent variables, intervening variables, and dependent variables. The figure describes how farmers receive extension knowledge from officers (the independent variable) to help increase their maize yield, but how well the farmer uses the knowledge or information reflects in the yield of maize (the dependent variable); this could be positive or negative, depending on the intervening variable. The dissemination process then moves on to the next step, where curriculum developers utilize the results of the extension information received by farmers about the effect it had on the maize yield to appropriately make recommendations for curriculum revision to train extension officers to meet the right farmer demands.

The goal of the feedback process is to review the curriculum's current agricultural extension service components. To achieve a well-balanced extension-curriculum goal in Ghana, field experiences from extension officers are equally considered in the curriculum development process. Several variables, including the method and contents of the agricultural extension program, the approach and willingness of farmers to accept change, and the incentives offered to farmers who embrace new farming techniques, will play a major role in how well this implementation process goes. Farmers that effectively implement extension concepts and skills see a rise in their maize output, which in turn improves their incomes.

The dependent variable (maize yield) could be positive or negative depending on the success of the implementation process of the extension program. Insights from the farmer's performance could help inform policymakers as well as curriculum developers to identify the lapses in the existing curriculum and the possible ways to address them through revision. This can be achieved through the effective engagement of farmers through programs both on and outside the field.

The revised curriculum when adopted by facilitators will help train more efficient extension officers with the needed skills to be able to update themselves with evolving field situations and complexities. This design process produces a curriculum that reflects the farmer-extension officer's needs to achieve an increase in general crop productivity.

2.2 THEORETICAL REVIEW

2.2.1 Technology Adoption Theories

According to Rogers (2003), technology acts as a facilitator or a means of transferring information, skills, and know-how to small farm-holders to boost agricultural output. In a similar vein, adopting technology by farmers could be seen as a decision-making process that calls for comprehension or the use of a person's capacity to perceive, understand, and interact with their immediate environment thoughtfully (Biswas et al., 2021; Uddin et al., 2016). Several ideas have been proposed in an attempt to comprehend the technology adoption process.

According to Yitayew et al. (2021), theories are "explanations of phenomena or abstract generalizations that describe the relationship among given phenomena, to explain, adequately predict and controlling such phenomena." Furthermore, the job of theory in research is to identify the root of the problem and establish the direction in which the problem is headed (Ma & Abdulai, 2016), the agriculture extension science evolved from rural sociology and throughout time, social psychology and communication were progressively included into extension study. Therefore, extension theory supports in a general comprehension of contextual components of the innovation process that provide insightful information on the factors that influence smallholder farmers' adoption of new technologies and decision-making. In the past, it was believed that all farmers would eventually see the benefits of the new technology and accept it as a consequence (Mohammed & Abdulai, 2022).

2.2.2 Diffusion of Innovation Theory

Diffusion has been explained as any process through which an innovation or idea spreads over time among small farm owners or onto other members of a society (Diab et al., 2020). A social system's structure and operation are changed through the spread of new ideas, having the effect of bringing about social change (Diab et al., 2020). The Diffusion of Innovation Theory, according to Dehghanpour et al. (2022) has improved both extension theory and practice. The spread of invention theory addresses many stages in the development of an innovation (Abukari et al., 2021). Researchers in agriculture were informed by the diffusion study's findings on how their recommendations were perceived. The theory also provides a basis for the creation of a coherent body of generalizations, without which the large corpus of accomplished research may be "a mile wide and an inch deep" (Abukari et al., 2021). Diffusion is not a single, all-encompassing idea, claims Rogers (1995). Instead, it is a meta-theory that encompasses several theoretical viewpoints related to the broad idea of diffusion (Awad et al., 2015; Nord et al., 2022; Silvestri et al., 2021). Researchers found four elements that affect an innovation's adoption, including:

The Innovation Itself: The chance that an invention will be adopted may be predicted by understanding its nature and how it ultimately aims to improve the lives of smallholder farmers and rural communities. In addition, Ortiz-Crespo et al. (2021), revealed in a study that the rate of innovation adoption by smallholder farmers is largely influenced by the innovation itself, its features, the individual attributes of the rural farmers, and the local context in which the technology/innovation transfer process takes place. However, any effort by extension workers to transfer an invention may fail without a thorough grasp of how innovation and the potential users (smallholder farmers) interact in their local environment before and throughout an innovation process. The invention may not be adopted by the intended consumers since this is a top-down

application of the innovation diffusion hypothesis (Kingiri, 2021). As a result, it is crucial to underline how effectively rural farmers may contribute to the innovation creation process.

Similar to this, the primary objective of agricultural technology/innovation diffusion within the rural community is to enhance household welfare, and this is accomplished by validating and promoting the use of agricultural innovation that could increase crop productivity and farmers' income (Mohammed & Abdulai, 2022).

The communication Channels: Information about the innovation is disseminated through the use of accurate and effective communication channels, which facilitate and influence the adoption of innovations in rural areas. As a result, according to Tilahun & Tadesse, (2022), the correct communication channels have the inherent ability to provide smallholder farmers with timely and relevant information. A few of the avenues that extension experts and researchers utilize to communicate are; farmer-to-farmer information exchange systems, community leaders, community broadcasting, contemporary ICT, interpersonal, and small group communication (Abukari et al., 2021; Maulu et al., 2021; Rahman & Connor, 2022; Tilahun & Tadesse, 2022), on the other hand, stated that the use of current ICT, particularly mobile technology text messaging, has been shown to be extremely beneficial in influencing the quick spread of agricultural innovation and subsequent adoption among Kenyan smallholder banana farmers. In contrast, farmer-to-farmer extension, according to Rahman & Connor, (2022), aids official extension organizations in encouraging the use of agricultural technology and boosting farmers' capacities.

Time: According to Danso-Abbeam, (2022), the diffusion technique is used to explain how innovation spreads over time through channels among members of a social system. Depending on how quickly news spreads, an invention's acceptance among smallholder farmers may vary. The likelihood that farmers will need to alter their mentality and beliefs in order to obtain correct

information prior to implementing an innovation increases with the complexity of the invention. Instead, if it is straightforward for farmers to test out a new technology, it is more likely to be embraced (Girma & Kuma, 2022). According to the timing of innovation adoption, smallholder farmers may be divided into four groups: innovators, early adopters, early and late majorities, and late adopters or laggards (Danso-Abbeam, 2022).

The Nature of the Society: Innovation is adopted by the smallholder farmers depending largely on their local surroundings and their social structure. Among the numerous factors that might influence the success of innovation diffusion are the nature of the society, social norms, and target users' beliefs, attitudes, and knowledge (Ghimire et al., 2015). Therefore, whether or not farmers decide to use a new technology may be influenced by their social environment.

But Feng et al. (2020) assert that "potential users make decisions to adopt or reject an innovation based on beliefs that they form about the innovation or technology." On the other side, Feng et al. (2020); Malapit et al., (2020) also identified five characteristics of the innovation theory: relative advantage, compatibility, complexity, triability and observability. Mudor & Matchaya, (2022) provides evidence in support of four fundamental hypotheses that are consistent with the diffusion of innovations in a related vein. These ideas cover the pace of adoption, perceived qualities, and individual creativity hypotheses. The cycle of innovation and decision-making is also included in them. According to Mudor & Matchaya, (2022), the basic issue with the approach is that it ignores the potential that people may reject an innovation even though they completely understand its justification. Similar neglect is shown to the qualities of innovation and how they evolve through time (Djuraeva et al., 2023).

2.2.3 The Theory of Planned Behavior

One example of a multi-equation theory that aims to explain human cognition is the Theory of Planned Behavior (TPB). The idea was initially presented by Gillespie et al., (2019), who considers the available knowledge, examines the outcomes of their actions, and explains why someone behaves in a particular way. The main immediate predictor of an action, in the hypothesis, is a person's desire to engage in (or refrain from engaging in) a behavior. The idea essentially predicts a person's purpose (Ragasa, 2020). The conceptual model also recognizes and incorporates additional behavioral aspects, such as attitudes, social influence, and emotions of control. The motivating factors are attitude toward the action, subjective norm, and behavioral control perception. A person's activities may have a range of repercussions depending on the circumstance under consideration (Ragasa, 2020). The theory provides a framework with which to describe how the factors employed in decision-making interact with one another.

According to Ayisi Nyarko & Kozári, (2021), three crucial concepts—attitude toward a specific conduct, subjective norms, and their perception of how they control behavior—determine an individual's intention. The Theory of Planned Behavior is effective at characterizing and forecasting the technological adoption patterns of farmers, but it blatantly ignores eccentric behavior as well as the intricacy of connections among farmers, employees, families, and third parties (Alotaibi et al., 2021).

2.2.4 Social Cognitive Theory

The Social Cognitive Theory, put out by Bandura for the first time in 1986, contends that social elements such as the environment, demographic characteristics (such as cognitive and emotional components), and behavior are all interrelated. Studies have demonstrated that factors including gender, age, and experience have an impact on how well technology is accepted and used in rural places (Cook et al., 2021; Thapa Magar et al., 2021; Yitayew et al., 2021). The cognitive abilities

of a person affect their behavior in terms of technology acceptance and adoption as well as their ability to interact with technology effectively (Dehghanpour et al., 2022; Isaac & Mzwakhe, 2020). Self-efficacy is a notion that is important to the Social Cognitive Theory. According to Niagia et al. (2022), self-efficacy is the belief that one can successfully use technology to complete a certain activity.

Due to its inability to explain age-related differences in behavioral competency and performance, lack of cognitive process specificity, and assertions that social conformity is a developmental milestone, the social cognitive theory has come under fire (Maake & Antwi, 2022). Although the theory does account for a substantial chunk of diversity in health behavior, it has also been criticized for overemphasizing the environment and providing very little justification for an individual's inner traits (Maake & Antwi, 2022). Critics of the theory claim that it is ill-designed, incompletely systematized, and ignores other dimensions in favor of focusing on one or two, such as self-efficacy (Asrat & Simane, 2018; Somanje et al., 2021).

2.2.5 Outcomes-Based Education as the Underpinning to Agricultural Extension Education

The educational policy of Africa is a second crucial element in creating benchmarks for Agricultural Extension Education. Outcome Based Education (OBE) is the cornerstone of the current educational strategy in Africa. OBE is learner-centered, goal-oriented, and less focused on specific content than it is on improving the learner's capacity for learning (Elgueta and Correa, 2021). According to the Resnick, (2022), education should be designed to provide students the abilities, information, and morals they need to contribute to their own, their families', their communities, and the country's advancement.

A system of adult education is agricultural extension. The current educational policy should thus be followed. Given that, the basis of this section is that an extension practitioner's connection with

a farmer is quite similar to an educator's interaction with a student (Antwi-Agyei & Stringer, 2021). Therefore, if Agricultural Extension is to keep up with the changes taking place in Africa and in African agriculture in particular, the integration of agricultural policy and educational policy (which will direct process) with Agricultural Extension praxis is essential (Deji et al., 2021).

The primary goal of integrating agricultural and educational policies with agricultural extension would be to guarantee that agricultural extension and extension practitioners offer farmers a service (i.e., an educational process) that both fulfills the goals of the African Agricultural Policy and conforms to the OBE learning process (Davis & Terblanché, 2016). The argument goes on to say that the integration process in the case of agricultural extension requires a four-pronged approach, which includes recognizing how agricultural extension as a field of study must change to support the African agricultural agenda, translating the OBE expectations and recast Agricultural Extension into the knowledge and skills required of extension practitioners, determining what needs to be changed in the curricula developed to produce recast extension practitioners, and identifying the learning objectives (Davis & Terblanché, 2016).

The outcomes of the integration process and the implementation of the findings include an agricultural extension curriculum that is relevant to both educational policy and agricultural policy. Farmers with the knowledge and skills to pursue the learning necessary for them to contribute to their progress as well as the progress of their families, the community, and the nation; extension practitioners who have the knowledge and skills to interact with farmers in a way that will ensure the objectives of agricultural policy are carried out; programs for agricultural extension developed or modified to carry out the objectives of agricultural policy; and extension services.

Furthermore, it is said that these four facets shouldn't be presented individually or in any particular sequence. There is a relationship between these four parts of the integration process and the desired

outcomes. The entire process of giving farmers a curriculum is depicted. The method is built on a logical cascade from curriculum through competent practitioners to extension programs to competent farmers.

There should be a feedback loop for each step in the process to make sure that lessons learned from a later step are applied to the prior step. There is a dynamic nature of the interaction between the curriculum's contents and the farming process which is consistent with Afrad et al., (2019) observation that OBE policy requires curricular creation to derive in part from involving stakeholders.

The various aspects of the process of incorporating agricultural and educational policies into agricultural extension relate to the process of connecting curriculum to farmers. Once more, the goal is to show how dynamic this interaction is. In both processes, there is interaction between the many levels. Shimali et al., (2021) asserts that this is a crucial phase of curriculum development. Additionally, it complies with the guidelines of the present agricultural development strategy and the National Agricultural Education and Training Strategy.

2.3 THE STATE OF AGRICULTURE EXTENSION SERVICE ACROSS THE WORLD

Extension as a term was primarily used to describe education programs designed for adults in the United Kingdom, notably in England, during the second half of the 19th century. These educational initiatives helped colleges expand their efforts outside of their borders and into adjacent nations (Diab et al., 2020). Land grant institutions were established in the United States which led to the adoption of the phrase, and its formal purpose included both research and extension operations. In 1914 the responsibility for extension was formally delegated to the Ministry of Agriculture by the British administrative government, however, in the 20th century, the phrase used to describe this new duty was changed to advisory services (Diab et al., 2020).

The term used to establish agricultural extension services was often linked to the donor organization that enabled it in almost all low-income countries. The USAID was essential in the 1960s and 1970s in the development of agricultural institutions and extension networks (Diab et al., 2020). Although practically all extension programs worldwide, including those in Asia, Europe, Africa, and other regions, are technically linked to their individual Ministries of Agriculture. People all across the world identify extension services more with the transfer of technology, strengthening the management, technical, and social capital skills of home farms, as well as with the development of their social capital (Niagia et al., 2022). In low-income countries, public extension systems were top-down and centrally supported during the 20th century. At that time, national food security was the major focus, at the cost of extension organizations that made advantage of the available green revolution technology (Niagia et al., 2022). Major food crops' worldwide supplies increased dramatically in the 1990s, as was seen around the world. This achievement was short-lived, nevertheless, since the price of food fell steadily over the world during the 1980s and 1990s, leaving small size land owners in the worst possible financial situation in terms of generating money (Diab et al., 2020).

The World Food Summit in 1996 was an important occasion that made a substantial contribution to redefining the idea of food security with an emphasis on personal and household food security, exhibiting its nutritional and accessibility components (Diab et al., 2020). The international food price index is currently experiencing a major and potentially long-lasting impact due to the rapid rise in demand for fruits, vegetables, and cattle in China and India. There is an increase in the production of biofuels with food crops in the US, South America, Asia, and Europe (Feng et al., 2020). In a similar vein, the historically large increases in gas and oil prices directly influenced the rise in costs of essential agricultural inputs like fuel, fertilizer, and pesticides. All these new trends

have an impact on how easily the hungry may acquire food, which ultimately affects their nutrition (Adjei et al., 2017). This suggests that many countries and donors are refocusing their efforts and resources on enhancing agricultural extension activities because they view extension as the most effective way to improve people's livelihoods by influencing their knowledge of farming practices and how to combat climate change to achieve food security (Feng et al., 2020).

2.4 THE STATE OF AGRICULTURAL EXTENSION SERVICE IN AFRICA

Africa's agriculture industry confronts many difficulties. The repercussions of climate change are now apparent. The profitability and sustainability of production are threatened by rising input costs, particularly the most recent sharp increase in gasoline prices (Agyeman et al., 2022). The effects of COVID-19 pandemic on the agriculture industry cannot be overemphasized as it has cut food sales, limiting or terminating operations of agro-processing facilities and major harbors owing to lockdowns, while restricting general output as a result of limited availability of vital inputs and mechanical components (Meyer & Börner, 2022). It is crucial for Africa to have competent, effective agricultural extension services under this circumstance. Agricultural farmers in rural regions have a direct relationship with extension and advisory personnel. They serve as a vital connection among the government, producers, the research agencies and the institutions that provide loans and inputs (Dooley & Roberts, 2020). In order to help communities, adjust to change, whether it be brought about by new circumstances or technological advancements, extension services are required (Maulu et al., 2021). As a result of climate change, one of their responsibilities is to assist farmers in increasing productivity while protecting natural resources (Maulu et al., 2021). Extension services are essential for rural development and poverty eradication when they are run effectively (Antwi-Agyei & Stringer, 2021; Maulu et al., 2021).

The majority of African nations have a three-tiered system of government, with legislative and executive power divided among the national, regional/provincial, and local levels of government (Maulu et al., 2021). The sector's coordination tasks are divided into national, regional and district levels. There are representatives from DALLRD, business, academia, research, and producer organizations at every level. The objective of DALRRD is a reformed agriculture, forestry, and fisheries sector that promotes economic development and food security for all through creative, inclusive, and sustainable policies, laws, and initiatives that seeks to advance food security, economic growth, and sector change (Adjei et al., 2017).

2.4 MAJOR ISSUES FACING AGRICULTURAL EXTENSION SERVICE AFRICA

The following issues affect Africa's public agricultural advice and extension service, according to the most recent government study (Ortiz-Crespo et al., 2021):

i. The extension and advisory services is always publicly criticized for being ineffective and invisible. In response to this criticism the department has attributed the challenge to the limited resources and internal departmental constraints. They further assert that extension workers have little control over the value chain, political interference and restrictions, climate change, and the depletion of natural resources.
ii. Extension officers lack adequate training.
iii. There is a lack of funding to build up the sector.
iv. Some employees have a tunnel-vision approach, concentrating exclusively on the present moment rather than taking a forward-looking perspective.
v. Extension employees lack the necessary training and opportunity to get real-world experience.

Extension experts contend that a lack of funding hinders their efficacy and ability to provide effective services. Inadequate experience and training among extension practitioners as well as poor utilization of technology for rural farmers are also noted (Olorunfemi et al., 2020; Ortiz-Crespo et al., 2021). Davis and colleagues (2019) also discovered that extension specialists had a tendency to hold farmers responsible for their own difficulties. The claims of inefficiency are well known to extension employees, which decreases motivation and self-efficacy and, as a result, performance (Olorunfemi et al., 2020).

Farmers have differing ideas about the effectiveness of agricultural advising services; some believe they receive appropriate support, while others claim to have never gotten help from extension agents. Farmers believed the public extension services were useless, according to studies conducted at the Eastern Cape Province, Gauteng province, Lagos, Accra, Kumasi, and Western Cape Province (Davis et al., 2021; Maake & Antwi, 2022). According to several studies (Adjei et al., 2017; Davis et al., 2021; Lee et al., 2023) the reasons for ineffective extension included the extension staff's lack of competency, their absence, and the divergent perspectives of farmers and extension officers about the objectives and results of effective extension. In the Northern Region of Ghana, research by Ma & Abdulai, (2016) discovered a significant disparity between farmers and extension officers' conceptions of what agricultural extension involves or should entail and the components of efficient extension approaches. According to majority of the farmers, extension service delivery should primarily concentrate on providing inputs rather than helping with technical advice and training (Ma & Abdulai, 2016). Unquestionably, a key element of agricultural extensionists' effectiveness is providing them with the necessary knowledge, abilities, and skills through suitable higher education.

2.3.3 The state of Agriculture Extension in Ghana

Ghana is not an exception; agriculture is essential to the socioeconomic growth of Africa. Over 60% of the population relies on agriculture for their living in Ghana, where it contributed 20.3% to GDP in 2015 and 22.6% in 2016 (Darkwa & Acquah, 2020). Smallholder farm households that produce their food using primitive methods dominate the agricultural industry. As a result, the majority of crops produce less than is desirable. For instance, according to Adjei et al. (2017), the yield of important staple crops like maize and rice is less than half of what is economically feasible. The poor yield in Ghana is due to many issues, including the use of antiquated production methods, dependency on rainfall, and a slow uptake of more advanced methods, such as automation, irrigation, improved seeds, and chemical fertilizers. Other contributing variables include the poor educational attainment of smallholder farmers, which affects their capacity to create human capital and make the most of opportunities and production technology to improve farm performance (Adjei et al., 2017).

Agyeman et al. (2022) in a study revealed that technical advancements increased agricultural output, hence enhancing the well-being of rural farmers. However, if farmers cannot access technical advancements, they might not be advantageous. Since most smallholder farmers are situated in rural locations, they rely on public agricultural extension services to provide them with information about modern agricultural technologies and techniques. This makes the development of an efficient agricultural extension delivery system for the transfer of knowledge and technology to smallholder farmers necessary to ensure increased productivity and farm incomes. In light of the aforementioned, the government of Ghana has increased the delivery of agricultural extension services to ensure that farmers are informed about modern production technology and are encouraged to use it, which is expected to increase productivity and revenue from agriculture

(Agyeman et al., 2022). According to Agyeman et al. (2022), the main goal of agricultural extension delivery in Ghana is to make it possible for farmers to effectively receive information about modern technology and productive operations. In most underdeveloped countries, providing extension services is challenging due to poor extension programs and message design. Many smallholders may decide not to use agricultural extension services even in places where they are available since they were not designed with their needs in mind. Many smallholders choose not to search for extension services as a result (Antwi-Agyei & Stringer, 2021). According to Bellon et al. (2020), rather than a lack of farmers desire to adapt technology and extension services strategies, the low adoption rate of these services among farmers is the result of inadequate extension service delivery strategies, insufficient staffing, lack of the needed logistics and supplies.

A progressive trend towards extension service privatization or the transfer of duty to farmer groups or non-governmental organizations is occurring in several countries as a result of the underwhelming performance of many official extension services (Awad et al., 2015). In Ghana, farmer associations have recently become more well-known, and non-governmental organizations both domestic and outside that get funds from donors provide extension services to smallholder farmers. The efficacy of agricultural extension officers clearly determines the effectiveness of it system, which is at the heart of each agricultural extension system. According to data, if all extension employees are deployed, there would be around one extension agent for every 1300 farmers in Ghana (Antwi-Agyei & Stringer, 2021).

Despite the difficulties noted above, agricultural extension services continue to be crucial for the advancement of agriculture and the improvement of rural lives in many developing nations, including Ghana. Agricultural extension is explained as any type of informal education that aims to raise the standard of life for smallholders who lack literacy (Mohammed & Abdulai, 2022).

Adjei et al. (2017) stated that ensuring national food security and enhancing rural lives are among the objectives of national agricultural development. These national objectives aim to boost farm income, encourage sustainable natural resource management methods, raise the production of primary food crops, and unite farmers into producer groups. To accomplish the national agricultural development goals, the National Extension Service performs essential extension responsibilities. A few of the extension's responsibilities are to transmit technology to farmers, educate them about sustainable farming practices, and help them organize into producer groups.

Ghana's extension delivery system has developed and undergone several changes to become more successful. In 1978, the General Agricultural Extension Approach which was infamous for its top-down methodology—was replaced by the Unified Extension System (UES) (Okorley, 2007). As part of the UES, extension agents visited farmers on the farms to offer education and guidance on cutting-edge technology through the Travel and Visit system. The Department of Agricultural Extension Services and research institutes were found to have poor coordination because of their association with other ministries (Abukari et al., 2021). The top-down mentality of the training and visit (T&V) system was one of its many flaws, which led to the creation of the Decentralized Extension System in 1997. The Ministry of Food and Agriculture (MoFA) is presently under the jurisdiction of the district-level offices of the District Assemblies., which represents the lowest level of government administration. The primary goal of decentralization was to establish a demand-driven extension system, the ultimate goal of which is to increase farmer productivity and income (Acheampong et al., 2017).

The extension system in Ghana has come under serious criticism for failing to emphasize the decision-making of farmers, who are important extension stakeholders, leading to general dissatisfaction with the extension system in the country (Acheampong et al., 2017). This criticism

comes despite efforts to promote decentralization and local participation in the development of extension programs (Acheampong et al., 2017). Despite decentralization initiatives, Ghana's extended delivery system continues to be mostly supply-driven, with extension agents placed in specified operating (geographic) zones. Access to extension is frequently limited by how quickly farmers can be reached because of resource and logistical limitations as well as a high extension agent to farmer ratio. In order to reach farmers with extension messages and new technology, farmer groups are also employed (Anang & Asante, 2020).

2.3.4 The Structure of Agricultural Extension Service Delivery in Ghana

The government has given the Directorate of Agricultural Extension Service (DAES) the responsibility of managing all agricultural extension operations across the nation. Additionally, this organization worked with non-governmental organizations (NGOs) and regional and district offices to run its operations (Resnick, 2022). The regional and district offices get the policies and guidelines created by DAES for implementation. To successfully implement the specified policies utilizing the instructions supplied by the central body, all the different levels both regional and district offices on the ground also collaborate with the private institutions, which consists of NGOs, Community-Based Organizations (CBOs), and other key stakeholders (Resnick, 2022). According to Resnick, (2022), DAES has the following important responsibilities:

i. Planning and developing expansion policies.
ii. To work together to provide extension services with public service organizations, NGOs, and other private service providers.
iii. To encourage strong links between research, extension, and farmers.
iv. To offer technical assistance to the regional and district to plan and carry out extension initiatives.

v. To offer logistics to all countrywide field personnel.

vi. To track and assess all extension operations conducted by the Ministry of Food and Agriculture.

vii. Using the finest extension approaches to offer services effectively and efficiently.

viii. To engage successfully with other stakeholders in the provision of extension services.

2.3.5 The Current State of Agricultural Extension Service in Ghana

Before the country's independence, Ghana's agricultural extension saw a number of political changes, from an approach that expanded exports of commodities to an advanced food crop production (Resnick, 2022). For the past forty years, there has been a gradual decline in the effectiveness of the Ghanaian government in emphasizing on technological transfer and the management of farm information provided by the government portion and toward the general public and private body service approach, addressing important issues such as risk management by farmers, how to market their agricultural products, disease and pest diagnostics, and environmental sustainability (Norton & Alwang, 2020). Due to this change, the Ghanaian government educated professionals from the food and agriculture ministry to address the requirements of extension workers, the non-commercial as well as commercial farmers, among the peasants (Awad et al., 2015).

A more engaged strategy has replaced the top-down, community-based methods of agricultural extension in Ghana at the moment. The change is in line with the global banks' training and visitation (T&V), product engagement strategies, farmer field schools (FFSs), radio station promotion to farmers and mobile phone promotion to farmers to sensitize farmers on agricultural best practices, as well as the innovative Information Communication Technology (ICT) that seeks to give farmers reasonable advice online (Cook et al., 2021).

Global extension systems have become more diversified in a limited amount of time due to various factors, including the use of replacement funding methods that are both publicly and privately funded (Nord et al., 2022; Ragasa, 2020). In Ghana, the adoption of cutting-edge ICT has lowered the barriers to information dissemination and delicately shifted the role of extension service away from the conventional message transfer in order to build a more robust and advance communication to make it more accessible to commercial and ordinary farmers (Danso-Abbeam, 2022).

2.3.6 Categories of Extension Service

Due to the expense of accessing extension delivery services, state extension services are provided through the state departments which are regarded as being fairly affordable. Government extension programs contact many farmers over time, which increases their influence. On the other hand, they are occasionally unreliable because of limitations imposed by bureaucracy and a lack of funding (Girma & Kuma, 2022).

In Djuraeva et al., (2023) study, it was said that through the "Public-Private Partnership for Extension Service" the extension service offered by private entities or companies comes but at a charge. They often target farmers who are educated with a respectable salary since they can afford them. In contrast to the services provided by the government, these services are effective and well-funded. However, they only cover a narrow geographic region and a tiny number of farmers, ignoring the vast majority of subsistence farmers.

While Girma & Kuma, (2022) in their study suggested that NGOs extension services are a component of private extension, Kumar et al. (2018) contrarily portrayed NGOs as a distinct category. Farmers involved in this survey claimed to have used one of the three types of extension services. Because of this, it was appropriate to refer to NGOs as unique. In comparison to private

extension services, the NGO extension services have a significant cost advantage and a wider geographic scope. NGO extension programs, however, are only formed for brief periods of time, which limits their ability to affect specific farmers (Djuraeva et al., 2023).

2.3.7 Agricultural Extension Communication Channels

The development of any society, especially the agricultural sector, depends on communication. There are many different types of communication techniques. One channel cannot be used to meet every situation. There are two different types of these communication channels. Both interpersonal and non-interpersonal communication can occur through several methods. Numerous factors affect the communication technique that farmers use. A few of these are price, availability, channel compatibility, the nature of the message, and the expectations or preferences of the farmer (Abukari et al., 2021).

Interpersonal Communication Channel is very essential in the information transfer process, it involves direct communication between the information recipient and the information provider, such as field demonstrations, contact or lead farmers, opinion leaders, and friends and family (Abukari et al., 2021). The channel is the technique utilized to physically transport the message from one person to another. While voice is the only channel accessible while speaking on the phone, speech and vision are used when communicating face-to-face (Abukari et al., 2021).

The Non-Interpersonal Communication Channel is important when giving information to farmers, these techniques prevent disagreement between the recipient and the information source. The internet, social media, telephone, billboards, newspapers, and traditional media like radio and television are among them (Abukari et al., 2021).

2.4 THE IMPACT OF AGRICULTURAL EXTENSION SERVICES ON FARMER'S YIELD AND OUTPUT

The agricultural yield is the typical annual net output of agricultural goods (e.g., in kcal, grams of protein, or net profit) generated by a unit of acreage. The total amount of farmland includes all the land required to produce the good, including any land used to produce manure or grow feed (Abukari et al., 2021). Agricultural production is increased through enhancing information, marketing, and distribution tactics. This helps in promoting agricultural growth as Information exchange is vital to the realization of agricultural extension goal. The current study aims to determine how agricultural extension service affect maize output and farmers livelihood so that we will be able to factor it into the school curriculum to better serve the information needs of farmers.

The following are the components of agricultural production: output sold (including trading between agricultural holdings); stock movements; output generated for own ultimate consumption; output produced for further processing by agricultural producers; and intra-unit consumption of animal feed products (Abukari et al., 2021). Because agricultural extension gives rural people access to crucial farming knowledge they can learn from and apply to address their farming issues, agricultural extension programs are significant tools for reducing poverty and boosting food security. According to Biswas et al. (2021), it also introduces farmers to new technologies and encourages their effective participation in knowledge and information activities. According to Yitayew et al. (2021), adoption of the new technology that adopters learn through extension service improves the standard of life, income, and productivity.

Extension service providers help farm families to become inventive, which increases adoption rates and keeps people from halting the diffusion process (Biswas et al., 2021). After introducing

farmers to a new technology, extension agents urge them to embrace it right away so that no one falls behind or has to learn it from a colleague later. Extension service is the means through which farmer issues are recognized, looked into, and supported in the creation of policies (Yitayew et al., 2021).

One of the vital roles extension officers play is to facilitate the adoption of agricultural extension technologies. Each new technology must meet the demands of farmers in order to be adopted. Stages are involved in the adoption of a technology. Prior to adopting, the farmer must make a decision. The intensity stage then enters once the choice to adopt has been made (Awad et al., 2015). Some farmers may be discouraged from implementing a technology, nevertheless, due to other causes. The farmer in question cannot adopt, for example, if there is a cost associated with it. The acceptance of new technology, or even the level of adoption, will depend on your relationship with the extension officer (Asrat & Simane, 2018; Ghimire et al., 2015). For instance, a smallholder farmer's knowledge sources may originate from many training centers that are spread out over diverse distances. The farmer will be forced to make a decision on where to go based on his needs and the location of the training facility. Age, education, diversity, and farm size, according to Gillespie et al. (2019), all have a positive impact on the adoption of new technologies. However, some researchers have shown that socioeconomic variables merely have an impact on the speed of adoption.

In developing nations, particularly in Sub-Saharan Africa (SSA), the sluggish uptake of new agricultural technology is a significant element in explaining ongoing productivity shortfalls and rural poverty. According to recent data, farmers in particular put off using integrated system technologies, which are collections of agricultural techniques that must be used in concert to realize their full productivity-enhancing potential (Abukari et al., 2021). Integrated system

technologies are usually knowledge-intensive because they necessitate both the adaptation of procedures to specific local agri-environmental conditions and the comprehension of at least essential underlying biological functions and processes (Asrat & Simane, 2018). While knowledge and information gaps are frequently mentioned as barriers to the adoption of agricultural innovations in general (Ghimire et al., 2015), they are also probably to blame for the partial or complete lack of adoption of complex system technologies (Awad et al., 2015).

In this regard, it's critical to have a better knowledge of how to further increase information sharing between the extension program's direct beneficiaries and other local farmers (Abukari et al., 2021). The study of processes that prevent incomplete diffusion is the subject of a growing corpus of literature. According to this study, a video intervention was necessary for the larger community to get more complicated information, such as the significance of putting practices into practice together and the process of producing compost (Asrat & Simane, 2018). On the other hand, the video presents an opportunity to highlight the complex components of the technology that could be overlooked or omitted in the stream of information in other circumstances (Awad et al., 2015). In contrast, the video could also be able to reach a larger percentage of the local populace and provide a channel of communication for them with the direct beneficiaries. The findings of this research indicate that contrary to earlier studies, which primarily concentrated on mechanisms that encourage model farmers to increase knowledge dissemination, interventions that stimulate knowledge-seeking processes among non-modal farmers are more effective and represent a promising area for further research (Abukari et al., 2021).

2.4.1 Importance of Agriculture Extension Service to Farmers

Information is essential to any civilization's development. To reap the benefits of their effort, farmers need precise and up-to-date information in three crucial areas: production, post-harvest,

storage, and efficient marketing. This knowledge is vital to reducing the poverty level of every farmer. Farmers mostly obtain this information from extension workers in agriculture who work to combat poverty and promote community engagement in the agricultural growth process (Kingiri, 2021). The extension service personnel provide farmers with agricultural expertise, which they then implement on their fields. The extension service offers farmers professional advice on agriculture in addition to the supplies and services they require to maintain their level of agricultural productivity. It provides farmers with information as well as fresh insights from agricultural research stations (Kingiri, 2021).

According to economists, demand-driven behavior has to do with supply and demand. Demand in economics refers to the quantity of products and the major services a consumer is willing and able to purchase at a particular price within a defined time frame. Demand-driven refers to a shift away from the traditional top-down approach to agricultural information delivery toward a method that is more focused on results and takes farmer demands into account (Anang et al., 2020). The modification increases agricultural extension services' efficiency and increases openness in the delivery of public services by taking farmers' welfare and concerns into consideration. Demand-driven service concentration has spread beyond agricultural extension to a variety of other industries. Demand-driven community water, healthcare, and education initiatives are currently being considered (Anang et al., 2020).

After harvest, the majority of farmers often struggle to sell their farm products. Farmers that seek advice from their extension officers on their plan to sell their farm produce gets aid and offered answers to market-based challenges, they are made aware of marketplaces in the country where demand for their produce are high and with high market value. The farmers are aware of the particular issues they face when trying to market their agricultural products. When agricultural

extension becomes demand-driven, it will offer answers to the unique problems that each farmer faces. This would promote sustainability since farmers are interested in having their problems resolved and private sector extension workers want to be paid for the services they provide. When the unique requirements of farmers are met, an inclusive market will be attained (Ortiz-Crespo et al., 2021).

The requirements of adolescents must be taken into account, with a focus on women, and efforts must be made to meet their particular problems. Due to the limitations on their movement and free time caused by their household obligations, they are challenged. In addition, women's access to land is more difficult than that of men, and certain society members' disrespect for women's skills also hinders their achievement (Danso-Abbeam et al., 2018).

Government and private sector cooperation is necessary for successful development to occur. A variety of skills and knowledge will be combined through this partnership. Collaboration between the two fields will result in entire growth because one skill may be the other's weakness. Traditional elders, for instance, can collaborate to grant land so that the government can carry out its development initiative. Diverse sorts of development partners frequently collaborate on successful initiatives (Danso-Abbeam, 2022).

Diverse agricultural households should be considered to be heterogeneous. Separation is necessary for the destitute, underprivileged, weak, uneducated, wealthy, and well-educated. The plan will become globally inclusive if the requirements of all these groups are taken into account, which will encourage all types of farmers to engage in whatever adoption approach a particular training is focused on. A strategy like this has a possibility to improve development and bring about beneficial improvements (Kingiri, 2021). However, the opposite is typically seen.

Agricultural extension has also encountered challenges with access and delivery, including how to design a perfect system that will meet the needs of the majority of farmers involved in various but complex farming systems, difficulties with monitoring, evaluating, and closely examining the effects of extension services, the reliance of extension on performance and its ensuing linkages, and inherent challenges in securing political commitment and support (Kingiri, 2021).

2.4.2 Policy Interventions towards Agricultural Extension

The Structural Innovation Policy

Agriculture extension has had enormous success, particularly in the field of agricultural research; as a result, the level of results in agricultural growth has transformed the economies of several countries, alongside gains in non-farm jobs and earnings juxtaposed to those in the agriculture industry (Norton & Alwang, 2020). Farm commercialization is increasing in relation to the non-farm business in order to satisfy the growing need for agricultural products, both in terms of their quality and volume. The farming industry is dual, with the majority of smaller, slightly more lucrative semi-subsistence farms located in low-income countries. What separates industrialized nations are agricultural enterprises, some of that are relatively small and part-time in nature (Ragasa, 2020).

Farms were increasingly commercialized as a consequence of the increase in demand for client-specific extension information, which is frequently offered by privately held firms (Mohammed & Abdulai, 2022). Most of the time, farm workers seek for information to aid in decisions that would increase their profit margins by increasing agricultural production, selling products, and other related activities (Mohammed & Abdulai, 2022). This sort of information is often provided by input suppliers and private consulting firms for each farm and field. Due to the expanding need for personal information, private firms are increasingly offering data to farmers on an open market or

incorporating it into inputs. Public extension services are generally shifting their focus away from extension as it is privatized and toward other areas, such as the need to educate non-commercial and small-scale farmers about environmental and natural resource issues and the value of their data to the public sector (Norton & Alwang, 2020). The change in priority for the extension service has been more pronounced in developed countries than in less developed ones, but it is an international phenomenon.

Agricultural Technology and Information Innovative Policy

Agricultural inputs like enhanced seedlings, bio-pesticides, and farm machinery may all be purchased with the use of agricultural data; also, agricultural data can be used to learn more about agricultural markets and practices (Somanje et al., 2021). Disembodied data may be monetized in both public and private settings. According to Mohammed & Abdulai, (2022), privately charged products offer information relating to pest diagnoses and fertilizer recommendations for particular farm areas, whereas disembodied public information in goods includes information on weather-based crop-disease prognosis and recent trends in the market. As materials and capital expenditures have dramatically increased, the proportion of information that is surrounded by inputs has increased globally within a short period.

Farm-specific service charge requests from private businesses have significantly increased in both developed and developing countries, and these demands are often made by large, profit-driven businesses (Norton & Alwang, 2020). A fee-for-service system has been designed for commercial farm employees in Mexico and Nicaragua, as well as the majority of governmental agricultural extension agencies in the United States collect fees for the services provided to commercial farms (Norton & Alwang, 2020). Again, in Honduras, large-scale farmers are thought to be responsible for nine percent of all extension services (Elgueta.and Correa, 2021). The privately run extension

division has recently been encouraged to take on a bigger role in the distribution of agricultural data than it did earlier when a lot more data was available and spread through publicly owned property. The public agricultural extension sector has to adapt its size, structure, and emphasis as a result of the ongoing rise of the private agricultural extension sector's engagement in the distribution of agricultural knowledge (Norton & Alwang, 2020).

Non-Governmental Organizations (NGOs) sometimes take up the responsibilities of the state extension service in contributing to the development of many countries in the world, even though the majority of NGOs are primarily supported by state funding and privately advised services (Norton & Alwang, 2020). Globally, there has been some gradual progress toward gender equality in agricultural extension services. According to studies over the past forty years, agricultural extension services have been very conscious of the harmful effects that gender prejudice has on agricultural output (Malapit et al., 2020). The story has altered in the twenty-first century, though, as nearly all countries now allow women to partake in decision-making and actively engage in extension-related activities (Malapit et al., 2020; Thapa Magar, et al., 2021).

Communication and Information Technology Policy

The ICT policy advancement has made it possible for agricultural extension systems to reach a sizable number of farmers without incurring significant costs and can transmit agricultural information promptly. (Cook et al., 2021). The majority of farmers now hold mobile phones. When it comes to owning specific kinds of media hardware like smartphones and computers, the lack of resources in the majority of developing countries continues to be a disadvantage for farmers. However, agricultural extension systems are steadily convincing clients for a wide variety of mass media programming for the maximization of profits on large- and small-scale farms (Cook et al., 2021).

Almost all communications sent using ICT are simpler than those delivered through face-to-face instruction. Despite this, the number of agricultural laborers communicated to by ICT's extension service is quickly increasing, and the associated costs are negligible. ICT-enabled extension services are postulated by Cook et al. (2021); Silvestri et al. (2021) to give farmers information on understanding and diagnosing insect-pest and diseases, accessing relevant insights to agricultural markets, the ideal time to begin farming, and the best way to adopt efficient agricultural techniques.

Financial Support Policy

During the 1970s and 1980s, international and federal donors provided significant assistance for agricultural extension. The support for agricultural extension programs, however, has been steadily declining in many countries today (Davis et al., 2021). In the 1980s and 1990s, the World Bank allegedly provided the financial resources necessary for its training and visits to several countries, according to Silvestri et al. (2021).

However, despite the fact that the training and visit system did not require much capital in the 1990s, the total public debt crises in many countries, particularly those in Africa and Latin America, forced their national governments to reduce their fiscal deficits. As a result, funds for extension activities have decreased. As urbanization and investments in publicly owned resources like roads, water, and irrigation systems grew quickly, the proportion of the global economy devoted to agriculture continued to decline (Norton & Alwang, 2020). As a result, central governments and donors neglected to support agricultural extension. Direct action was taken to fulfill the anticipation that the private sector would step up and provide enough support and funding for extension service (Girma & Kuma, 2022).

Government Decentralization Policy on Agriculture Extension Services

Governmental responsibilities as well as publicly run agriculture extension programs have been decentralized in nations including Uganda, the Philippines, Ghana, Columbia, Nepal, and others (Kingiri, 2021). Decentralization occurs when certain administrative tasks are shared from the central government authority down to local state organizations. Decentralizing minimizes the dependence of local government institutions on the federal government, but it also calls for the restructuring of state institutions, including the extension sector (Norton & Alwang, 2020). Extension agents who operate at the district level report to the district offices, who report to administrators at the regional level and vice versa. One rationale for this shift is to make the units responsible to officers whose work is motivated by farmers' needs (Mohammed & Abdulai, 2022).

The perception of support for extension programs from local government entities is typically constrained by a lack of funding, which is a significant problem for many extension systems. Nevertheless, the decentralized nature of extension systems speeds up production and the transmission of targeted and specific information (Norton & Alwang, 2020). Decentralization has a common disadvantage as some extension workers are usually perceived as being politically motivated or acting as the government's eyes and ears rather than as impartial communicators of agricultural information (Nord et al., 2022). There is evidence that decentralization has worked rather successfully in industrialized countries, particularly the United States, where extension services are intimately tied to decentralized state institutions as well as state academia investigative structure. Governmental agencies provide a hand in splitting the cost of paying employees of local extensions, and the state-level expert backup (Kingiri, 2021).

Diverse perspectives on the effects of decentralizing expansions exist in low-income countries. For instance, the phrase has been crucial in enhancing local communities' engagement and control

over the provision of extension services in Uganda (Abukari et al., 2021). Despite this, extension service programs are at a standstill due to issues such as a lack of funding from local sources, reliance on unfeasible government grants, the inability to retain and recruit staff, and bribery and capture by local leaders (Kassem et al., 2021).

2.4.3 Challenges Farmers Face in Accessing Agricultural Extension Services

Despite this, the country's agricultural production is still subpar. It is widely acknowledged that the primary reason for this poor and static output is a lack of information especially directed toward addressing local wants and issues of technical know-how at the farm level (Mohammed & Abdulai, 2022). This scenario exemplifies the interplay of several factors, such as the "Mafia" of buyers and middlemen, the absence of the infrastructure required for farm exports, poor management, and marketing abilities, a lack of continuity in agricultural policies, a politicized environment in agricultural support institutions, the isolation of agricultural education, research, and extension wings, unfavorable prices, feudalism, and absenteeism. Agricultural extension is one way to improve food security and decrease poverty. Agricultural extension is a term used to describe an ongoing program that provides basic education to farmers, mostly to rural employees in the agricultural sector. To help them requires deliberate, organized engagement with agricultural communities and among farmers. Its main objective is to increase knowledge about farming and primarily focuses on a better understanding of farming methods, the clear expression of farmers' desires, the identification of farmers' difficulties, and the search for answers (Tilahun & Tadesse, 2022). The following explains some of the challenges facing agricultural extension service.

2.4.4 Agricultural Extension Needs Availability

Crop yields are still below the predicted yields of research-managed plots (Rahman & Connor, 2022). No extension fits all kinds of adopters, which is a product of research extension that assumes

all extension techniques will fit all categories of adopters (Dehghanpour et al., 2022). For farmers to increase their yields, access to the extension services they need is crucial. According to Rane, (2020), the agricultural extension's ability to contribute to the expansion of agricultural production and productivity would be constrained by the demands of farmers.

2.4.5 Non-Participatory/Top-Down

Successful agricultural advising systems, in the opinion of Dehghanpour et al., (2022), consider farmers as co-decision-makers and include and integrate their traditional knowledge into the research process. Formal research and extension must adapt their expertise to different knowledge systems to benefit this rural community (Ayisi Nyarko & Kozári, 2021). Currently, Ethiopia's agricultural extension is taking place as described as a process where majority of the time, a top-down approach is used, with development organizations instructing farmers on how to use technology that was manufactured elsewhere (Rane, 2020). On the issue of poor research-extension cooperation, Ayisi Nyarko & Kozári, (2021) reported that earlier empirical studies in developing countries identified poor links between research and the extension sector as the main factor hindering the effective flow of information, knowledge, practical new technologies, and resources among system actors. They also recommended measures to overcome these weaknesses. According to Antwi-Agyei & Stringer, (2021), agricultural extension service often performs the role of a farmer organization by communicating institutes with information. However, due to the separation of extension and research activities, agricultural research and extension in Ethiopia are not well integrated (Antwi-Agyei & Stringer, 2021), carried out under the control of many entities, with little or no coordination between them.

2.4.6 Improper Policy Focus

Only wealthy farmers have easy access to agricultural extension services. Poor farmers are often unable to access and adopt new technologies because they must pay a charge to access those (Ayisi Nyarko & Kozári, 2021). On the other hand, some farmers believe that because some services are free, they do not value them. The reason for this is that wealthy farmers who can afford to pay for any service never utilize the free technology (Ayisi Nyarko & Kozári, 2021).

2.4.7 Lack of Qualified Extension Supervisors and Workers

According to Ayisi Nyarko & Kozári (2021), since the government regulates its spending, most budgets are reduced to a sizable limit without taking into account current demands. Given quotas to the training institutes, this budgetary restriction caps the number of extension workers who may be taught. Consequently, there is a scarcity of extension supervisors or employees. Additionally, it results in the training facilities lacking the tools necessary to instruct the police. As a result, the staff had insufficient expertise in the field. Therefore, it will not be possible to properly communicate the necessary information to farmers or report the issues they are having (Alotaibi et al., 2021).

2.4.8 Transportation

Transport arrangements for livestock and agricultural extension services are inadequate in many African nations, particularly in Ghana and Kenya (Antwi-Agyei & Stringer, 2021). Many agricultural extension agencies use group extension strategies like farmers field days and chief's Barazans (public gatherings) since transportation facilities are inadequate. According to Alotaibi et al., (2021), the purchase of new transportation facilities will ease the transportation difficulties that extension services have when carrying out their duties. To teach farmers about optimum agricultural practices so they may boost their farm yields, various extension agents carry out their

duties in different regions of the African continent on foot, bicycles, or leased motorbikes (Alotaibi et al., 2021).

2.4.9 Cost Delivery

A major problem confronting the agricultural extension service is inadequate funding. Because of this, the public extension officers are unable to carry out all of their goals. Due to this, farmers turn to hiring private extension agents, which raises their investment costs on the farm while also providing them with insufficient assistance (Tilahun & Tadesse, 2022). Additionally, the number of requests exceeds the capacity of the extension officers resulting from the high officer-to-extension request ratio. Due to the increase in demand, officers' service costs have increased. Even the extension officers for the general public are becoming more and more reliant on gasoline. They all have a tendency to significantly raise delivery prices. Farmers may now unite and ask an extension officer for help since there is such a widespread understanding of the value of extension services (Wigboldus et al., 2016).

2.4.10 Inadequate Field Allowance

Due to the high farmer-to-extension officer ratio, it is challenging for the officers to notify farmers in a timely manner and reach all of them. Due to their reluctance to exert oneself, extension officers are absent or given insufficient field time, which leaves the majority of farmers unattended. In order to reach the majority of farmers, the field allowance would have encouraged the officers to put in extra effort (McFadden & Huffman, 2017).

2.4.11 Weak Legislation on Agricultural Extension Services

Certain crops are not encouraged to be grown by government regulations and policies. To the detriment of other crops like maize and millet, a lot of emphasis is usually paid to crops like cotton and cocoa that can brag of their ability to generate foreign cash. Because they want to grow vital

crops that will enable them to sell their products on the global market, this prevents farmers from diversifying to adapt to climate change. The farmers' potential to be innovative is being killed by this. Additionally, large-scale farmers receive a lot of attention, which is to the detriment of the smaller majority of farmers (Abukari et al., 2021).

2.4.12 Weak Institution and Inadequate Logistics

The organizations tasked with providing agricultural extension services lack the authority and resources necessary to carry out their duties. The majority of them lack the necessary logistics to do their tasks. Some people utilize their own belongings, such as a vehicle and a tool, to help them service their clients (Maulu et al., 2021). The movement and operation of certain officials are restricted by the insufficient logistics, which prevents them from being able to respond to the demands of the farmers in their catchment area. Poor road infrastructure presented another difficulty for some extension personels. In certain places, particularly during the rainy season, poor roads make it difficult for extension staff to service their farmers. The most challenging issues are mobility and access to information, according to agricultural extension services over the years (Maulu et al., 2021).

2.5 GHANA`S EDUCATION CURRICULUM FOR SENIOR HIGH SCHOOL

Education generally refers to the transfer of knowledge either in a form of experiences, skills, values, customs and or ideas. Over time education has been accepted and acknowledged as the bases for civilization and enlightenment, Ghana’s educational system at one time in history was regarded in a very high esteem among its West Africa counterparts, but by the 1980s the one time vibrate system went into a dark phase, and almost collapsed, it was therefore declared not fit for purpose in the overall goals of the nation (Stanislaus, 2014). There was henceforward the need for the country`s education system to undergo certain reforms, one that sort to develop a model which

will apt both intend and purpose of the current and future generation (MacBeath, 2010), which saw to the various education reforms the country has witness over the period.

Fundamentally, curriculum reforms or reviews are to address the inherent challenges in the existing curriculum and to response to a national need of shifting the content of the education system from merely examination focus to nurturing values, building character, and raising critical problem solvers (NaCCA, 2018). The Pre-Tertiary Education Curriculum forms the policy guideline against which SHS curriculum is reviewed when required (Ministry of Education, 2018). The present structure of education in the country, which starts at the age of five-six years, is a six-three-three-four (6-3-3-4) structure representing, six years of primary, three years of Junior High School, three years of Senior High School and four years University education (George et al., 2015). This current system was adopted in 2008, mainly to revert from the four years of senior secondary school which was introduced in the year 2000 to the previous three years duration.

According to NaCCA (2020) curriculum review, Senior High School education is aimed at delivering an extensive gamut of academic knowledge and skills necessary for pursuing higher education and training. The Ghana Education Service and the National Council for Curriculum Assessment (NaCCA) are the frontiers of curriculum development, off-course with oversight responsibility from the Ministry of Education. The public senior high schools curriculum is designed to comprise core and elective subjects including Social Studies, Mathematics, Integrated Science, and English Language (NaCCA, 2020). making up the four compulsory core subjects, complemented by three or four elective subjects selected from a student`s course of study, which are usually classified under these categories: Sciences, Arts, Vocational, Technical, Business, and Agriculture (NaCCA, 2020). For instance, the elective subjects in the General Science category include; Biology, Mathematics, Chemistry, and Physics, Home Economics students take three or

four of the following; Management in Living, Food and Nutrition, Broad Knowledge of the Arts, Biology, Economics, and Business Students' Elective Subjects: Accounting, Costing, Economics, Business Management, and Mathematics. Students majoring in the arts have the option to choose three or four electives from the following: Economics, Government, History, Geography, Literature, French, Mathematics, Akan, and Christian Religious Studies. Students majoring in Visual Arts can choose from Sculpture, General Knowledge of Arts, Textiles, Graphic Design, and Economics. Students majoring in Technical Skills can opt for Chemistry, Physics, and Mathematics, Technical Drawing, Wood Carving, Metal Works, and Building Technology. Students in Agriculture Science can choose three or four elective subjects to complete their course curriculum from Animal Husbandry, General Agriculture, Horticulture, Physics, Biology, Mathematics, and Chemistry (Albert Anum, 2016).

To mark the end of the three years of study, students are required to undertake a mandatory examination under the West African Senior Secondary Certificate Examination (WASSCE) in the subjects of study (Adu Gyamfi et al., 2017). The Ministry of Education, Ghana Education Service, and National Council for Curriculum Assessment are currently working on a new curriculum design for senior high schools, which will be adopted for the 2024/2025 academic year. This new curriculum will focus more on STEM for science-based students and a broader introduction to climate change and the environment (forestry).

Agricultural Science education has been part of Ghana`s culture for a long time, be it formal or informal even before the introduction of modern education (Hutchison, 2013). The introduction of agriculture science as a senior high school program was developed alongside other aspects of the senior high school curriculum to equip students with training and hands-on practical knowledge and experience to boost the agriculture sector in the country (Ameyaw-Akumfi, 2004; Hudu et al.,

2013), however, this is not without challenges, there have been several reports detailing issues with agriculture science education in senior high schools that dispels the intent of the curriculum setup, Hudu et al. (2013) outline a number of these challenges include low emphasis given to subject matter, disconnection between theory and practical application and using teachers without agriculture background.

2.5.1 Harmonizing Agricultural Extension and Education Theory

A course of study's expectations for both teachers and students are outlined in the curriculum. It comprises of books, teacher-created materials, and national and state academic standards. The curriculum is the collection of information that has been determined to be relevant to a certain topic (Ayisi et al., 2021). As with training in any academic subject, agricultural extension training is the result of an educational process with specific scientific content. However, Agricultural extension is also a system of education in and of itself and that using educational concepts in both extension training and real-world application is crucial (Gillespie et al., 2019).

Education is defined by Meyer & Börner, (2022), as a gradual process through which people integrate and acquire knowledge, abilities, and understanding. They distinguish between professional technical skills and professional practical skills as the two levels of education, and they claim that by being proficient in both, a student will be able to think like a professional and will know what and how (from the former and will know why from the latter). They go on to say that to do this, students must take ownership of their education and be given the chance to participate actively in their learning rather than merely receiving it (Ayisi & Kozári, 2021). In terms of both excellent accountability and effective learning, already existing educational theory also supports a competency-based approach to education (Alotaibi et al., 2021). Through implementation of the outcomes-based education, this strategy has received formal recognition in

Africa (Thapa Magar et al., 2021). This makes it important that agricultural extension curricula and practices are competency-based.

The evolution of educational systems must take into account the particular environment in which they are designed to operate (Yitayew et al., 2021). Similarly, Cook et al., (2021) opined curriculum should take into account and adapt to changes in the social situation. Therefore, creating specific African-specific benchmarks for agricultural extension education is a worthwhile, though not necessary, task.

2.5.2 Curriculum Developers for Agricultural Extension Education

A framework for agricultural education is presented along with some of its elements in the examination of the African agricultural policy, the educational policy, and the agricultural education strategy that follows (Davis et al., 2021). In addition, many of the aforementioned ideas, plans, guidelines, and points of view may be applied to the development of learning agenda competencies, such as technical competence, practical experience, and theoretical foundation. To be able to meet the objectives of the National Strategy for Agriculture, these competencies must also convert into farmer skills in the case of agricultural extension and at a level adequate to their farming and common farmer aspirations (Dehghanpour et al., 2022). The extension agent must thus possess a particular set of competences to help farmers acquire these skills.

It should be noticed that the word "capability" rather than "competency" is used here. Isaac & Mzwakhe, (2020) mentioned competencies for Agricultural Extension, however, due to their integration, capabilities are a better notion to employ when building curriculum. A capacity, in the words of Niagia et al., (2022), is "an integration of a repertoire of skills, usable knowledge, attitudes, and aptitudes in professional praxis, in such a way that these are combined and applied appropriately for successful performance in real-world contexts." The connection between

professional skills and disciplinary knowledge is represented by holistic capabilities as well (Maake & Antwi, 2022). Four fundamental skills define the idea of capacity, according to Somanje et al. (2021). Which include:

i. Taking appropriate and effective actions;
ii. Explaining what they are about;
iii. Cooperating and working effectively with others and
iv. Continue to learn from their experiences as individuals in association with others, in a diverse and evolving society.

According to Somanje et al. (2021), capable people are not only aware of their specialties but also possess the self-assurance in applying their knowledge and skills in a variety of givers and evolving situations and to continue honing their specialized knowledge and skills after they have completed their formal education. In such a setting, Asrat & Simane, (2018) contended that specific workplace competences cannot be understood with the degree of precision necessary for the development of restricted capabilities like those frequently created for agricultural extension sector. Given the extent of agriculture's dynamism, it might not even be preferred.

To collect and synthesize the concepts presented in these tools, the following set of agricultural extension markers was created. The four basic types of these suggested markers are the learning contents markers, the meta-markers, the practical content markers, and the process markers. It is widely understood that the terms "theory and practice" refer to ideas, concepts, techniques, and skills as well as the related attitudes and understandings (Diab et al., 2020).

In Ghana's northeast, curriculum development is linked to agricultural extension services, farmer productivity, and yield. It provides examples of the elements of an effective agricultural extension

service program that might support sustainable agriculture, food security, the eradication of poverty, and economic prosperity. Improving farmer capacity, inputs, outputs, and outcomes are some of these components.

Some of the inputs employed in the program include agribusiness equipment, agricultural inputs including seeds, fertilizer, and pesticides, as well as agricultural extension services and farmers' agricultural experience. These inputs are essential in equipping farmers with the information, assets, as well as tools needed to improve their agricultural operations and boost output.

Farmers' capacity building is the process of developing a program that involves agricultural extension services, knowledge and technology transfer, farming practices, and yield improvement. The extension services serve as a platform for transferring of knowledge and technology to farmers. This knowledge is then applied to improve farming practices, which in turn leads to yield improvement.

The outcome results include increased output, improved agricultural practices, greater wages, and better living circumstances for farmers. These outputs are essential for the program to succeed and for the anticipated outcomes to materialize. In terms of sustainable agriculture, the program's outcomes include increased food security, decreased poverty, and economic growth. These outcomes are important for the development of the region because they assist Ghana's northeast region in achieving the Sustainable Development Goals established by the United Nations.

The framework emphasizes the need for curriculum development to ensure that the program meets the requirements of extension workers and farmers who have been identified to complete it. The process of developing a curriculum includes analyzing outputs and outcomes, determining the

knowledge and skills required for agricultural extension services, building a curriculum to satisfy those needs, implementing the curriculum, and assessing the curriculum.

Form the conceptual framework that was presented, it is obvious in the Northeast Region of Ghana how agricultural extension services, farmer yield, and curriculum development are related. This paradigm may serve as a guide for developing effective agricultural extension services programs that support sustainable agriculture, food security, poverty reduction, and economic growth.

2.6 EMPIRICAL STUDIES

The scope of crop farmers' difficulties in obtaining the extension services offered by the department of Agricultural Extension (DAE) was explored in research by Panetto et al. (2020). Three villages in Bangladesh; Mymensingh district, Gauripur, and Upazila (sub-district) served as the subject of this study. A pre-tested and organized interview schedule was used to conduct face-to-face interviews with 100 randomly selected farmers to collect data. Using a 4-point rating scale, the essential variable known as the degree of issues was measured. The data entry and step-wise regression models were both used. According to the findings, 40% of respondents had high issues, compared to 50% who had moderate problems. According to the respondents, the most important problem was the extension workers' weak communication skills, followed by a lack of resources and keeping in touch with farmers who had access to plenty of resources. The challenges experienced by crop producers were strongly correlated with their education level, perceived economic return, and involvement in extension activities, training, and fatalism. The degree of issues with extension services was shown to be significantly influenced by education, perceived economic return, participation in extension activities, and training. By addressing the major impacting elements, the study identified several options for policymakers to enhance DAE's agricultural extension services.

Through the use of demand-driven extension education (DDEE) methodologies, Brown et al. (2018) explored demand-driven agricultural extension education in Nigeria and underlined the necessity for every extension personnel to develop soft skills in addition to their technical expertise. To evaluate diverse ideas of the demand-driven extension education, capacity development, skill, and skill-mismatch, an evaluation of demand-driven agricultural extension education in Nigeria as introduced by Sasakawa Africa Fund for Extension Education in universities was conducted. The reviews were subjected to a thematic analysis, and the results were presented in accordance with the topics that emerged from the review analysis. The theoretical foundation of this work is provided by the ideas of reconciling jobs and human capital. The study also outlined the many advantages of DDEE, chief among which are its flexibility in meeting the needs of students and employers, its use of dynamic work-based pedagogy to enhance competencies, and its responsiveness to the demands of the labor markets to maintain continuous alignment between expected qualifications and available training. In order to provide farmers with better and more sustainable extension and services, it is critical to effectively incorporate the use of demand-driven extension education methodologies in the training of extension employees.

Bellon et al. (2020) examined the opinions of enrolled agriculture extension students regarding the agricultural extension curriculum that are currently offered in Pakistan's agricultural colleges. The major goals were to identify areas of the curriculum that needed improvement and to present information on students' evaluations on the whole structure of the agricultural extension program. The study's target population consisted of four agricultural institutions in Pakistan. Data were gathered from 142, or 80%, of the 168 students in the agriculture extension program out of 168 (70%) due to a lack of responses to the mail survey regarding the objectives, contents, goals, relevance, understanding of challenges for jobs and the field, technology effectiveness, and overall

satisfaction. Results of the study showed that the curriculum supported higher level thinking abilities (which 64% of respondents agreed), improved students' confidence (which 69% strongly agreed to accomplish), and motivated students to learn more (which 55% of respondents were clear about). Students thought that each course's goals were clearly stated, that the instructional strategies were suitable, and that the presentations made sense. 65% of the students believed that the curriculum's quality was good, that it included real-world examples, and that it helped them comprehend agriculture extension programs and services after they finished the course. Participants were encouraged to ask questions and participate in discussions by the instructors. The atmosphere in the classroom fostered learning. There were a few issues with the current curriculum, such as course overlap, a lack of links between students and the extension department, and limited chances for students to properly apply theory. It may be inferred that the respondents are satisfied with the curriculum's format, goals, capacity to aid in skill development, and relevance to their field of study. A relationship between students and the agriculture extension department should be established, and it was suggested that the curriculum be updated to reflect contemporary extension ideas.

In their paper "Agricultural extension and its effects on farm productivity and income: insight from Northern Ghana," Danso-Abbeam et al. (2018) examined cross-sectional data from 200 farming households in two districts in the northern region of Ghana. The study used Regression on associated variables, regression on likelihood scores, and Heckman effect of treatment mode were used to evaluate the consistency of the estimates. The study found that, depending on the main factor of interest (the ACDEP agricultural extension program), socioeconomic, institutional, and farm-specific variables had a major impact on farmers' incomes. These findings were made in

relation to the estimation technique employed. Extension programs were also found to have a positive economic impact on farmers' financial status.

They concluded that agricultural extension services are essential for raising household income and farm production. They suggested that the delivery of agricultural extension services be improved by hiring agents on time, training them on a regular basis, and setting up sufficient logistics.

Huang et al. (2022) assert that agriculture is regarded as the foundation of the country's economy. This is true since it is the source of income production, food security, and poverty alleviation. To increase food security and the nutritional status of the populace, the federal government has implemented sensible policies, plans, and initiatives. To deal with the nation's food supply, it becomes necessary for today's farmers to enhance their knowledge and abilities. Farmers' education is the duty of agricultural extension agents from both the public and private sectors. This shows that a farmer's efficacy and efficiency may be influenced by the strategies, techniques, and procedures used by extension agents to carry out their duties. Like everyone else, farmers in the country are adult learners, and they surely have comparable and special characteristics. Rural extension agents need to be familiar with anagogical principles to get the greatest outcomes. The research looked at Malcon Knowles' pedagogical theories, how they were applied to farmer education, and what that meant for rural extension workers.

Having studied all these works, it is evident that little has been done in the area of harmonizing agriculture extension with the curriculum at the Senior High School level in other to prepare learners who offer agriculture programs adequately towards assisting farmers on the field.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

This chapter explains the methodology employed in the study consisting of the design of the study, profile of study area, study approach, study population, techniques and procedures used in sampling as well as collecting data and its analysis.

3.1 STUDY AREA

3.1.1 Location and Size

The North East Region was carved out as one of the new regions of Ghana. It is located in the northeastern part of the country and was created in the year 2018 after a referendum was voted upon to break it off of the Northern Region of Ghana (Tambo, 2016). The North East region covers an area size of 9,072-kilometer square representing 6.3 percent of the total land mass of Ghana and shares boundaries with Upper East to the north, Northern Region to the south, Togo to the east, and Upper West region to the west. The Region is lying between longitudes 0˚5' and 46.7124''E and 0˚5.7785'E and between latitudes 10˚31'7.6584''N and 10˚31.1276'N (Tambo, 2016).

3.1.2 Climate, Topography and Drainage

A single rainfall pattern carried in by the tropical maritime air mass (MT) is characteristic of the northeast area, which is located near the tropical continental western edge. Every year, this takes place between April and October (Achana et al., 2015). The tropical continental air mass (CT) that follows causes the dry season (Harmattan), which lasts from late November to early March. The average annual rainfall ranges from 1000 to 1500 millimeters, with the peak months being July through September. The area has a protracted dry season, with March and April being the driest

months. The yearly mean temperature varies from 27.4°C to 35°C depending on the season, making the temperature quite high. The dry season has the greatest temperatures, while the harmattan season has the lowest temperatures (Rhebergen et al., 2016).

The Gambaga escarpment marks the northern limits of the Voltain Sandstone basin, and the topography is normally rather undulating. With the exception of the mountainous regions that surround the escarpment, there is virtually any drainage when it rains. There are numerous forms of rock formation due to the varied relief features, which range from mountains with sharply pitched peaks to valleys with flat bottoms (Rhebergen et al., 2016). The upper portion of the region is highlighted by the middle Voltain formation, which is composed of shale, mudstone, iron pans, and sandstone. The location provides a good drainage basin. As it approaches the northeastern section around Gambaga, the Red Volta joins the White Volta. The Nawong and Moba rivers are important perennial rivers in the region of the North East (Tambo, 2016).

3.1.3 Geology and Soil

In the area, there are primarily two types of soil. These are the Groundwater Laterites and Savannah Ochrosols. The upland soils were mostly created on Voltain sandstone, and the Savannah Ochrosols, which nearly entirely covers the region, is moderately drained. The surface soil has a sandy-to-sandy loam texture and a significant amount of water retention. A lesser area of the territory is covered by Groundwater Laterite, which is mostly found in the southern half of the region (Acheampong, Agyemang, & Abdul-Fatawu, 2017). Most of the materials used to create these concretionary soils were argillaceous sandstone, mudstone from the Volta Mountains, and shale. The soil has a sandy loam texture, which makes it perfect for producing annual food crops like maize, millet, sorghum, and watermelon as well as significant tree commodities with protracted gestation periods, such sheanut, dawadawa, and cashew (Achana et al., 2015).

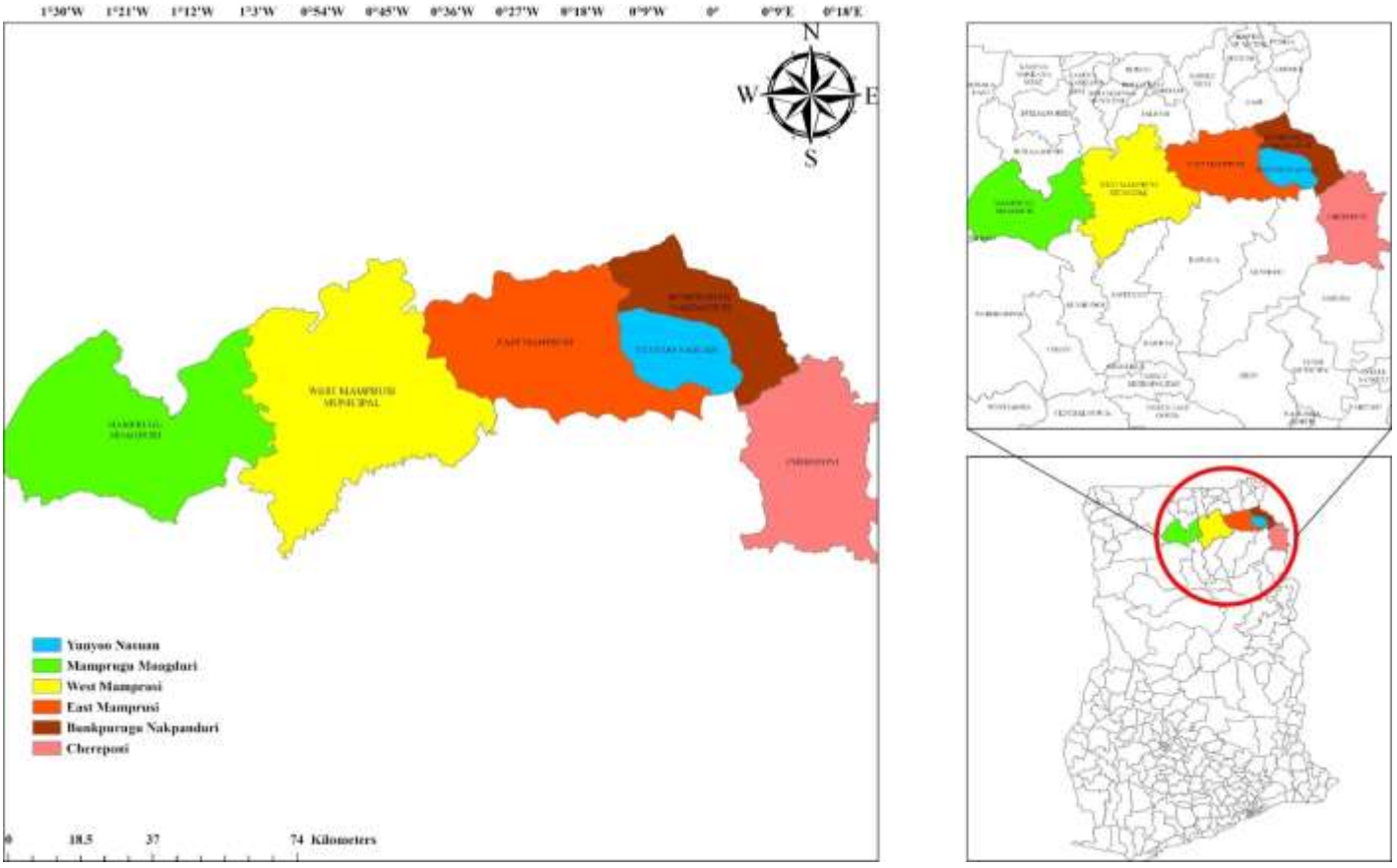

Figure 3.1: Map of North East Region of Ghana

Soure: Field survey, 2023

3.1.4 Vegetation, Land Use and Agriculture

The North East area features common grass vegetation and trees like dawadawa, baobab, sheanut, etc. It is located inside the inner woodland savannah belt. The grasses can grow up to three meters tall and are tussock-like in growth (Rhebergen et al., 2016). De pending on the two dominant climatic conditions, there is a noticeable variation in the vegetation. Animals may graze on the grasses that serve as their food during the rainy season, which relieves animal owners of having to locate food for their livestock. For the women who harvest shea nuts and turn them into shea butter, the shea tree has enormous economic importance (Acheampong et al., 2017). The overall land area of 9,072 sq. km is expected to be 70% arable (6,350.4 sq. km). Although the general fertility of

the land is still unclear, farmers must apply a lot of fertilizer to grow adequate crops. Land is also utilized for urban expansion, mining, and forest reserves in addition to agriculture. Family leaders frequently own the land, which they under various circumstances lend to other individuals for development reasons (Antwi-Agyei, Dougill, & Stringer, 2015).

3.1.5 Demography

The last census carried out by the population and housing census in 2021 pegged North East Region population at 658, 946. It is the second to last populated region in Ghana after Oti region. Among the six (6) districts in the North East Region, East Mamprusi Municipal recorded the larest population size, 188, 006 (29%) out of the region's total population. West Mamprusi Municipal recorded 175, 755 (27%), Chereponi district recorded 87, 176 (13%), Bunkpurugu-Nakpanduri district recorded 82, 384 (%), Mamprugu Moagduri district recorded 68, 746 (10%) and Yunyoo-Nasuan district recorded (13%) (Antwi-Agyei et al., 2015). According to the findings of the 2021 Population and Housing Census, the population of the region is comprised of 337, 380 females (51.2%) and 321, 565 males (48.8%) (Kleemann et al., 2017).

3.1.6 Major Economic Activities

Whether directly or indirectly (through production and processing), agriculture employed more than 80% of the local population. Trading, mining, weaving, basket making, traditional textile production, and fishing are examples of additional economic activity. Agriculture contributes more than one-third of the nation's gross domestic product and has long been the main economic driver in the area (Antwi-Agyei & Stringer, 2021). The majority of farmers raised yams, groundnuts, beans, and other roots and tubers in addition to food crops including millet, sorghum, and maize. They also raise ruminants and cattle, however the majority (91.4%) of farmers in the area live in rural regions. There are parallels between the remaining urban and rural regions in the region, with

the exception of cities like Nalerigu, Gambaga, and Walewale, which account for slightly more than half (52.9%) of the agricultural households in the rural districts (Antwi-Agyei et al., 2015). One-fifth of the agricultural homes in the region had 10 or more members, making up 20.4% of all agricultural households. Furthermore, 27.2% of its population is made up only by East Mamprusi Municipal. With an average size of 6.9 people, it can be concluded that agricultural households in the North East Region are substantial (Antwi-Agyei & Stringer, 2021).

3.2 STUDY DESIGN

The study used a cross-sectional study design. This was used for its ability to easily analyze data collected by the researcher to provide insights from a population at a particular period of time. A cross-sectional survey is concerned with the collection of data to make inferences on conditions or relationships, people's opinions, and popular practices at a particular period. To seek information on the effects of agricultural extension services on the yield of maize farmers in the northeast region, the study adopted the survey quantitative approach. This study is grounded on the Positivist thinking who believe in resorting to empirical evidence and scientific methods to understand a social and natural occurrence. Positivist strongly believes that the only way knowledge can be derived is through observation and systematic process based on facts that are measurable. This philosophy further argues that scientific research should not be conducted subjectively thus to avoid bias or emotions as they are irrelevant to scientific investigations. It has been particularly useful in social fields of study as it offers empirical and a step by step explanations to reasons and factors for change in behavior and attitudes of people in a society (Creswell & Creswell, 2013). The variable “farmer’s yield in maize” can be measured and interpreted hence fits perfectly well with the positivist thinking.

3.3 STUDY POPULATION

As defined by Cappella et al. (2011), a study population is a group that the researcher is interested in learning more about in order to draw conclusions. The entire group of individuals, objects, or occurrences that the researcher wants to analyze is known as the population (Hyett et al., 2014). The study's participants were local maize farmers, extension agents, and SHS agriculture science instructors. The number of registered maize farmers in the region is unclear, however the North East regional MoFA directorate estimated registered farmers who are specifically into maize cultivation at 1000 and reported that 51 extension officers are employed in all of the region's districts. This study mostly examined maize farmers, who are often involved in the food value chain and work in agricultural settings.

The importance of maize in the region cannot be overemphasized, in fact maize is traded through local and global supply chain, and at various points along the chain and sold as various products (Cappella et al., 2011). Agricultural extension officers, Farmers, and agricultural science teachers were the participants in the domestic value chain who were selected for the study. The research population is characterized as being of a heterogeneous type since the characteristics of the participants are relatively dissimilar in terms of function. Although the precise sizes of individual players are known, the total number of cases that comprise the research population is unknown (Hyland et al., 2017).

The total number of senior high schools that offer agricultural science programs in the northeast region is five with a total of 67 teachers (GES, 2022).

3.4 Sampling and sample size determination

This study sampled participants among three different categories; extension officers, teachers, and farmers to understand how agricultural extension services affect the yield of maize**.** Given this assumption, the sample size was calculated based on Cochran's (1977) formulae for calculating a sample proportion.

$$n=\frac{\frac{Z^2(p)(1-p)}{e^2}}{1+\frac{Z^2(p)(1-p)}{Ne^2}}$$

Where;

(n)= Sample size

(N)= Population Size

(e) = Margin of Error=0.05

(z) = Confidence Level of 95%=1.96

(p) = Standard Deviation of 50% (or 0.5)

Therefore;

$$n=\frac{\frac{1.96^2(0.5)(1-0.5)}{0.05^2}}{1+\frac{1.96^2(0.5)(1-0.5)}{1000(0.05)^2}}$$

$$n=\frac{384.16}{1.384}= 277.57 =278$$

n≈278 and adding a 10% design effect (Cochran, 1977) to the sample realizes a total of 306 for farmers.

Therefore, the total sample size for farmers in this study was 306 calculated from the estimated 1000 registered maize farmers by the MoFA directorate.

Adding the (306) farmers, (51) extension officers (51) and teachers (67) therefore obtains the sample size is 424.

The farmer, teacher, and extension officers' population is presented in the table below.

Table 3.1 Summary of Study Populations

Categories	Sample size
Farmers	306
Teachers	67
Extension officers	51
Total sample	**424**

Soure: Field survey, 2023

3.5 SAMPLING TECHNIQUES

The sampling technique used in the study was purposive sampling. Purposive sampling is a technique where the sample is selected because they have specific characteristics the researcher desires(Campbell et al., 2020). In other words, units are chosen on purpose in purposive sampling. Purposive sampling is selecting groups or places that already exist naturally at random, and then taking certain elements from those groups or places. Before the respondents are selected for the study cluster sampling was done by dividing the entire area in to three clusters: Chereponi and East Mamprusi districts, Bunkpurugu-Nakpanduri and Yunyoo-Nasuan districts, West Mamprusi Municipal and Mampurugu moagduri. Three of these districts (East mamprusi, Mamprugu moagduri and the Bunkpurugu-Nakpanduri districts) were purposively selected for their dominance in maize cultivation. The research deals with three categories of respondents; maize

farmers, agriculture science teachers at senior high schools, and agriculture extension officers. A total of 306 maize farmers were purposively sampled from districts that dominated in maize cultivation however the entire population of agriculture science teachers (67) and agriculture extension officers (51) were interviewed for this study.

3.6 DATA COLLECTION PROCEDURE

The researcher obtained an introductory letter from the Head of the Agricultural and Consumer Sciences Education Department and served it to the various institutions under consideration. The data collection commenced upon permission granted by the heads of these institution

Both primary and secondary data was collected for the study using an interview guide at the regional GES office and MOFA Directorate respectively. Descriptive method was employed because the main aim of the study was to assess the effects of agriculture extension services on the yield of maize in the northeast region. The respondents were assured of their anonymity and confidentiality hence were encouraged to give more honest responses to help the research study. To increase the validity of the responses the research was scheduled appointments with each category of respondents at their time of convenience. The study involved three categories of respondents; extension officers, agriculture science teachers and maize farmers in the northeast region. The research employed the use of questionnaire and semi-structured interviews in order to cater for the uniqueness of each category of respondents.

The questionnaire was use to solicit information from extension officers because they could read and write hence could complete a questionnaire with little guidance. Data from farmers was collected by guiding them through the questionnaire because they could not read and write.

3.7. DATA COLLECTION INSTRUMENTS

Data was collected using questionnaires.

The questionnaire was use to solicit information from extension officers because they could read and write hence could complete a questionnaire with little guidance. Data from farmers was collected by guiding them through the questionnaire because they could not read and write.

. A data collection tool that was used to administer the questionnaire all three categories of respondents was the **kobotool collect app.** This was used due to the large size of the target population.

The questionnaire was put into sections with each addressing an objective in the study.

Section A asks questions on the demographic information of respondents.

Section B elicits information on the views of maize farmers in the northeast region about the current state of agricultural services.

Section C seeks the opinion of farmers in the region producing maize on the effect of agricultural extension services on the yield.

Section D seeks the opinions of extension officers and agriculture science teachers on the implications of the study for curriculum development.

However, parts of the questionnaire were adopted from past research and retailored to suit the objectives of this study. The questionnaire was converted to digital form to hasten the data collection and analysis procedure. Because it removes data entry, a challenging step in data administration.

3.8. VALIDITY OF THE INSTRUMENTS

A research instrument's validity is established, under Patterson et al. (2018) by how well it accomplishes the objective for which it was designed. It is measured to what extent a research tool is accurate. Validity is simply the act of determining if an instrument can accurately perform the intended function in light of the quality of the output. Validity has to do with establishing the degree to which a researcher's conclusions effectively reflect empirical reality and assessing whether constructs used by a researcher represent categories of human experiences.

Content validity was used to assess the relevance of the questionnaire in the study. This was done by assessing and measuring whether the questionnaires contained all relevant aspects of the objective, the theoretical concept, and possibly the ground idea of the research and how it could lead to findings that address the same. The disciplines in a study may be different from each other or the method used to collect the data and analyze it may equally vary, but what scientific research strives for is reliability and validity (Wykstra, 2017).

3.9 RELIABILITY OF THE INSTRUMENTS

The degree to which a measure deviates from the change and observation over time for a certain unit of analysis measured several times by the same instrument is known as reliability (Santee, Marszalek, & Hardinger, 2019). Continuity is defined by Santee et al. (2019) as the degree of information stability or consistency, or more precisely, the degree to which the same information is provided when a measurement is conducted more than once. To confirm accuracy, consistency, reliability, and stability, pretesting was done on the data collection methods and equipment to see if they could measure the intended thing consistently. Test-retest reliability was applied; a pretested version of the questionnaire was administered to a sample of participants and repeated

over some time. This was done to measure if the test instrument is reliable and can repeat results the same as previously. In light of the pre-test findings, areas of concern that require clarification were amended. Reliability is concerned with the explicability of scientific findings; validity is concerned with the accuracy of scientific findings.

3.10. DATA ANALYSIS AND PRESENTATION

Data was analyzed using STATA V.18. Both descriptive and analytical statistics were used in presenting the results of the data. Data for each of the research questions was analyzed as indicated in table 3.2 illustrating the type of data for each of the research objectives and how they were analyzed in this study.

Table 3.2 Summary of Data Analysis

OBJECTIVE	DATA	ANALYSIS
1. To assess the current state of agricultural extension services in the North East Region of Ghana.	Quantitative	Descriptive statistics such as frequencies and percentages were used to summarize the current state of agricultural extension services in the Northeast Region of Ghana
2. To determine the factors affecting yield of farmers in the North East Region of Ghana.	Quantitative	Inferential (chi-square) used to determine the factors affecting yield of farmers in the Northeast Region of Ghana.
3. To investigate the effects of agricultural extension services on the yield of farmers in the Northeast Region of Ghana.	Quantitative	Descriptive statistics was used to measure the effects of agricultural extension services on the yield of maize farmers in the Northeast Region of Ghana
4. To explore the implications of the study for curriculum development in agricultural extension services in the Northeast Region of Ghana	Quantitative	Inferential (Chi-Square) and descriptive statistics was used to explore the implications of the study for curriculum development in agricultural extension services in the Northeast Region of Ghana.

Soure: Field survey, 2023

3.11 ETHICAL CONSIDERATION

An introductory letter was sought from the university and permission from key stakeholders. Informed consent was given for respondents to agree or otherwise to answer or respond to the questionnaire. The informed consent was read out and interpreted by the researcher to respondents who had not been through formal education.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 INTRODUCTION

The findings and analysis of the field data are presented in this chapter. The analysis and findings in this chapter is organized into various themes or parts based on the study's objectives. It also situates the evidence obtained by juxtaposing it with previous studies to identify convergence or divergence for purposes of discussion. The socio-demographic information of respondents, such as age, sex, religion, and education, is presented in the chapter's first section.

4.1 SOCIO-DEMOGRAPHIC INFORMATION OF EXTENSION OFFICERS

The table below shows the socio-demographic information of extension officers in frequencies and percentages, these are the officers who were engaged in the northeast region of Ghana

Table 4.1: Socio-Demographic Information of Extension Officers

Variable	Category	Frequency	Percentage (%)
Gender	Male	32	62.7
	Female	19	37.3
Age	18-30	10	19.6
	31-40	24	47.1
	41-50	17	33.3
Marital Status	Divorce	5	9.8
	Married	26	51.0
	Never Married	8	15.7
	Not Married	10	19.6
	Separated	2	3.9
Education	SHS	7	13.7
	Tertiary	44	86.3

Soure: Field survey, 2023

Table 4.1 above shows the socio-demographic information of extension officers in this study which revealed that the majority (62.7%) of extension officers are male. This is consistent with earlier studies, the Food and Agriculture Organization (FAO) of the United Nations (UN) reported in a study that, in many developing countries, agriculture is still predominantly a male-dominated sector, with men accounting for 60-80% of agricultural workers (FAO, 2019). This may be due to cultural and societal norms that view farming as a masculine activity.

It was further found that the majority (47.1%) of the population of extension officers interviewed were found to be within the age brackets 31-40 years, this is supported by Edwards and Oteng's work, (2019) which revealed that majority of extension officers fall within the age category of 31-40 are considered to be in the prime of their careers and are likely to be more experienced and knowledgeable in their field. A study by the International Fund for Agricultural Development found that farmers trained by vibrant, more educated, and well-equipped extension agents are more likely to adopt new agricultural practices (Edwards & Oteng, 2019). Another finding was that the majority of extension officers are married, this finding is also consistent with the work of previous studies by Adewole et al. (2020) which found a positive correlation between marital status and agricultural productivity. This may be because married farmers are more likely to have access to resources such as land, capital, and labor, which can help them to be more productive (Adewole et al., 2020).

4.2 DEMOGRAPHIC CHARACTERISTICS OF AGRICULTURE SCIENCE TEACHERS

Table 4.2 presents the demographic characteristics of teachers, including variables such as gender, age, years of practice, and highest level of education obtained by the teacher. Below is a detailed discussion of these findings, compared with relevant literature to evaluate whether these results align with broader trends and studies.

Table 4.2: Demographic Characteristics of Teachers

Variable	Category	Frequency	Percentage (%)
Gender	Female	31	46.3
	Male	36	53.7
Age	31-40	23	34.3
	41-50	41	61.2
	above 50years	3	4.5
Years of practice	0-3	10	14.9
	4-6	33	49.3
	7 and above	24	35.8
Highest level of education/certificate obtained	Certificate/Diploma	7	10.4
	Degree	56	83.6
	Masters	4	5.9
	PHD	0	0.0

Soure: Field survey, 2023

Table 4.2 shows a relatively balanced gender distribution, with males representing 53.7% and females 46.3% of the teachers. This is somewhat atypical compared to the global trend where males generally dominate the agricultural sector. The FAO (2011) reports that men usually have greater access to resources such as land and credit, which can influence their higher participation rates in farming. However, in some regions, particularly in sub-Saharan Africa, women play a crucial role in agriculture, often being responsible for a significant portion of food production. This finding might indicate a region where gender roles in agriculture are more balanced or where initiatives to empower female teachers have been more successful. Greater populations of respondents were found to be 41-50 years representing 61.2% and a relatively higher number of respondents had many years of experience in the field as they have served in the teaching sector between 4-6 years representing 49.3%. The highest educational level of the majority of respondents was degree representing 83.6%.

4.3. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF FARMERS

Table 4.3 presents the demographic characteristics of farmers, detailing their gender, age, education, household head status, household size, and income. Here, the study discussed the findings and compared them with relevant literature to analyze whether these results are in agreement or disagreement with broader trends and studies.

Table 4.3: Demographic characteristics of farmers

Variable	Category	Frequency	Percentage
Gender	Female	96	31.4
	Male	210	68.6
Age	18 – 24	19	6.2
	25 – 30	47	15.4
	31 – 35	37	12.1
	36 – 40	82	26.8
	41 – 45	54	17.6
	46 – 50	54	17.6
	above 50years	13	4.2
Educational Status	No formal education	150	49.0
	Primary	0	0
	JHS	39	12.7
	SHS	76	24.8
	Tertiary	41	13.4
Are you the household head	No	148	48.4
	Yes	158	51.6
	1 – 3	19	6.2

Household size	4 – 6	121	39.5
	7 – 9	100	32.7
	10 – 13	66	21.6
Income	Below GHc100	48	15.7
	GHc100-300	69	22.5
	GHc301-600	81	26.5
	GHc601–900	57	18.6
	GHc901-1200	23	7.5
	above GHc1200	28	9.2

Soure: Field survey, 2023

The results indicates that 68.6% of the farmers are male, while 31.4% are female (Table 4.3). This male dominance is a common trend in agricultural communities worldwide. Literature consistently shows that men are more likely to be involved in farming activities due to traditional gender roles and access to resources. For instance, FAO (2021) highlights that men often have better access to land, credit, and agricultural inputs compared to women. This gender disparity in agriculture underscores the need for gender-specific policies to ensure equitable access to resources and opportunities.

The distribution in age of respondents indicated a significant concentration of farmers between the ages of 36 and 40, accounting for 26.8% of the sample. This aligns with studies indicating that middle-aged individuals are more likely to be engaged in farming. Younger individuals (18-24) constitute only 6.2% of the farmers, which may reflect the migration of younger populations to urban areas in search of better opportunities, a trend noted in many developing countries. According to the World Bank (2020), youth migration from rural to urban areas often leaves an

aging population to manage agricultural activities, affecting productivity and innovation in the sector

The educational attainment of the farmers reveals that nearly half (49%) have no formal education, while only 13.4% have tertiary education. This low level of formal education among farmers is a critical issue, as it can limit the adoption of modern farming techniques and technologies. According to Feder, Just, and Zilberman (2019), education significantly impacts the ability of farmers to implement new agricultural practices. Enhancing educational opportunities for farmers can lead to improved productivity and sustainable farming practices

The study further shows an equal distribution of household heads, with 51.6% of respondents indicating they are the household heads. This balance suggests that decision-making in farming households may be more evenly distributed than traditionally thought. Literature such as Doss (2017) highlights the importance of recognizing the role of both men and women in household decision-making to implement more effective agricultural policies.

The majority of farmers (39.5%) have household sizes ranging from 4 to 6 members. Larger household sizes can be beneficial for labor-intensive agricultural activities, providing a substantial labor force. However, they can also indicate higher dependency ratios, which might strain household resources. Studies by Ellis (2020) show that larger households can both positively and negatively impact agricultural productivity, depending on the balance between labor contribution and consumption needs.

Income distribution among farmers is varied, with the largest group (26.5%) earning between GH₵301-600 monthly. Notably, a significant portion (15.7%) earns below GH₵100, highlighting the prevalence of low-income levels in farming communities. This income disparity is consistent

with findings from various studies, such as those by the IFAD (2010), which report that smallholder farmers often struggle with low incomes due to limited access to markets and resources. Efforts to improve market access and provide financial support are essential to enhance the economic well-being of farmers.

The demographic characteristics outlined in Table 4.3 align with existing literature on agricultural communities. The gender disparity, age distribution favoring middle-aged individuals, low levels of formal education, equal household head distribution, large household sizes, and varied income levels are all consistent with broader trends observed in agricultural studies. These findings highlight the ongoing challenges in the agricultural sector, including gender inequality, youth migration, educational deficits, and income disparities. Addressing these issues through targeted policies and interventions is crucial for sustainable agricultural development and improved livelihoods for farmers.

4.4. Current State of Agricultural Extension Service in the Northeast Region?

The table below discusses the current state of agriculture extension services in the northeast region of Ghana.

Table 4.4: Current state of agricultural extension service in the northeast region of Ghana

Variable	Category	Frequency	Percentage
Extension officers in the region have requisite knowledge of the content of extension services	Agree	34	66.7
	Disagree	12	23.5
	Neutral	5	9.8
Extension officers are well-equipped with the requisite communication skills	Agree	5	9.8
	Disagree	44	86.3
	Neutral	2	3.9
Extension officers use different types of technology when delivering extension services	Agree	20	39.2
	Disagree	24	47.1
	Neutral	7	13.7
Extension personnel are trained with evaluation skills	Agree	37	72.5
	Disagree	10	19.6
	Neutral	4	7.8
Overall, I am satisfied with the available infrastructure	Agree	34	66.7
	Disagree	15	29.4
	Neutral	2	3.9

Soure: Field survey, 2023

The results from table 4.4 indicate that extension officers in the region have requisite knowledge of the content of extension services, with 66.7% agreeing and only 23.5% disagreeing. This is a positive finding as it suggests that extension officers are well-versed in the information and resources they are providing to farmers (Mohammed et al., 2018).

However, the results also show that most respondents do not believe that extension officers are well-equipped with the requisite communication skills, with 86.3% disagreeing. This is a

significant concern as effective communication is crucial for the successful delivery of extension services. This could be addressed through additional training and support for extension officers to improve their communication skills (Selorm et al., 2023).

In terms of the use of technology, the results revealed that technology is poorly utilized in the discharge of their duties, with 47.1% disagreeing that extension officers use different types of technology when delivering services. Suggestion by Osei-Kofi et al. (2023) indicated that there is a need for further investment in technology and training for extension officers to better utilize digital tools in their work.

The majority of respondents (72.5%) agree that extension personnel are trained with evaluation skills, which is important for assessing the impact and effectiveness of extension services. This is a positive finding as evaluation is essential in determining whether agriculture extension programs are producing the expected results (Suvedi et al., 2016).

Overall, the majority of respondents are satisfied with the available infrastructure for extension services, with 66.7% agreeing. This suggests that there is a solid foundation in place for the delivery of extension services, but there may still be room for improvement in certain areas such as communication skills and the use of technology.

In conclusion, while extension officers in the region have good knowledge of the content of extension services, there are areas such as communication skills and the use of technology that could be further developed to enhance the delivery of extension services. Additional training and support in these areas could help to improve the overall effectiveness of extension programs in the region.

Types of Extension Services Rendered

Table 4.5 shows the various types of extension services rendered to farmers in the northeast region.

Table 4.5: Types of extension services rendered

Variable	Categories	Frequencies	Percentage
Technical services	Excellent	14	27.5
	Fair	6	11.8
	Good	6	11.8
	Poor	25	49.0
Facilitation services	Excellent	14	27.5
	Fair	13	25.5
	Good	8	15.7
	Poor	16	31.4
Advisory services	Excellent	12	23.5
	Fair	7	13.7
	Good	12	23.5
	Poor	20	39.2

Soure: Field survey, 2023

Based on the results provided in table 4.5, it can be seen that the technical services received the highest number of ratings in the 'poor' category, with 25 respondents giving a poor rating. Facilitation services received the highest number of ratings in the 'poor' category, with 16 respondents giving a poor rating. Advisory services had the highest number of ratings in the 'poor' category, with 20 respondents giving a poor rating.

These results suggest that there may be areas in technical services that need improvement to meet the expectations of the respondents. Organizations need to address any issues identified in technical services to improve overall customer satisfaction (Rane et al., 2023).

In the literature, technical services are considered a vital component in service quality and customer satisfaction. An article by Parasuraman emphasizes the importance of technical expertise and reliability in service delivery. Organizations that excel in technical services can build trust and loyalty among their customers (Rane et al., 2023)

Out of all the categories, respondents showed their dissatisfaction in the technical services delivered by the extension service. There seem to be some notable concerns regarding the quality or delivery of technical services, which could be linked to factors like technical expertise, responsiveness, or reliability. Technical expertise and reliability are essential factors that contribute to service quality and customer satisfaction, as highlighted by the studies conducted by (Mwololo and Aseta (2019 and Nordin and Höjgård (2017). Organizations must tackle these concerns to improve overall customer satisfaction and cultivate trust and loyalty among their customer base.

Facilitation services, on the other hand, received more positive ratings compared to technical services. This could indicate that the respondents were more satisfied with the level of support and assistance provided in their interactions with the organization. Facilitation services are important in ensuring smooth and efficient processes for customers, and organizations should continue to focus on providing high-quality facilitation services (Karakış et al., 2016).

It appears that these services meet basic expectations, but there is still room for improvement in order to achieve higher levels of satisfaction. Facilitation services play a vital role in ensuring that customers experience smooth and efficient processes. Respondents expressed higher levels of satisfaction with the support and assistance provided, as evidenced by the relatively more positive ratings compared to technical services. It is crucial for organizations to prioritize the maintenance

and enhancement of facilitation services in order to guarantee a satisfactory customer experience (Zivkovic, Jelic, & Rajic, 2009).

Advisory services in extension play a crucial role in helping customers make informed decisions and navigate complex issues, and extension organizations should prioritize enhancing the quality of advisory services to meet customer expectations (Ibbetson et al., 2021).

A total of 20 respondents expressed their dissatisfaction. These findings suggest that there may be areas where advisory services could be improved in terms of their effectiveness, relevance, or delivery.

The advisory services are essential in assisting customers in making well-informed decisions and navigating through intricate matters. Organizations must focus on improving the quality of advisory services to meet customer expectations and offer valuable guidance and support (Ogundari, 2022).

Overall, the results suggest that there are areas for improvement in technical, facilitation, and advisory services. By addressing these areas, organizations can enhance customer satisfaction and improve overall service quality.

4.5. CHALLENGES OF AGRICULTURAL EXTENSION SERVICE DELIVERY IN THE NORTHEAST REGION OF GHANA

Figure 4.1 presents' results on the challenges of extension services in the northeast region of Ghana. According to a number of studies, various factors contribute to extension officers' ineffective performance in providing extension services to farmers. Ragasa et al. (2016) identified several of these factors as major setbacks to extension officers' effective performance in the field,

including a lack of funding, cooperation, a clear policy and mandate, the ageing and poor competency of agents, and their inability to interact with key actors. From the figure below it is shown that more of the extension officers pointed to communication, high extension officer-farmer ratio, and lack of field allowance among other factors as challenges confronting them in their course of duty. Communication however was the most challenging factor hindering the effective performance of extension officers in the region and representing 29.4% on the figure 4.1 below which agrees with a study by (Taouab & Issor, 2019) who found that communication barriers were a significant challenge for agricultural extension workers in Nigeria. In the same study it was revealed that the extension officers faced challenges such as inadequate communication infrastructure, poor access to information, and language barriers. Secondly, highlighting communication challenges as a major obstacle for agricultural extension workers, a similar study by Rahman et al., (2021) found that the extension officers faced difficulties such as poor network coverage, inadequate communication equipment, and insufficient training in communication skills.

A few of the respondents pointed that lack of field allowance was a hindering factor to the effective performance of extension officers recording the least among the challenges with 7.5% as shown on the chart below. This is similar to a finding in a study by Bitzer (2016) revealing that "lack of funds for field, equipment, transport and information facilities" negatively affects the morale and performance of extension workers.

The figure below illustrates the various challenges militating against extension officers in the effective discharge of their duties in the northeast region of Ghana.

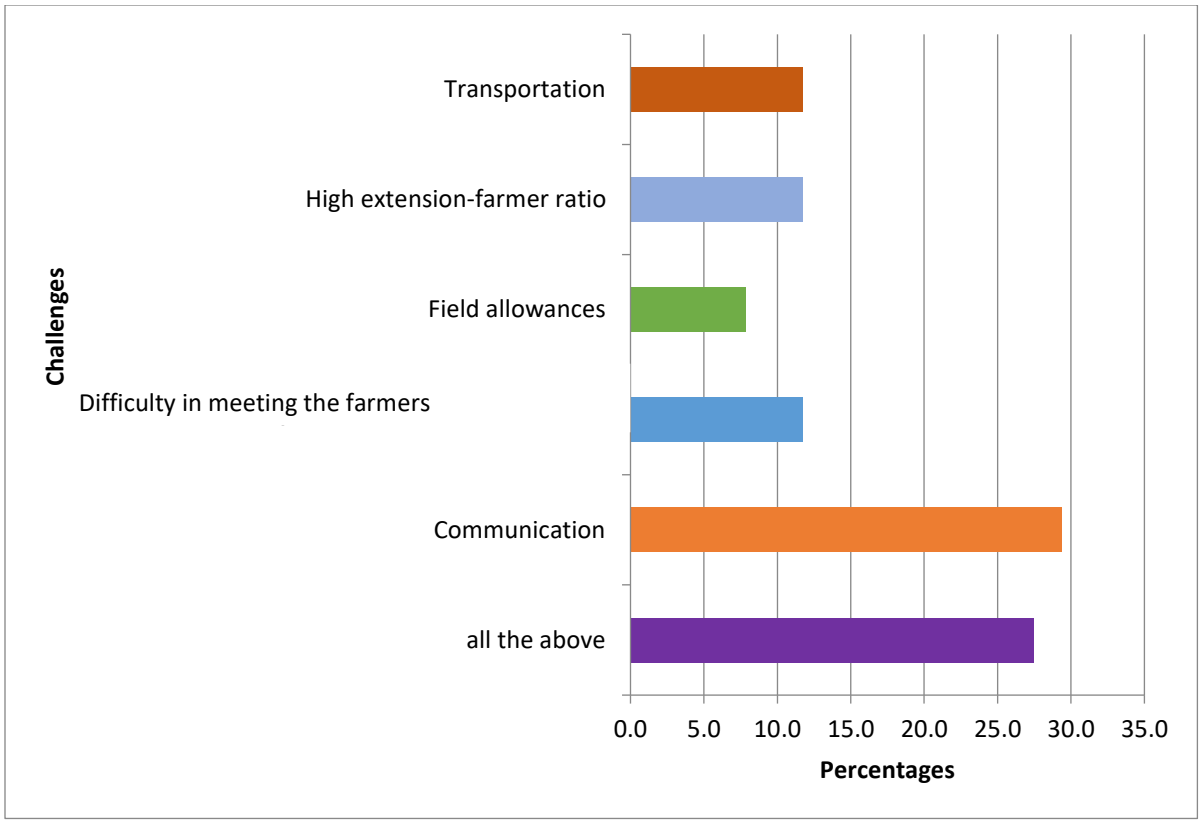

Figure 4.1: Challenges of agricultural extension service in the Northeast region of Ghana

Soure: Field survey, 2023

4.6. FACTORS AFFECTING YIELD OF MAIZE IN THE NORTHEAST REGION?

This research question explored the socio-demographic information of farmers as well as other potential factors that affect farmers' maize yield in the northeast region. The study used chi-square to analyze this data to determine which factors influenced the maize yield of farmers in the region.

Table 4.6 presents results on the factors that affected yield and the level of association of each factor.

Table 4.6: Factors Affecting Yield of Maize Farmer

Variable	Categories	Improve yield	Poor yield	Chi-square	P-value
Technological	Yes	162	44	19.09	0.002
	No	88	12		
Biological	Yes	220	18	24.6	<0.001
	No	22	46		
Environmental	Yes	136	40	7.1	0.005
	No	30	98		
Household Size	1 - 3	0	19	8.7	0.032
	4 – 6	83	38		
	7 – 9	68	32		
	10 – 13	47	19		
Education Status	No Formal education	52	106	13.3	0.004
	JHS	17	23		
	SHS	50	15		
	Tertiary	38	5		
Income Level	**Below ghc100**	**23**	**25**	**18.03**	**0.012**
	Ghc100-300	11	61		
	Ghc301-600	20	69		
	Ghc601–900	20	41		
	Ghc901-1200	8	17		
	Above Ghc1200	12	18		

Soure: Field survey, 2023

From the above table it was deduced from the data collected among the 306 maize farmers that the adoption of improved technological practices such as the use of modern farm machinery significantly impacted farmer yield, with a chi-square value of 19.09 and a p-value of 0.002. This is in line with a study conducted by Wossen et al. (2017) which detailed the impact of technological adoption on farm yield. The findings again supports the outcome of other studies by Teka and Lee (2020), and Kopalo et al. (2021) affirming the positive impact of adopting improved farm technologies on crop yield and farmer wellbeing (income).

Similarly, when it comes to biological factors incorporated by farmers in the study area to improve soil health such as integrated pest and disease management, weeds control, conservation tillage, and agroforestry practices among others, the results show a strong significant relation between farmers who adopted these practices or otherwise and the quantity of harvest (maize yield). Thus, farmers who practiced any one or more of these activities have been reported to have significantly higher yield than their counterparts who do not, the results therefore show a chi-square value of 24.6 and a p-value of <0.001 as shown below in table 4.6. These findings resonate with the findings of Pretty et al. (2011), which reported a 14% increase in rice yield among Indian smallholder farmers as a result of the adoption of integrated pest management practices (IPM). Furthermore Dijkhoorn et al. (2020), also reported a significant increase in crop yield of about 12% as a result of farmers` adoption of IPM. Pittelkow et al. (2015) research showed a 3%-9% increase in maize and soybean yield as a result of adopting biological farm practices such as conservation tillage and cover cropping.

With the adoption of environmental control measures, farmers who have resorted to the use of climate change mitigation measures by embracing various climate resilience approaches against floods and drought have been observed to have increased seasonal yield (harvest) over the period

comparatively, with a p-value of 0.005. Hence sampled maize farmers who have espoused existing climate resilience approaches have significantly higher maize yields, the results align with the study by Thierfelder (2009), and Montgomery (2007) who similarly revealed that the reduction of risk of climate change factors such as drought reduces climate-induced losses thereby improving harvest.

The educational status of the farmer was also found to be significantly associated with the yield farmers had in the region representing (p=0.004). The given results demonstrate that income is a factor that have a significant association with yield showing a value of 18.03 and a (p=0.012).

A study conducted by Smith et al., 2015 supports the finding that income is significantly associated with yield. It suggests that higher income allows farmers to invest in better agricultural practices (Danso-Abbeam et al., 2018a). The educational level of farmers as well as the income of farmer plays a vital role in the adoption of new ideas and practices given to them, especially in rural areas. This was revealed by a study conducted by Eric, Prince & Elfreda, (2014), that education plays a major role in the improvement of farmers' yield such that formal education prepares the farmers' minds for new knowledge, non-formal education on the other hand offers the farmer hands-on training with better methods of farming to farmers and informal education keeps farmers updated with modern innovations to allow them share experienced they gain (Anang & Asante, 2020). All these factors were found to have influenced the maize yield of farmers in the northeast region of Ghana.

4.7 EFFECTS OF EXTENSION SERVICE ON FARMERS' MAIZE YIELD?

This question sought to investigate the effects of agriculture extension service on maize yield in the northeast region of Ghana.

The analysis revealed that a greater number of respondents in the region representing 71.3% agreed that extension service interventions such as modern planting methods, fertilizer applications, soil conservational methods, weed control as well as pest and disease control generally improved their maize yield while 28.7% believed that it had no effects on their maize yield. This is supported by a study conducted by the International Food Policy Research Institute (IFPRI) in Nigeria, which found that farmers who received extension services had higher yields compared to those who did not receive any services (Chandra et al., 2020).

Similarly, another study in Ethiopia found that farmers who adopted agriculture extension interventions through training programs on improved agricultural practices had higher yields compared to those who received only information (Danso-Abbeam et al., 2018).

Figure 4.2 illustrate the effects of agriculture extension on yield of maize farmers.

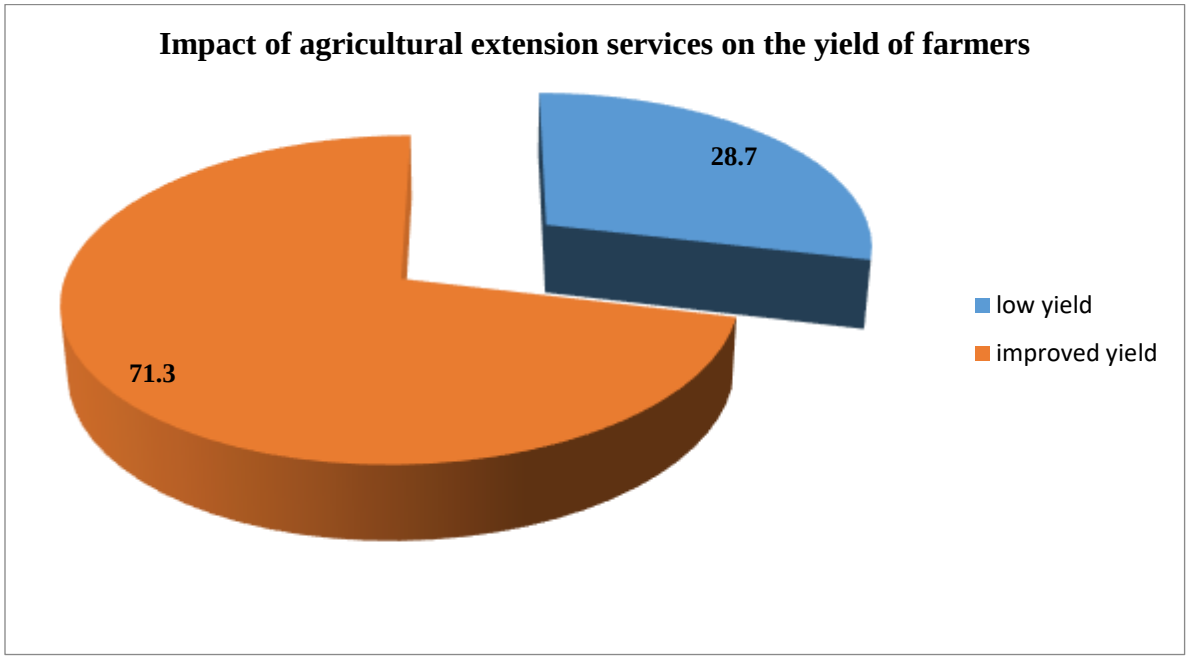

Figure 4.2: The impact of extension service on farmers yield

Soure: Field survey, 2023

4.8 IMPLICATIONS OF THE STUDY FOR CURRICULUM DEVELOPMENT

The results from Table 4.7 highlight several significant issues related to the practical application of the curriculum in the educational context, and these findings align with relevant literature on the subject.

Table 4.7: Implications of the study for curriculum development in agricultural extension services

Soure: Field survey, 2023

Variable	Category	Frequency	Percentage	P-values
The curriculum does not provide much practical experience to the students	Agree	32	65.3	0.045
	Disagree	17	34.7	
There is no practical application of theory	Agree	41	83.7	<0.001
	Disagree	8	16.3	
Courses are repeated	Agree	30	61.2	0.15
	Disagree	19	38.8	
Students have no links with extension department working in the country	Agree	33	67.3	0.02
	Disagree	16	32.7	
Learning in the classroom is more theoretical than practical	Agree	42	85.7	<0.001
	Disagree	7	14.3	
No study tours to places like fields	Agree	38	77.6	0.13
	Disagree	11	22.4	
School administrations ignores the department and problems faced by extension	Agree	37	75.5	0.001
	Disagree	12	24.5	

Firstly, the data in the above table reveals that 65.3% of participants are of the view that the existing curriculum does not provide much practical experience, a finding consistent with the Kolb's Experiential Learning Theory that criticizes traditional educational systems for their heavy emphasis on theoretical knowledge over practical skills. For instance, Kolb's Experiential

Learning Theory suggests that practical experience is crucial for deep learning and the application of knowledge in real situations. The lack of practical experience, as highlighted by the participants, could hinder students' ability to apply theoretical concepts, which is a concern widely documented in educational research.

The overwhelming consensus (83.7%) agreed that there is limited practical application of theory in the curriculum supports Dewey's (2018) argument that education should be grounded in experiential learning, where students actively engage with the material in meaningful ways. This disconnect between theory and practice is not unique to this study; it is a recurring theme in educational critiques that argue for a more integrated approach to learning, where students can see the relevance of what they are studying to real-world applications.

Additionally, 85.7% of respondents perceive classroom learning as more theoretical than practical. This aligns with the concerns raised by scholars like Schön (2023) who emphasize the importance of reflective practice in education, where students should be encouraged to think critically about their learning experiences and apply them practically. The chi-square value of less than 0.001 for this variable further underscores the significant consensus among participants regarding this issue.

The study also indicates that 67.3% of respondents feel that learners do not have links with the extension departments working in the country, which reflects broader issues in education regarding the disconnection between academic institutions and industry or community-based organizations. This finding aligns with research that advocates for stronger partnerships between educational institutions and external organizations to provide students with practical experience and industry insights. The P value of 0.02 suggest how significant this concern is among the participants.

Lastly, the perception that school administrations ignore the department and problems faced by the extension, as agreed by 75.5% of respondents, points to systemic issues within educational institutions. This is supported by literature that calls for more responsive and supportive administrative structures that address the needs of both educators and students. The significant P value of 0.001 for this variable highlights the widespread nature of this concern.

In conclusion, the results from Table 4.7 corroborate the arguments made in educational literature about the need for curricula that balance theory with practice, the importance of experiential learning, and the necessity for stronger links between educational institutions and external entities. These findings suggest that without addressing these issues, students may continue to struggle with applying theoretical knowledge in practical contexts, ultimately affecting their preparedness for real-world challenges.

CHAPTER FIVE

SUMMARY, CONCLUSION, AND RECOMMENDATION

5.0 INTRODUCTION

This section summarises the study, including the most important findings as well as conclusions made based on these findings. The chapter also looks at possible recommendations that can help the research community in addressing the identified concerns.

5.1 SUMMARY

The research investigated the effects of agricultural extension services on the yield of farmers in the northeast region of Ghana and narrowed down on the implication of curriculum development. The study employed a quantitative research methodology, analyzing the current agricultural extension services provided to farmers in the northeast region, and evaluating the challenges hindering the extension service delivery. By assessing the effects of these services on crop yields specifically maize and some key factors that affects maize yield. The study identified some of the challenges hindering the success of extension officers in the discharge of their duties.

The research uses a cross-sectional survey approach. The study is descriptive in both nature and style. Three hundred and six (306) maize producers, fifty-one (51) agricultural extension officers, and sixty-seven (67) agriculture science teachers were respectively interviewed by the researcher. The target population was purposively sampled to select farmers who only cultivates maize in the region.

The findings indicated that the farmer population was male dominated representing (68.6%) and majority of teachers were males (53.7%). A greater population (86.3%) of extension officers had tertiary education. However, the current curriculum does not offer a better understanding for most

respondents, and teachers also agree that practical learning is lacking at senior high schools offering agricultural science. There are no study tours to fields or links between students and extension departments working in the country, however the region has a majority of experienced extension workers representing 49.3% and most agricultural science teachers at the senior high schools attained degree certificate representing 83.6%. Communication challenges among other factors pose challenge for extension officers in the discharge of their duties as suggested by majority of extension officers in the region. Some factors that affected the yield of maize farmers included technology adoption level, biological factors, environmental, educational status of farmers and income level of the farmer. Agriculture extension service generally contributed positively to the yields of maize farmers in the region. To address the issues of content and delivery approach revealed by the extension officers indicated in the findings of this study, it is expected that the curriculum be revised to provide more practical experience and study tours, and efforts should be made to improve communication and engagement between extension officers and farmers to enhance the effectiveness of extension services.

5.2 KEY FINDINGS

1. The majority (68.6%) of the maize farmers are male.
2. Majority (66.7%) of extension officers agreed that they are satisfied with the existing infrastructures within the extension service department of the region.
3. From the study about, 86.3% disagreed that extension officers are well equipped with the requisite communication skills.
4. More of the extension officers pointed to communication challenges among others as a lead factor obstructing them in their course of duty.

5. The region has an active labor age for agriculture production as indicated by majority of farmers who were found within the ages (36-40) years representing 26%.
6. Factors such as technology, biological, the environment, income level as well as educational level of farmers were found to be significantly associated with yield of maize farmers in the region with p-values 0.002, less than 0.001, 0.005 and 0.012 and 0.004 respectively.
7. The study found that the intervention of extension services such as modern planting methods, fertilizer applications, soil conservational methods, weed control as well as pest and disease management generally improved farmers maize yield accounting for about (71.3%) of the responses.
8. About 65.3% agriculture science teachers interviewed indicated that the curriculum does not provide much practical experience to the students.
9. About 85.7% of respondents agreed that learning in the classroom is more theoretical than practical.
10. About 68% of the teachers disagreed that the current curriculum offers a better understanding of extension concepts.
11. A significant number (77.6%) of the respondents also agreed that there are no study tours to places like farm fields.
12. Similarly, 67.3% of respondents agreed that students have no links with extension departments working in the country.
13. More research has not been done in the area of harmonizing agricultural extension services with curriculum development.

5.3 CONCLUSION

Based on the findings of this study the following conclusions were made;

- Extension officers have good knowledge of the content of extension services and are well equipped with the requisite communication skills but are poor at the utilization of technology in the discharge of their duties. However, communication (language barrier) and other factors posed challenges to the successful execution of their duties.
- Factors such as technology, biological, the environment, income level as well as educational level of farmers were found to be significantly associated with yield of maize farmers in the region.
- Agriculture extension service interventions generally improved farmers maize yield.
- The current curriculum does not provide enough practical experience and does not offer a better understanding of agriculture extension concepts to learners, again learning in the classroom is more theoretical than practical.
- The curriculum does not adequately balance theory with practice and has a poor link between educational institutions and external entities.
- There is again inadequate research done in the area of harmonizing agricultural extension service with curriculum development and how to factor farmer experiences into curriculum designing.

To address these issues, there is a need to revise the current educational curriculum to provide more practical experience for agricultural science students and as well schedule study tours to fields.

Farmers should be offered education in order to better prepare them for new ideas and technology adaptations. Additionally, efforts should be made to improve communication between extension

officers and farmers to enhance the effectiveness of extension services, the concepts of the curriculum should consider the needs of the local farmer to improve its adaptability and merit.

5.4 RECOMMENDATIONS

The following recommendations are made based on the finding:

1. Investment in technology: Government and other stakeholders should invest more on agriculture technology in order to advance the technological skills of extension officers.
2. Address communication challenges: Extension officers should be given more communication trainings through regular seminars and workshops by government and other stakeholders
3. Education: farmers should be offered education as it was evident that educational level of farmers were found to be significantly associated with yield of maize farmers in the region.
4. Incentives for agriculture extension officers: Government and other NGOs should offer extension officers the needed motivation to be able to reach out to more farmers in the region.
5. Revise the curriculum: Revising the curriculum to provide more practical experience could help improve understanding and skills of extension officers.
6. Increase study tours: Increasing study tours could offer learners the opportunity to apply classroom knowledge into practices while still at school.
7. Link students with extension departments: There is need to strengthen the links between educational institutions and external entities.
8. Address gender imbalance in the population: Balancing the gender of extension worker's population could be achieved through targeted recruitment and training programs for women.

9. Addressing the research gap: More research should be done in the area of harmonizing agriculture extension services and the educational curriculum in Ghana.

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APPENDIXES

FARMER QUESTIONNAIRE

Introduction

This research is an academic exercise and all information given shall be used solely for this purpose. I therefore wish to have your personal views on the ***Effects of Agricultural Extension Services on Yield of Farmers in North East Region of Ghana: Implication for Curriculum Development.*** *I would strongly like you to note that the confidentiality of your responses is assured. Thank you for considering this request.*

SOCIODEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

1. Gender? Male [ ] Female [ ]

2. Age of the respondent? Below 18 [ ] 18 – 24 [ ] 25 – 30 [ ] 31-35 [ ] 36 – 40 [ ] 41 – 45 [ ] 46 – 50 [ ] above 50years

4. Marital status? Married [ ] Not married [ ] Never married [ ] Separated [] Divorced [] Widow []

5. What is your level of education? Primary [] JHS [] SHS [] Tertiary [] No formal education []

6. Are you the household head? Yes [ ] No [ ]

7. What is your household size? 1 – 3 [ ] 4 – 6 [ ] 7 – 9 [ ] 10 – 13 [ ] above 13 [ ]

8. What is your average monthly income? Below GHc100 [ ] GHc100-300 [ ] GHc301-600 [ ] GHc601–900 [ ] GHc901-120 [ ] above GHc1200 [ ]

OPINIONS OF FARMERS ON THE CURRENT STATE OF AGRICULTURAL EXTENSION SERVICES

9. Does the extension agent communicate with/contact you? Yes [ ] No [ ]

10. If your answer in Q12 above is yes, how often do you see him? (a) Once a week [ ] (b) once every fortnight [ ] (c) once a month [ ] (d) once a year [ ] (e) Rarely [ ] (f) other (specify).....

11. If no will you want the extension agent to be contacting you? Yes [ ] No [ ]

12. Have you ever visited the extension agent in his/her office or home? Yes [ ] No [ ]

13. Do you get access to agriculture extension information? Yes [ ] No [ ]

14. What issues do you think need to be considered in the extension delivery services aside what they are already offering?

THE EFFECT OF AGRICULTURAL EXTENSION SERVICES ON THE YIELD OF MAIZE FARMERS

15. Are you a member of a Farmer Based Organization (FBO)? Yes [ ] No [ ]

16 . Do you own the maize plot you cultivated this year? Yes [ ] No [ ]

17. Do you use pesticide for the farming season? Yes [ ] No [ ]

18. Do you use weedicide for the farming season? Yes [ ] No [ ]

19. Do you use chemical fertilizer? Yes [ ] No [ ]

20. Do you use improved seeds? Yes [ ] No [ ]

21. Do you have access to credit for your farming? Yes [ ] No [ ]

22. How long have you been farming maize? a) 1-5) years b) 6-10 c) 11-15 d) 20 and above

23. Do you weed on your farm? Yes [ ] No [ ]

24. Did you adopt any technological practices on your maize farm? Yes [ ] No [ ]

25. Did you adopt any biological practices (i.e. use of integrated pest and disease management, weed control, conservation tillage, etc.) on your maize farm? Yes [ ] No [ ]

27. Did you adopt any environmental/climatic resilience approach (i.e., flood and drought resistance measures) on your maize farm? Yes [ ] No [ ]

28. Periods and quantity harvested

Period	2019	2020	2021	2022
Quantity harvested (100kg bag)				

AGRICULTURE EXTENSION OFFICERS` QUESTIONNAIRE

Introduction

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SOCIO-DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

1. Gender? Male [ ] Female [ ]

2. Age of the respondent? Below 18 [ ] 18 – 24 [ ] 25 – 30 [ ] 31-35 [ ] 36 – 40 [ ] 41 – 45 [ ] 46 – 50 [ ] above 50years

4. Marital status? Married [ ] Not married [ ] Never married [ ] Separated [] Divorced [] Widow []

5. What is your level of education? Primary [] JHS [] SHS [] Tertiary [] No formal education []

THE IMPLICATIONS OF THE STUDY FOR CURRICULUM DEVELOPMENT IN AGRICULTURAL EXTENSION SERVICES

Below are a number of statements regarding the **Opinion of Extension Officers about the Overall Quality of Curriculum development.** Please read each question and indicate to what extend you disagree or agree with each statement where SD = strongly disagree; D=disagree; N=neutral; A=agree and SA=strongly agree ***Please tick any statement applicable [ ]***

To be administered by only Agriculture Extension Officers

Statements	SA	A	N	D	SD
5. Extension officers have a better understanding of concepts and principles in extension services					
6. Extension officers are equipped with the requisite Communication skills					
7. Extension officers use information communication technology more effectively when delivering extension services					
8. The curriculum equips extension personnel CHAwith evaluation skills					
9. Overall, I am satisfied with the quality of the curriculum					

TYPES OF EXTENSION SERVICE DELIVERY

Opinions of Extension Officers about Rating the Services rendered to Farmers in the Region.

Statements	Excellent	Good	Fair	Poor	Very Poor
Technical services					
Facilitation services					
Advisory services					

7. What are the major challenges affecting the extension delivery service/s in the region?

i) High extension-farmer ratio ii) Communication iii) Transportation iv) Safety & Security v) Cost of delivery vi) Field allowances vii) Difficulty in meeting the farmers High extension-farmer ratio

a) High extension-farmer ratio and Communication

b) High extension-farmer ratio, High extension-farmer ratio and Communication

c) All the above

8. Suggest any issue/s that need to be considered in the curriculum development to be able to serve farmer needs better …….

TEACHERS` QUESTIONNAIRE

Introduction

This research is an academic exercise and all information given shall be used solely for this purpose. I therefore wish to have your personal views on the ***Effects of Agricultural Extension Services on Yield of Farmers in North East Region of Ghana: Implication for Curriculum Development.*** *I would strongly like you to note that the confidentiality of your responses is assured. Thank you for considering this request.*

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF TEACHERS

1. Gender? Male [ ] Female [ ]

2. Age of the respondent? Below 18 [ ] 18 – 24 [ ] 25 – 30 [ ] 31-35 [ ] 36 – 40 [ ] 41 – 45 [ ] 46 – 50 [ ] above 50years

4. Marital status? Married [ ] Not married [ ] Never married [ ] Separated [] Divorced [] Widow []

5. What is your level of education? Certificate /Diploma [] Degree [] Masters [] PHD []

6. How long have you been teaching agriculture science? 0-3[] 4-6[] 7 and above []

Below are a number of statements regarding the **Opinions of Agriculture Teachers about Major Drawbacks in the Existing Agriculture Extension of the Curriculum** Please read each question and indicate to what extend you disagree or agree with each statement where SD = strongly disagree; D=disagree; N=neutral; A=agree and SA=strongly agree

Please tick any statement applicable [ ]

Statements	SA	A	N	D	SD
10. The curriculum does not provide much practical experience to the students					
11. There is no practical application of theory					
12. Courses are repeated					
13. Students have no links with extension department working in the country					
14. Learning in the classroom is more theoretical than practical					
15. No study tours to places like fields					
16. School administrations ignores the department and problems faced by extension					

17. Suggest any issue/s that need to be considered in the curriculum development to be able to prepare agriculture science students at all levels of education

Thank you