A FRAMEWORK FOR AGRICULTURAL EXTENSION PRACTICES AMONG FARMERS WITH DISABILITIES IN GHANA

BY

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A thesis submitted in fulfilment of the requirement for the degree

DOCTOR OF PHILOSOPHY IN AGRICULTURE
(AGRICULTURAL ECONOMICS & EXTENSION)
DEPARTMENT OF AGRICULTURE AND ANIMAL HEALTH

In the
COLLEGE OF AGRICULTURE AND ENVIRONMENTAL SCIENCES (CAES)
FACULTY OF SCIENCE AND AGRICULTURE

at the
UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROF AM ANTWI

2023

DECLARATION

I, Mark Arhin, declare that my thesis, "A Framework for Agricultural Extension Practices among Farmers with Disabilities in Ghana," is my work in design and execution. The materials used in this research work have been duly acknowledged, and it has not previously been submitted for any degree to any other university.

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DEDICATION

This thesis is dedicated to my son Odell Opoku Arhin and my parents, Sarah Ama Sackey and Isaac Kwadwo Arhin (Late).

ACKNOWLEDGEMENTS

I begin by offering my sincerest gratitude and praise to God for granting me life and continuously providing for my needs. His unwavering presence in all that I do is deeply appreciated. My heartfelt thanks go to my supervisor, Professor MA Antwi, for his understanding and guidance throughout my academic journey. Your humility and support kept me motivated, even when I wanted to give up. May God bless you with good health and a long life. I am deeply grateful to my family for being my source of inspiration throughout my academic career. Without their unwavering support, my academic journey would have been longer, lonelier, and impossible to traverse. I would like to extend my sincere gratitude to my wife, Mrs Gifty Arhin, and my children, Odelia A. Arhin, Benny-Moore Arhin, and Abigail Ohemeng. Their love and encouragement were invaluable to me. My gratitude also goes to my brothers, Albert Yankson and Benjamin Arhin, Ps. Ernest Eddison Arhin, Ps. Eric Ato Kwamena Arhin, Emmanuel Arhin, and Isaac Kwaku Arhin, for their support and encouragement.

I want to thank Mercy Adufua Sackey, who provided the financial resources that enabled me to start my primary school education. Her support was instrumental in helping me reach this point. I extend my heartfelt gratitude to Emmanuel Freeman (PhD) at Ghana Communication Technology University and Emmanuel Duncan at Valley View University for motivating me during challenging academic pursuits. Your encouragement was invaluable. I would also like to thank the Director of Agriculture Ga-West, Angelina Owusu (Miss), Mr Paul Obeng Ntiamoa, and Amanda Karikari for their tremendous support during my studies at Unisa. Again, to my current employer Euro-Africa cultivators (Alessandro Bossi) for their support. Your contributions were instrumental in helping me succeed. Thank you all for your support and encouragement throughout my academic journey.

Abstract

The main aim of this study was to develop a comprehensive framework for improving agricultural extension practices among farmers with disabilities (FWDs) in Ghana. To achieve this, specific objectives were set to analyse: demographic and socio-economic determinants of extension service contacts of FWDs, challenges faced by FWDs with key associated factors, determinants of farm income of FWDs, and agricultural extension mediations that could enhance agricultural practices among FWDs. The study is organised into six chapters, covering topics from introduction to conclusions and recommendations. Data were collected in 2022 from all 16 regions of Ghana using a questionnaire administered to a randomly selected sample of 386 FWDs and 62 Agricultural Extension Officers (AEOs) who work directly with FWDs, and analysed using statistical software such as SPSS, STATA, and Excel. Analyses included descriptive statistics and inferential/regression analyses. The Fractional Outcome Regression Model analysed the determinants of FWDs' access to agricultural extension services per year. A Multiple Linear Regression Model assessed the influence of agricultural extension practices/services and other socio-economic/demographic factors on the farm income of FWDs. Factors associated with the six essential challenges faced by FWDs were assessed using the Pearson correlation coefficient. Key findings indicated that most FWDs were male (68.7%), 43% had no formal education, and varied types of disabilities were present, with physical disability being the most predominant. Several challenges were identified, including discrimination, feelings of inferiority, and lack of tailored programs for FWDs. The Fractional Outcome Model identified major determinants influencing FWDs' access to extension services as age, participation in Farmer-Based Organizations (FBOs), and years of farming experience. The Multiple Linear Regression analysis found that participation in non-farm activities, land size, the proportion of inputs purchased, and the proportion of products sold were crucial determinants of FWDs' annual farm income. Correlation analyses showed significant associations between various challenges faced by FWDs and several factors. For instance, poor building design was correlated with factors such as the source of disability and number of household dependents, while discrimination against FWDs correlated with gender and household headship, among others. The study identified several effective agricultural extension mediations, including home visits, provision of tools, and supply of farm inputs, which were positively perceived by FWDs. A cohesive and actionable framework was developed for FWDs in Ghana, emphasizing social inclusion, economic empowerment, and personalized interventions. This framework advocates for inclusive policies addressing anti-discrimination and equitable resource access, informed by demographic variables such as age, FBO membership, and farming experience. It underscores the need for capacity building of AEAs, focusing on disability awareness and gender-sensitive communication, and recommends community engagement programs to reduce stigma and foster cooperation among FWDs, AEAs, and local communities. The study also calls for investment in adaptive farming technologies and the implementation of a robust

monitoring and evaluation system to continuously refine these interventions. International collaboration is encouraged to facilitate knowledge exchange and best practices, while establishing sustainable funding mechanisms, including grants and microfinance, tailored to FWDs' needs. These multifaceted recommendations aim to integrate FWDs into the national agricultural development strategy, enhancing the sector's inclusivity, effectiveness, and resilience.

KEY WORDS: Farmers with disability, framework, Fractional Outcome Regression Model, Pearson correlation, Ghana.

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List of Acronyms

ACDEP	Association of Church Development Projects
ACDI/VOCA	Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance
ADRA	Adventist Development and Relief Agency
AEA	Agricultural Extension Agent
AFAASs	African Forum for Agricultural Advisory Services
CMB	Cocoa Marketing Board
CRS	CARE International, Catholic Relief Service
DAO	District Agricultural Officers
DDA	District Director of Agriculture
DDO	District Development Officers
FAO	Food and Agriculture Organization
FSR/E	Farming Systems Research and Extension
FWDs	Farmer With Disabilities
GAWU	General Agricultural Workers' Union
GFRASs	Global Forum for Rural Advisory Services
GSS	Ghana Statistical Service

IFDC	International Fertilizer Development Center
IPM/FFSs	Integrated Pest Management Farmer Field Schools
IRRI	International Rice Research Institute
MMDAs	Metropolitan, Municipal and District Assemblies
MoFA	Ministry of Food and Agriculture
NAEP	National Agricultural Extension Project
PAFFO	Pan African Farmers Forum
PFAG	Peasant Farmers' Association of Ghana
PWDS	People living with Disabilities
RADU	Regional Agricultural Development Unit
RELC	Research Extension Linkage Committees.
SMSs	Subject Matter Specialists
SOE	State-Owned Enterprise
T&V	Training and Visit
UGFCC	United Ghana Farmers' Co-operative Council
UN	United Nations

CHAPTER ONE

BACKGROUND AND ORIENTATION TO THE STUDY

1.1 Background

The world recognises people with disabilities (PWDs) as a sizable minority population that experiences marginalisation and inadequate representation (Gomda, 2018). The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) was established in 2006 to address integrating disability concerns into development planning procedures globally. (United Nations, 2013).

Article 32 of the UNCRPD emphasises the significance of involving PWDs in all development initiatives to safeguard their rights and dignity (UNCRPD, 2013). The convention seeks to end the marginalisation and guarantee that people with disabilities have equal access to opportunities in employment, healthcare, and education (Groce, et al, 2011; Wapling and Downie, 2012).

Over one billion individuals worldwide, or roughly 15% of the world's population, have some form of disability (Mitra and Sambamoorthi, 2014). According to Mitra and Sambamoorthi (2014), 2.2% of the world's population experiences severe functional problems, with a disproportionately high number of people with disabilities living in developing nations like Ghana. Farmers make up a significant share of the 386 million persons with disabilities employed globally, as agriculture is their primary source of income (Van Daele, 2008).

The agricultural sector presents difficulties for farmers with disabilities, such as crippling accidents and low output brought on by climatic shocks and resource shortages (Friesen et al., 2010). Farmers with disabilities are more vulnerable to work-related injuries, psychological stress, and the onset of new disabilities, further increasing their susceptibility (Friesen et al., 2010).

On a global scale, initiatives have been made to overcome the difficulties farmers with disabilities face. The United States Department of Agriculture (USDA) provide support to organisations like the National Arability that work to improve the lives of farmers and

agricultural workers with disabilities (Ethridge et al., 2018). Similarly, the Food and Agriculture Organization (FAO) works to increase income-generation and employment opportunities for those with disabilities in agriculture while including disability problems in policies and programs for rural development (Golay and Biglino, 2013).

People with disabilities in Africa suffer tremendous obstacles, notably in the context of agriculture. According to UN estimates, up to 80% of Africans with disabilities live in poverty, and their vulnerability to food insecurity and poverty is made worse by their exclusion from the agricultural sector (Carter et al., 2021). Traditional African farming techniques were interrupted by historical circumstances, such as colonisation, and new techniques were adopted that were inaccessible to those with disabilities. Their exclusion from agricultural development projects is further exacerbated by insufficient inclusive policies and programs (Carter et al., 2021).

People with disabilities in Ghana have many obstacles that prevent them from working in agriculture, including limited access to assistive devices, a lack of knowledge of contemporary farming methods, and limited access to credit and markets (Agyei-Okyere et al., 2019). Ghanaian farmers are most likely to have disabilities and struggle to access crucial agricultural supplies (Agyei-Okyere et al., 2019).

The Ghanaian government offers all farmers free agricultural extension services as part of the Modernizing Agriculture initiative. However, agricultural extension agents frequently lack the education and comprehension of the requirements of farmers with disabilities, resulting in little attention being paid to their particular needs (Nachimuthu, 2018).

The worldwide viewpoint highlights the importance of inclusive development planning and the widespread acceptance of the rights of people with disabilities. Farmers with disabilities in Africa, notably Ghana, confront difficulties that limit their involvement in agriculture. Poor access to resources, knowledge gaps, and societal constraints restrict their chances for a living. A framework for agricultural extension methods that specifically caters to the requirements of farmers with disabilities in Ghana is thus urgently needed.

1.2 Problem statement

In Ghana, several injustices and difficulties restrict the agricultural production abilities of farmers with disabilities. It is crucial to investigate the challenges that farmers with

disabilities face and consider potential solutions to ensure they have access to financial resources, technical knowledge and skills, and the necessary equipment to support their livelihoods. In Ghana, people with disabilities comprise about 15% of the population (Opoku et al., 2015).

According to research by Opoku et al. (2015), most Ghanaian citizens with disabilities lacked access to the land, fertiliser, and agricultural equipment they would require pursuing a successful profession in agriculture. This inaccessibility was ascribed to a lack of assistance from the government and other organisations and ignorance of the legal rights of people with disabilities. The study also discovered that people with disabilities frequently experience discrimination and inequality, further restricting their access to resources.

Ghana's insufficient support system for farmers with disabilities is a problem that needs to be considered. Agyei-Okyere et al. (2019) claim that although Ghana's agricultural sector contributes significantly to the country's economy and employs more than half of the population, people with disabilities have difficulty working there due to a lack of accessible infrastructure and resources. Additionally, the current assistance system for farmers with disabilities is insufficient, with limited access to resources and services. It has made it difficult for these farmers to generate income due to their lack of financial stability, access to land, and access to technology. Furthermore, discrimination against and exclusion from agricultural extension services are commonplace for farmers with disabilities. These factors make it difficult for people with disabilities to work in the agricultural industry, which hurts the economy. To ensure Ghana's economic development, appropriate support structures for the nation's farmers with disabilities must be put in place.

More than half of Ghana's 31 million inhabitants live in rural areas and depend on agriculture as their primary source of income (UNDESA, 2020). Unfortunately, few resources and support are available for the agricultural sector, which has long been ignored. Farmers with disabilities, who frequently face additional challenges due to physical or mental limitations, are particularly affected by this lack of support. For instance, according to a study by the International Labor Organization (ILO, 2007), the tools and resources available to farmers with disabilities in Ghana are frequently restricted, as is their capacity to obtain credit. Once more, farmers with disabilities often cannot use modern technologies that could help them increase their productivity and

profits due to limited access to education and resources. Because of the lack of resources, the income gap between those with disabilities and the general population grows even more expansive. Therefore, for farmers with disabilities to have access to the resources they need to succeed, the Ghanaian government must develop policies and initiatives that are more inclusive and supportive of them.

Due to their insufficient access to the resources and services they need to realise their full potential as farmers, farmers with disabilities in Ghana are more likely to live in extreme poverty. Statistics show that this is the case, with 54% of farmers with disabilities in Ghana living below the poverty line (ILO, 2007). To succeed and support their local economies, farmers with disabilities must have access to adequate support services. Government of Ghana can reduce poverty and improve equal opportunities for farmers with disabilities in Ghana by investing in resources and aid to improve access.

1.3 Rationale of the Study

The study provided knowledge and unique insight into the primary agricultural extension services that should be rolled out to benefit farmers with disabilities in agriculture, which other researchers have not explored. It will provide literature on agricultural extension services for Ghanaians and Africans, which will, in turn, ignite their desire to explore more in this area to enhance their understanding and enable them to suggest better ways of handling such services extended to farmers with disabilities. The study is of immense importance in timing due to the current happenings in the country and the world, as Gomda et al. (2021) mentioned. Specifically, the study will benefit the following in diverse ways:

- **Tertiary Students.** The study will be helpful for students who want to learn more about agricultural extension services for people with disabilities and those who wish to conduct research in any of the areas mentioned. Thus, students who may want to delve much deeper into the activities of FWDs to offer solutions to their plight in that regard will be aided by the knowledge that this study will show. By implication, the availability of this study's valuable information will assist tertiary researchers in the study area to be fully guided in their quest to explore.

- **Agriculture Extension Officers:** Knowledge of agricultural extension services will be enhanced. The study will also provide agriculture extension officers with specific

issues that can be worked on to supplement or improve existing extension services for farmers with disabilities.

- **Ministry of Agriculture and Associated Agencies**. Awareness will also be created among agricultural agencies and the Ministry of Agriculture in Ghana on the need to adopt a robust framework from this study on agricultural extension services for persons with disabilities in agriculture, which will be the main novelty of this study.

- **Future Researchers.** The current study will serve as a reference point and the basis for many researchers who may want to research agricultural extension services for farmers with disabilities, considering the apparent limited empirical studies in this area.

1.4 Research Questions

To address the above-stated problem, the following research questions are asked:

1. What are the socio-economic determinants of extension service access to farmers with disabilities in Ghana?
2. What are the challenges to accessing agricultural extension services by farmers with disabilities?
3. What are the agricultural extension mediations that could enhance agricultural practices among farmers living with disabilities in Ghana?
4. What are the determinants of the farm incomes of the farmers living with disabilities in Ghana?
5. How does extension service access impact the farm income of farmers with disabilities in Ghana?
6. What framework could enhance agricultural extension practices among farmers with disabilities in Ghana?

1.5 Scope of the study

This research study provided a framework for agricultural extension practices in Ghana specifically designed for farmers with disabilities. The study intended to shed light on the difficulties farmers with disabilities encountered when trying to receive agricultural extension services, investigated the socio-economic factors that influenced their access, and examined how agricultural extension methods affected farmers' farm income. The study also looked at alternative solutions and provided an appropriate framework to improve agricultural extension practices for farmers with disabilities.

The study's primary focus was on farmers with disabilities in Ghana, considering their particular requirements, constraints, and experiences in the agricultural industry. Data was gathered from farmers with disabilities and agricultural extension officers.

The study only covered Ghana since it wanted to focus on the unique problems and difficulties experienced by farmers with disabilities. Due to its sizeable agricultural sector and the presence of farmers with disabilities who faced challenges receiving extension services, Ghana is an important setting for this study.

While the study's primary focus is on agricultural extension practices, it also considered broader socio-economic aspects like resource accessibility, financial security, and social inclusion that affect the lives of farmers with disabilities. The research offered essential insights into the financial aspects of agricultural practices that accommodated people with disabilities by looking at the factors that affect access to extension services and their effects on farm income.

It is significant to emphasise that the study's conclusions and suggestions should be taken considering its context and constraints. Due to the study's focus on a particular sample and setting, the findings may not apply to all farmers with impairments in other countries. The findings of the research, however, can be used as a foundation for more studies and to guide policies and initiatives that support inclusive agricultural practices for farmers with disabilities, both in Ghana and in other contexts.

This study aimed to develop an improved framework for agricultural extension practices among farmers with disabilities in Ghana. The study intended to enhance disability-inclusive agricultural practices and support the economic well-being and livelihoods of farmers with disabilities in Ghana by concentrating on the difficulties, factors, and effects of agricultural extension services on farm income.

1.5.1 Aim of the study

The development of a comprehensive framework for agricultural extension practices among farmers with disabilities in Ghana was the primary aim of this research study. The project determined the factors associated with farmers with disabilities' access to agricultural extension services and identified the barriers they confront. The study aims to improve the livelihoods and financial stability of farmers with disabilities by investigating the effects of agricultural extension practices on their farm income.

The study intends to shed light on the distinct needs and requirements of farmers with disabilities by thoroughly examining their access to agricultural extension service, socio-economic determinants, obstacles, and opportunities. The study aims to create a suitable framework that can effectively support and empower farmers with disabilities in their agricultural endeavours by investigating potential interventions and considering the perspectives of critical stakeholders, including farmers and agricultural extension specialists.

The study's overarching goal is to enhance inclusive agriculture practices and development that are accessible to people with disabilities in Ghana. The study aims to inform policy decisions, improve accessibility and equity in agricultural extension services, and promote the economic development and social inclusion of farmers with disabilities in Ghana by addressing the difficulties faced by these farmers and offering evidence-based recommendations.

This research study aims to create a comprehensive and helpful framework that can direct agricultural extension practices and guarantee that Ghanaian farmers with disabilities have equal opportunities, access to resources, and the necessary support to succeed in the agricultural industry.

1.5.2 Research Objectives

The study's main objective is to identify and analyse the prevailing challenges of farmers with disabilities in accessing agricultural extension services, including the determinants of their access to extension services. The study intends to provide informed policy recommendations and a framework for agricultural extension practices among farmers with disabilities in Ghana. The specific objectives of the study are:

1. Analyse the demographic and socio-economic determinants of the extension service contacts of farmers with disabilities in Ghana.
2. Determine the challenges faced by farmers with disabilities in accessing agricultural extension services and the key associated factors.
3. Assess the demographic and socio-economic determinants of farm income of FWD.
4. Examine agricultural extension mediations that could enhance agricultural practices among farmers living with disabilities.
5. Develop a suitable framework for agricultural extension practices among farmers with disabilities.

1.5.3 Research Hypothesis

It may be hypothesized that:

1. Agricultural extension access has a statistically significant impact on the income of farmers with disabilities.
2. Socio-economic and demographic characteristics are significant determinants of access to extension services by farmers with disabilities.

1.6 Organisation of the Dissertation

The dissertation consists of six chapters that explore various aspects of a framework for farmers with disabilities. Chapter One provides the background and context for the study, including the research problem, aims, objectives, and hypotheses. Chapter two presents a literature review covering topics such as the characteristics of farmers with disabilities, challenges in extension services, and the relationship between agricultural extension and farmers with disabilities. Chapter three outlines the research methodology, including the study area, sampling and sampling techniques, analytical methods, and variables to be used. Chapter four presents the first set of findings, including descriptive statistics and challenges faced by farmers with disabilities. Chapter Five presents the results of regression analyses conducted in the study. Finally, Chapter Six summarises the study's findings and recommends addressing the research outcomes.

1.7 Limitations of the Study

It is important to acknowledge certain restrictions that may affect the study's scope and applicability to farmers with disabilities in Ghana when researching the framework for agricultural extension practices among those farmers. These restrictions consist of:

External Factors: External factors outside of the researcher's control, such as modifications to governmental regulations, alterations in the state of the economy, or advances in technology, may impact the study's findings.

Despite these drawbacks, the study seeks to offer insightful analysis and suggestions for strengthening agricultural extension methods among Ghanaian farmers with disabilities. Future research can expand on the results of this study and solve any gaps or restrictions that emerge by accepting these limitations, thereby advancing knowledge in this subject.

1.8 Conceptual framework

A conceptual framework is a theoretical framework used to comprehend and explain a specific phenomenon or concept (Williams, 2007). It comprises a set of concepts and their relationships, and it assists researchers in clarifying their thinking about a specific topic and identifying the key ideas and theories relevant to their study (Saunders et al., 2009). A conceptual framework can be created from existing theories and research, or it can be created from scratch to provide a fresh perspective on a specific topic (Williams, 2007).

In the context of agricultural extension practices, a conceptual framework for farmers with disabilities should consider the unique needs and challenges that these farmers face and the various strategies and resources that can be used to support their participation.

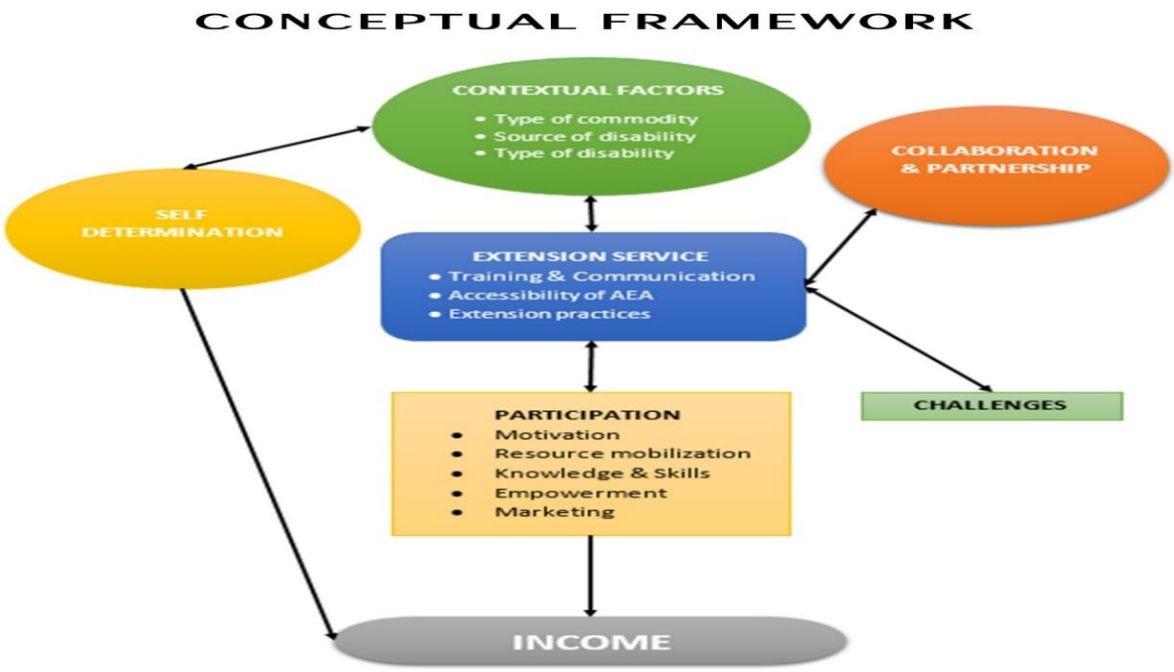

Figure 1.0: Conceptual framework

Source: Authors' Compilation (2022)

1.9 Chapter Summary

This chapter provided a comprehensive overview of the research study on the framework for agricultural extension practices among farmers with disabilities in Ghana. It focused on the background of the study, highlighting the marginalization and challenges faced by people with disabilities, particularly in accessing agricultural resources and support. The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) and the World Health Organization's Disability Report are essential references to emphasise the global recognition of the rights and dignity of individuals with disabilities.

The problem statement identifies the issues faced by farmers with disabilities in Ghana, including limited access to resources, exclusion from agricultural extension services, and discrimination. The study's rationale justifies the need for this research, emphasizing the economic significance of the agricultural sector in Ghana and the importance of ensuring inclusivity and equal opportunities for all farmers, regardless of their disabilities. Previous studies, such as Opoku et al. (2015) and Agyei-Okyere et al. (2019), are referenced to highlight the existing gaps in knowledge and the urgency for effective policies and interventions.

The research objectives and questions are presented to guide the study. The objectives focus on analysing the determinants of extension service access, understanding the challenges faced by farmers with disabilities, assessing the impact of agricultural extension practices on farm income, examining potential interventions, and developing a suitable framework for agricultural extension practices. These objectives align with the overarching goal of improving the livelihoods and productivity of farmers with disabilities in Ghana.

Several research questions are formulated to address these objectives, providing a structured approach to the study. The research hypotheses propose expected outcomes regarding the impact of extension service access on farm income and the role of socio-economic and demographic factors in determining access to extension services.

Finally, the chapter acknowledges the study's limitations, including generalizability, external factors, and time constraints. These limitations provide transparency and set the boundaries for the study, highlighting areas for further research and improvement in the future.

This chapter provides a comprehensive research study overview, establishing the background, problem statement, rationale, objectives, research questions, and hypotheses. It also identifies the limitations that should be considered when interpreting the study's findings.

CHAPTER TWO

LITERATURE REVIEW

2.0 introduction

This chapter critically reviews existing literature on developing frameworks and practical applications of agricultural extension services, particularly on farmers with disabilities (FWDs) in Ghana. The review employs a theoretical framework based on self-determination theory, participation theory, and the importance of contextual variables, accessibility, and collaborations. These elements guided the investigation, addressing the unique needs of FWDs in the context of agricultural extension services.

The literature review covers several important topics, including Ghana's agricultural sector, the intersection of disability and agricultural extension practises, and the socio-economic factors that affect FWDs. It investigates the factors that influence the accessibility and effectiveness of agricultural extension services.

The primary goal of this literature review is to develop a thorough understanding of the subject, identify knowledge gaps in the existing literature, and establish a coherent context for the current study. The chapter is a scholarly investigation to shed light on the dynamics of agricultural extension services and farmers with disabilities.

2.1. Theoretical framework for the study

Farmers with disabilities (FWDs) are participating in agriculture in more significant numbers, but their access needs to agricultural extension services are still unfulfilled. This review aims to determine how self-determination theory, participation theory, contextual variables, accessibility, cooperation and partnerships, and partnerships can be used to represent the unique needs of FWDs with agricultural extension services. Farmers with disabilities use agricultural extension work in numerous ways, but accessibility, cooperation, and partnerships are crucial.

2.1.1 Accessibility

According to the World Health Organization (2011), people with disabilities in Ghana face various challenges in accessing agricultural extension services. These obstacles, which

might be physical, social, or financial, can prevent access to crucial knowledge and resources.

Inclusion and accessibility should be the fundamental principles that guide agricultural extension practices for farmers with disabilities. Accessibility procedures may include adapting materials or technologies to be more available, providing transportation or accommodations for farmers with mobility issues, and safeguarding that extension staff are trained in disability sensitivity and inclusion (UNESCO, 2009).

Agricultural extension agencies must modify materials to make them more usable by farmers with disabilities. The material could entail creating documents in alternate formats for farmers with visual impairments, such as braille, audio, or large print, and clarifying complicated terminology and jargon for farmers with learning disabilities (UNESCO, 2009).

Farmers with mobility challenges may need assistance with transportation or accommodations to receive agricultural extension programs. For farmers with disabilities, extension programs must include transportation, wheelchairs, and other assistive aids (World Health Organization, 2011).

To guarantee they can offer suitable services to farmers with disabilities, extension staff members should get training in disability sensitivity and inclusion. This training will give employees the knowledge they need to provide inclusive and accessible services while also comprehending the difficulties that farmers with disabilities face (UNESCO, 2009).

In Ghana, farmers with disabilities must be included in the design of agricultural extension programs and have access to them. To guarantee that farmers with disabilities have access to crucial information and services, actions like material adaptation, transportation and accommodations, and staff training are required. Agricultural extension officers can guarantee that all farmers in Ghana, including those with disabilities, have equal opportunities to succeed in agriculture by fostering accessibility and inclusion.

2.1.2 Collaboration and Partnerships

Designing and implementing inclusive agricultural extension techniques for farmers with disabilities requires effective teamwork and partnerships. Various parties should work together, including local governments, disability rights organisations, and farmers with disabilities (UNESCO, 2009). Through these collaborations, farmers with disabilities'

particular needs and concerns can be considered when designing and delivering agricultural extension services (UNESCO, 2009). Farmers with disabilities and their representative organisations can assist in identifying obstacles and creating solutions that address their needs by actively participating (World Health Organization, 2011).

Partnerships with local government agencies and organisations that support the rights of people with disabilities can be used to implement inclusive practices. By doing so, it will be possible to ensure that agricultural extension services are accessible and that farmers with disabilities have equal access to resources and information (UNESCO, 2009). Collaboration can also result in assistive technology that will enhance the quality of life for farmers with disabilities and remove obstacles to their full engagement in agriculture (World Health Organization, 2011).

In conclusion, cooperation and partnerships are crucial for making sure that farmers with disabilities in Ghana have access to agricultural extension services. Developing solutions that address their particular requirements can be aided by including farmers with disabilities and their representative organisations in the planning and execution of extension services. Agricultural extension officers can develop a more inclusive and accessible agricultural extension system for farmers with disabilities by collaborating with local governments and disability rights organisations.

2.1.3 Contextual factors

When developing agricultural extension techniques for farmers with disabilities in Ghana, contextual issues are crucial considerations. Ghana's agriculture industry is diversified, with different nationwide crops and farming techniques. Several contextual elements must be considered to ensure that agricultural extension initiatives successfully meet the needs of farmers with disabilities.

The threats and opportunities faced by farmers with disabilities in Ghana's agriculture sector are a significant contextual phenomenon. Physical and mental hurdles, restricted access to agricultural resources and services, and inadequate policy frameworks supporting their involvement in the industry are just a few of the difficulties farmers with disabilities must overcome to engage in agricultural operations.

Along with these difficulties, some chances can be taken advantage of to promote the inclusion of farmers with disabilities in the agricultural industry. For instance, efforts are

being undertaken to promote disability rights and inclusion in various sectors, including agriculture, due to a growing awareness of disability concerns in Ghana.

The typical crops and farming practices in Ghana are another significant contextual aspect. Ghana's agriculture industry is diversified, with different nationwide crops and farming techniques. Maize, cassava, yam, rice, and cocoa are a few of the crops frequently farmed in Ghana. Small-scale subsistence farming and large-scale commercial agriculture are prevalent in Ghana's agricultural systems.

Understanding the types of crops and farming systems standards in Ghana is essential for designing agricultural extension practices relevant to the needs of farmers with disabilities. For example, extension services may need information on accessible farming practices for specific crops or farming systems to enable farmers with disabilities to participate effectively.

Overall, contextual factors play a critical role in designing effective agricultural extension practices for farmers with disabilities in Ghana. By considering the challenges and opportunities facing farmers with disabilities and understanding the types of crops and farming systems standard in the country, agricultural extension services can develop relevant and effective interventions promoting the inclusion of farmers with disabilities in the agriculture sector.

2.1.4 Self-determination theory

The self-determination theory is a well-known and prominent psychological theory that describes how people can increase their motivation, engagement, and well-being (Deci & Ryan, 2000). This theory has not, however, been extensively used in the context of farmers with disabilities. This is unfortunate, considering the daily difficulties and obstacles these people face.

Self-Determination Theory (SDT) is a theoretical framework that seeks to comprehend people's fundamental psychological requirements for survival and well-being. Humans have three basic psychological demands, according to SDT: relatedness, competence, and autonomy. These requirements are universal across all cultures and crucial for human growth and development (Evans, 2015). The urge for people to feel in control of their lives and that their acts are self-determined is referred to as autonomy. Competence expresses the need for people to feel in control of their environment and competent in their actions. The need for people to feel related to others and have a sense of belonging

is relatedness. People are more inclined to experience intrinsic motivation, which is the desire to engage in an activity for its own sake without any external incentives or pressures when these fundamental needs are realised (Evans, 2015).

SDT supports people's optimal functioning and well-being in several industries, including education, sports, and healthcare. For instance, by giving students meaningful choices and chances for self-expression, teachers can encourage students' autonomy in the classroom, increasing their motivation and engagement (Evans, 2015). For those seeking to enhance well-being and optimal functioning in people, both individuals and organisations can benefit from having a basic understanding of SDT.

Farmers with disabilities encounter difficulties performing their work because agriculture is one of the most physically demanding occupations. As they have significant obstacles in accessing markets, services, and resources that can help them manage their farms successfully, the situation of farmers with disabilities is a critical issue that requires attention. Farmers with disabilities encounter various difficulties, including those related to mobility, communication, and information access, according to Hutto et al. (2015).

The lack of appropriate infrastructure, equipment, and support services further compounds these challenges. For instance, farmers with mobility impairments may find it challenging to access their fields or operate heavy machinery, while those with visual or hearing impairments may have difficulty reading labels or communicating with customers. Additionally, farmers with disabilities often struggle to access credit and financing, which limits their capacity to invest in their farms and expand their operations. Addressing the plight of farmers with disabilities requires a multifaceted approach that involves providing accessible infrastructure and assistive technologies, creating inclusive policies and programs, and raising awareness of these farmers' challenges.

A helpful paradigm for comprehending how to support people with impairments, particularly farmers with disabilities, is the Self-Determination Theory (SDT). According to SDT, when people's fundamental psychological demands for autonomy, competence, and relatedness are satisfied, they are more likely to be motivated and involved in activities (Fisher et al., 2020).

It ensures that farmers with disabilities feel in charge of their agricultural operations, are confident in their skills, and can form deep connections with other farming community members. Giving farmers with disabilities assistive technologies and equipment that let them handle farming duties autonomously is one method to enhance autonomy (Fisher

et al., 2020). Farmers with disabilities may also feel more competent and confident in their farming abilities if training and resources are made available to assist them in becoming more capable. Finally, giving farmers with disabilities a chance to interact with other farmers and community people can support the development of a sense of relatedness and belonging. The SDT framework can aid in directing interventions and assistance for farmers with disabilities, increasing their participation, contentment, and success in their farming endeavours.

To sum up, the self-determination theory (SDT) has been acknowledged as an essential framework for comprehending the motivation and well-being of people with disabilities, including farmers. SDT can be used to support the autonomy, competence, and relatedness of farmers with disabilities, which can positively impact their job satisfaction, productivity, and general well-being. We can encourage their self-determination and improve their quality of life by recognising the difficulties faced by farmers with disabilities and offering them the appropriate assistance and resources to exercise their autonomy, develop their talents, and create meaningful relationships.

2.1.5 Participation Theory in the Context of FWDs and Extension Service

The participation theory is particularly relevant in extending service delivery for farmers with disabilities (FWDs). Extension services are designed to provide farmers with training, technical assistance, and advisory services to improve their productivity and income. However, the effectiveness of extension services depends on the ability of extension agents to reach and communicate with all farming community members, including FWDs. Several theories of participation can be applied to extension service delivery for FWDs. One such theory is the resource mobilisation theory, which suggests that participation is driven by the availability of resources, such as time, money, and information, that allow individuals and groups to engage in the participatory process (Somma, 2023).

This theory suggests that if FWDs have access to the necessary resources, such as transportation to extension training sessions or assistive technologies to facilitate communication, they may be more likely to participate in extension services. The social exchange theory contends that participation is influenced by the perceived benefits and costs of participation and the perceived level of influence and control that participants have over the decision-making process, which is another pertinent theory in this context (Burton, 2009). This theory contends that FWDs may be more likely to take advantage of

extension services if they believe they will gain something from the training and feel they have a voice in the design and delivery of the services. The empowerment theory is pertinent to extending services provided to FWDs. Empowerment gives people or groups more control over their ability to decide what to do and how to do it (Huq, 2023). Empowerment theory suggests that in providing extension services to FWDs, extension services should aim to improve their capacity to decide on their farming practices and advocate for their own needs and interests.

It can be achieved through training, advisory services, and other forms of support that enable FWDs to participate in the planning and decision-making processes that affect their lives. In conclusion, participation theory is critical in extending service delivery for FWDs. Extension services should aim to involve FWDs in the planning and decision-making processes that affect their lives and to provide them with the resources and support they need to participate effectively. Resource mobilization, social exchange, and empowerment can help understand and promote participation by FWDs in extension services.

2.2. Disability in Ghana

In Ghana, disability is a complicated, multifaceted problem that affects a sizeable portion of the population. According to statistics, an estimated one million people are living with disabilities in Ghana, where the prevalence of disabilities is estimated to be around 3.6%. (World Health Organization, 2020). Physical impairments, visual impairments, and hearing impairments are the three most prevalent categories of disabilities in Ghana (Opoku et al., 2015). Unfortunately, it is complicated for people with disabilities to access employment, healthcare, and education opportunities in Ghana. These difficulties are frequently brought on by the absence of adequate laws and support systems for those with disabilities.

According to Mock et al. (2003), Ghana has an even higher prevalence of disability, with an estimated 2.6 million people having a disability of some kind. About 10% of the total population is represented by this number. Because people who live in poverty are more likely to lack access to healthcare and other necessities, disabilities are frequently linked to poverty in Ghana. In Ghana, many people with disabilities also experience stigma and discrimination, which can further restrict their access to opportunities for employment, education, and other services.

Despite these difficulties, initiatives have been made to enhance the lives of people with disabilities in Ghana. The 2006 passage of the Persons with Disability Act, which aims to uphold and advance the rights of people with disabilities, is a significant development. To ensure that people with disabilities have equal access to opportunities and services, more must be done to address the structural barriers fuelling Ghana's high prevalence of disability.

Physical disabilities Some of these impairments are amputations, spinal cord injuries, and cerebral palsy. In Ghana, 1 per cent of the population is thought to have a visual impairment and 1 per cent a hearing impairment. Less frequently occurring, intellectual disabilities—syndromes like Down syndrome and autism—affect about 0.7 per cent of the population. The authors point out that these limitations often result in social exclusion and discrimination, particularly regarding access to chances for school and employment.

Many obstacles still exist for people with impairments despite the 2006 passage of the Persons with Disability Act, which ensures equal rights and opportunities. The inaccessibility of buildings and public transportation, as well as harsh attitudes toward people with disabilities, are some of the obstacles. According to Baffoe (2013), one of the key issues facing those with disabilities in Ghana is the absence of inclusive education, which restricts their options for higher education. Due to this, the unemployment rate and literacy rate for people with disabilities both declines. Additionally, the mobility of those with disabilities is restricted due to a lack of accessibility in public areas and public transportation. The lack of accessibility also constrains their capacity to engage in social and commercial activities.

In Ghanaian society, there are still unfavourable views and preconceptions about individuals with disabilities, further marginalising them. People with disabilities cannot receive social services or participate in community activities due to prejudice and social exclusion. The lack of employment options is a critical issue that affects people with disabilities. When they look for work, they are subjected to stigmatisation and prejudice, and frequently, companies cannot make the required modifications to meet their demands.

In Ghana, individuals with disabilities face many complex issues that call for a comprehensive strategy to address their needs and advance their social and economic engagement. Ghana may become a more inclusive society that respects and upholds the

rights of those with disabilities, enabling them to fully engage in all facets of life with the help of the appropriate interventions.

2.2.1 Types of Disabilities in the Context of Farmers with Disabilities

Farming requires a lot of physical strength, endurance, and flexibility. These requirements might offer a variety of difficulties for farmers with disabilities, which must be resolved to ensure their success and well-being. In this context, it is critical to comprehend the limitations that farmers can encounter and the problems and obstacles they might encounter. This disease condition covers physical impairments that farmers may meet, such as mobility issues or chronic pain, as well as issues with their mental health and physical accessibility that may hinder their capacity to work and prosper.

The physically demanding nature of farming makes physical disability widespread among farmers. Research by Davis and Kotowski (2007) found that farmers who perform manual labour have a higher risk of physical impairments. These impairments, ranging from chronic pain to musculoskeletal conditions, can drastically lower a farmer's quality of life. The repetitive and physically demanding activities needed for farming are among the leading causes of physical disability in farmers. This situation may result in musculoskeletal conditions such as tendinitis, lower back discomfort, and carpal tunnel syndrome.

Due to exposure to dust, pesticides, and other air pollutants, farmers are also at risk of acquiring respiratory conditions such as chronic obstructive pulmonary disease (COPD). These diseases can harm the lungs over time, making it challenging for farmers to carry out physically demanding chores. Overall, physical impairments are a significant problem among farmers and can negatively impact their well-being and means of subsistence. Farmers should take precautions to reduce their chance of having physical impairments, such as adopting the right tools and practices.

Farming is a unique profession with various difficulties that can seriously affect mental health. Mental health issues in the farming community are common and becoming a bigger problem. According to a recent study by Cole and Bondy (2020), because of the elevated levels of stress, isolation, and financial demands associated with the profession, farmers are more likely to experience depression, anxiety, and other mental health difficulties. Farmers frequently deal with erratic weather patterns, shifting commodity prices, and strenuous physical labour, all of which can contribute to chronic stress and tiredness. Furthermore, farmers frequently labour in remote locations with little access to

mental health resources, making getting treatment when needed challenging. Farmers may hesitate to seek assistance due to the stigma associated with mental health since they may view it as a sign of weakness.

It is critical to acknowledge the difficulties with mental health that farmers experience and to give them the tools and assistance they need to deal with these problems. Farmers' mental health and well-being can be enhanced by providing readily available mental health services and support groups and removing the stigma associated with mental health in the farming community.

Farmers with impairments may find it challenging to perform the physically taxing and labour-intensive tasks associated with agriculture. According to Huang et al. (2017), accessibility hurdles for farmers with impairments include physical and psychological ones. Inability to access farm buildings and equipment, and the absence of accessible transportation, are examples of physical barriers. For instance, farmers with mobility issues could find it challenging to step into a tractor or manage the uneven terrain of a farm. Similarly, farmers with vision impairments could find it challenging to read equipment labels or recognise plants and crops.

On the other hand, attitude barriers refer to people's unfavourable attitudes and opinions about people with disabilities. Farmers with disabilities may experience an unwelcoming environment due to these views, making it more difficult for them to seek resources and assistance. For instance, agricultural extension agents or service providers who misjudge their capabilities may discriminate against farmers with disabilities. In conclusion, the accessibility challenges that farmers with disabilities have may significantly impact their quality of life and ability to earn a living. It will take a holistic strategy addressing structural and psychological barriers to overcome these obstacles.

In conclusion, farmers with disabilities experience difficulties in farming and supporting themselves, support, and accommodations they need to succeed; it is essential to have a thorough understanding of the various sorts of disabilities they may experience. Farmers with disabilities should not be disregarded, and their needs should be considered, whether physical or mental health issues. Agricultural officers can build a more welcoming and supportive agricultural community for everybody by recognising and addressing the different disabilities that farmers may experience.

2.2.2 Sources of Agricultural Information to FWDs

For farmers, particularly those with disabilities, accessing various agricultural information sources is essential to improving farming methods. Farmers receive much agricultural knowledge through extension agents, who serve as a bridge between farmers and research institutions (Osei et al., 2017; Yaseen et al., 2021). They are crucial in disseminating vital information and techniques to the agricultural community, empowering farmers to better their farming practices and make well-informed decisions (Yaseen et al., 2021).

Mass media, such as television, radio, and newspapers, are also crucial sources of information for farmers regarding agriculture (Sawe, 2022). Smallholder farmers in Tanzania heavily rely on the media, particularly radio, to obtain pertinent agricultural information (Sawe, 2022). However, difficulties like communication gaps, unfavourable program schedules, and tight financial resources for agricultural extension staff might make it difficult to effectively use the media as a source of information (Sawe, 2022).

Another major source of agricultural information is farmer-to-farmer relationships (Sawe, 2022). Farmers routinely share their skills and knowledge, providing insightful information on agricultural methods, inexpensive farm equipment, soil conservation strategies, and improved seed varieties (Sawe, 2022). This unofficial exchange of knowledge across farming communities encourages education and the adoption of cutting-edge farming techniques.

Additionally, care farm and agricultural groups offer guidance and assistance to farmers, including those with disabilities (Schreuder et al., 2014; Hassink et al., 2015). Care farming provides specialised support for people with disabilities by fusing agricultural output with health, social, and educational services (Schreuder et al., 2014; Hassink et al., 2015). Farmers with impairments now get the support and help they need to successfully handle their farm obligations thanks to programs like the Arability initiative in the United States (Minus et al., 2021).

In conclusion, farmers have access to various sources of agricultural information, including those with disabilities. The communication of valuable information and support for farmers is facilitated via extension agents, the media, interpersonal encounters, and agricultural groups. It is possible to improve farming techniques, increase agricultural

output, and improve farmers' livelihoods by comprehending and utilising these various sources of agricultural information.

2.3 Overview of the agricultural sector in Ghana

The bulk of the population in Ghana is working in the agricultural sector, which is a crucial part of the country's economy and makes up a sizeable portion of the GDP (Gross Domestic Product). Enu & Attah-Obeng (2013) estimate that the agricultural industry employs 54.4 per cent of Ghana's workforce, accounting for about 20 per cent of the nation's GDP. The sector's contribution to foreign exchange profits, with agriculture serving as Ghana's primary source of non-traditional exports, serves as further evidence of its significance.

Additionally, agriculture provides the nation's agro-based industries, like cocoa processing and textile production, with the necessary raw materials. The Ghanaian government has implemented policies and initiatives to improve agricultural productivity, expand market access, and lure private sector investments despite the sector's difficulties, such as poor infrastructure, low productivity, and climate change.

Farmers in Ghana face several obstacles that reduce their productivity and profitability, according to Frimpong and Adwani (2015), including a lack of access to current information and technology. Traditional farming techniques, which take more time and produce less than modern technologies, are still used by farmers in Ghana. Furthermore, it is challenging for farmers to decide on their farming activities because they lack information on weather patterns, crop varieties, and market prices.

Inadequate access to credit facilities is a significant issue Ghanaian farmers face. Most farmers in Ghana are small-scale farmers who cannot obtain loans from financial institutions because they lack the necessary collateral. As a result, they cannot expand their farming operations or invest in innovative farming technologies. Furthermore, poor road networks make it challenging for farmers to transport their goods to markets, which presents another challenge for Ghanaian farmers.

Despite these difficulties, Ghana's small-scale farming community is essential to the nation's agricultural industry. According to Yengoh et al. (2010), small-scale farmers are the foundation of Ghana's food system because they produce 80% of the nation's agricultural output. These farmers raise livestock like cattle, sheep, and goats and grow cereals, vegetables, and fruits. They rely on family labour and basic, traditional farming

methods with little to no use of agrochemicals. However, they encounter many difficulties, such as limited financial availability, subpar extension services, and a dearth of market prospects (Yengoh et al., 2010).

To support small-scale farmers in Ghana, governments and other stakeholders must give them access to loans, extension services, and market opportunities. It will help enhance the farmers' quality of life and advance the nation's agricultural industry. The government is addressing these issues by boosting investment in the sector, enhancing infrastructure, and promoting sustainable farming methods.

In conclusion, Ghana's agricultural sector has enormous potential for growth and development and can continue to contribute to the nation's economic and social development with the right policies and investments. Over half of the workforce is employed in the sector, significantly boosting GDP. Due to their contribution to food security and the production of most of the nation's food, small-scale farmers play a significant role in the sector.

2.3.1 History of Agricultural Extension in Ghana

In Ghana, agricultural extension has a long and rich history. Various strategies and models have been used over the years (Danso-Abbeam, et al, 2018). The colonial system of extension, which the British developed during the colonial period, was one of Ghana's oldest agricultural extension types (Frimpong et al., 2015). This arrangement prioritised large-scale commercial farms while paying little attention to smallholder farmers (Degefu, 2020).

Ghana's government launched many initiatives to improve the agricultural industry after gaining independence in 1957, including creating the Ministry of Food and Agriculture. The government also launched a new extension system as part of these initiatives, intending to give smallholder farmers technical support (Bonye, 2012). This system was based on the "farmers' school" model, which called for creating demonstration plots and employing extension agents to give farmers instruction and guidance (Chaudhary, et al, 2018).

The "community-based extension" model sought to involve local communities in the extension process, and decentralised extension services to the district level were first implemented in Ghana in the 1980s (Hoffmann, et al. 2017). This strategy aimed to give farmers more control and motivate them to participate more actively in the extension

process (Agole et al., 2021). This strategy called for forming intimate groups of farmers who gathered regularly to exchange ideas and learn about new farming methods and technologies (Ragasa et al., 2013).

The establishment of the Agricultural Extension and Advisory Services (AEAS) in 2007 (Nkomoki, et al, 2018), which aims to provide extension services to smallholder farmers through a network of extension agents and community-based organisations, is one of the more recent initiatives the government of Ghana has introduced to improve the effectiveness and efficiency of extension services (Agole, et al, 2021). To enhance the provision of extension services, the government has also introduced digital technologies, such as mobile phones and online platforms (Hoffmann, et al, 2017). These initiatives aim to modernise Ghanaian agriculture and enhance the lives of smallholder farmers (Agole et al., 2021)

2.3.2 Agricultural Extension Practices in Ghana

Agricultural extension practices in Ghana have a long and dynamic history, evolving with changing external pressures and local needs. This literature review will examine the state of agricultural extension services in Ghana, how they have become, and how their delivery has impacted farmers. By digging into the research done on agricultural extension, this review will seek to understand better the role of extension services for Ghanaian farmers and its implications for the future of agriculture in Ghana.

Agricultural extension in Ghana has been a critical factor in improving crop yield and the overall livelihoods of small-scale farmers.

Agricultural extension practices have become an essential component of agricultural development in Ghana. It is vital to improving agricultural productivity, food security, and rural incomes. According to Antwi-Agyei and Stringer's (2021) publication, Climate Risk Management, programmes are instrumental in improving farmers' livelihoods through adopting climate-smart agricultural practices. The authors note that extension programmes have been used to increase the knowledge and awareness of farmers regarding the effects of climate change on their production. They also point out that it is essential to provide farmers with access to the necessary resources and technologies to help them adapt to climate change and the support to implement them.

Furthermore, the authors suggest that the effectiveness of agricultural extension programs in Ghana can be improved with better coordination between the various actors

involved, such as the Ministry of Agriculture, NGOs, and private companies. Additionally, they emphasise the need for increased funding and capacity building to ensure these programs' successful implementation. In conclusion, agricultural extension programs in Ghana have the potential to be successful in improving the livelihoods of farmers, but only when there is a comprehensive and well-coordinated approach.

Agricultural extension practices in Ghana are inspiring and have demonstrated much success in the last few years. The expertise and knowledge of experienced extension agents have enabled Ghanaian farmers to access the proper techniques, resources, and tools for better agricultural production. Furthermore, the extension programs have allowed farmers to apply their understanding, skills, and experience to their practices, resulting in increased yields and improved overall livelihood. Beyond the success of Ghanaian agricultural extension, findings from the literature review suggest that there is still much potential for even more significant advances in agricultural extension programs. With resources, technical knowledge and collective support, Ghanaian farmers could be further equipped to gain access to new, sustainable farming methods and technologies, leading to higher and more sustainable incomes, better nutrition, and healthier livelihoods.

2.4 Ghana Agricultural Extension Approaches

The Ministry of Food and Agriculture (MoFA) and the Ministry of Local Government and Rural Development (MLGRD) in Ghana are implementing the General Extension method to improve crop and livestock production among smallholder farmers. MoFA aims to promote food security, emergency readiness, better income growth, and the application of science and technology to food and farm development, while MLGRD's mission is to promote human development and ensure healthy growth in rural and urban communities.

Programming in Ghana is centralised and regulated by technical and administrative professionals at the national, regional, and district levels. The decentralised local government system has changed the control of the agricultural industry, but linkages with national-level units remain. The Department of Agriculture's staff includes Subject Matter Specialists (SMSs), field officers, and supporting staff at the district, municipal, and metropolitan levels.

Agricultural Extension Agents (AEAs) provide general extension services to smallholder farmers through demonstrations and farm and house visits. They rely on resources primarily provided by the federal government but also have a relationship with extension

providers in the commercial sector. The method is supported by mass media such as radio, posters, and publications.

The rise in national commodity production determines the success of the General Extension model, but the strategy is expensive due to the substantial number of extension employees involved. Extension agents are often rendered ineffectual due to flaws in the timely provision of financial allocation, poor supervision, and negative attitudes towards work. The number of extension staff is falling due to attrition, and they have limited access to materials such as transportation and travel allowances when visiting smallholder farmers.

2.4.1 Commodity-Based Extension Approach

The Commodity-based Extension Approach (CEA) is a strategy used in Ghana to improve the quality and quantity of cash crops such as cocoa, coffee, rubber, pineapple, and banana.

Today, the CEA involves parastatals, private enterprises, commercial farms, and producer groups such as Twifo Oil Palm Plantation Limited (TOPP), Ghana Rubber Estates Limited (GREL), and Ghana Cocoa Board (COCOBOD), as well as other farmer organisations, to promote the transfer of crop-related technologies for export and profit. The main goal of this approach is to improve the quality and quantity of cash crops through research, production, post-harvest handling, marketing, and consumption.

COCOBOD, a parastatal active in commodity-based approaches, focuses on boosting cocoa output for export and processing for domestic. The organisation invests in cocoa production, extension, research, input supply, marketing, transportation, and pricing determination. COCOBOD's Cocoa Health and Extension Division (CHED) facilitates the timely distribution of messages to smallholder cocoa farmers in Ghana's Western, Ashanti, Brong Ahafo, Eastern, Volta, and Central Regions.

Under the commodity-based extension approach, commodity organisations oversee programming and implementation. The organisations' governing boards determine the extension's aims and objectives, the content of information and communications, the timetable of operations, and personnel issues. Beneficiaries are encouraged to closely follow or embrace pre-determined technology packages disseminated by a few extension workers.

For example, Unilever's Twifo Oil Palm Plantation Limited (TOPP) offers a strategy that organises oil palm production by smallholder farmers connected to the company's plantations. Farmers are provided with materials, financing, and production assistance for the fruits to be harvested and supplied to the palm oil processing plant on time.

Commodity-based extension organisations invest in staff training and management and smallholder farmer management. Occasionally, highly qualified scientific and field personnel are hired to instruct farmers, and credit programs are set up to help them support their produce. The extension organisation's personnel are to instruct cultivators as part of the implementation plan. It is accomplished through individual or group face-to-face contact, as well as the use of written training materials in areas where literacy is considered vital.

The commodity-based strategy has the advantage of distributing technology tailored to farmers' commodity production issues. The activities under this strategy are simple to track and evaluate. Because the areas of operation are typically closer and smaller in terms of coverage, the strategy is cost-effective. Farmers have an assured market and security. Organisations, for example, buy huge quantities of farm products. COCOBOD and other Licensed Cocoa Purchasing Organizations purchase all cocoa produced by farmers.

However, the method tends to focus on recipients' non-commodity-related difficulties. Farmers' concerns are frequently overlooked in favour of the interests of commodities producers. Advisory services on other farming businesses of farmers that produce many commodities are underutilised. Farmer and advocacy groups frequently argue that commodity prices are set arbitrarily to boost the profits of organisations, with little or no input from farmers in the process.

2.4.2 Training and Visit Approach

The Technology and Transfer (T&V) strategy was designed to improve the delivery of public extension services. It was based on a single line of command that focused on contacting farmers who were expected to share information with other farmers. The model assumed that field employees were under-trained and unaware of technical advancements, and it aimed to improve communication between extension agents and farmers. To achieve this, the T&V strategy arranged some activities in advance, provided frequent training, and had tight ties to research (Anang and Awuni, 2018)

In Ghana, the T&V strategy was initially tested in the Upper East, Upper West, and Volta regions. However, it was transformed into the Unified Extension System (UES) in 1992. Under the T&V model, trained Agricultural Extension Agents (AEAs) made bi-weekly visits to contact farmers, who were then expected to share their knowledge with a minimum of ten other farms. The AEAs provided farm demonstrations and talks to disseminate valuable information to farmers—the T&V strategy aimed to increase agricultural yields and total production to measure success.

The UES, on the other hand, focused on farmer group activities rather than individual farmers. This innovative approach involved less frequent training of agricultural extension agents and instead encouraged collaboration between extension and research professionals on what, how, and when to train farmers. Sivabalan (2021) noted that the T&V strategy increased staff mobility and programming and provided field personnel with more technical guidance and logistical support. The World Bank funded the T&V strategy to cover the program's prohibitive costs, including logistics and salaries of extension agents.

However, despite its initial success, the T&V strategy had some limitations. It assumed contact farmers would effectively disseminate information to other farmers, but this was not always the case. The training frequency of agricultural extension agents decreased over time, and management and monitoring were insufficient. Additionally, the T&V strategy did not focus on farmers' non-technical issues, such as access to credit and markets. Nonetheless, the T&V strategy improved communication between extension agents and farmers, encouraging collaboration between extension and research professionals in Ghana.

2.4.3 Participatory Agricultural Extension Approach

In Ghana, smallholder farmers are the primary beneficiaries of agricultural extension services, and their participation is essential at all stages of extension activities. The Participatory Agricultural Extension (PAE) strategy seeks to involve extension partners equitably in the design, planning, execution, and evaluation phases of extension activities.

The PAE strategy assumes that farmers are often left out of decision-making processes that affect them despite familiarity with the knowledge system. However, it recognises that outside information and expertise are crucial in improving their living standards. Farmers' participation ensures they acquire new knowledge and technology while integrating what

they already know. PAE also assumes that researchers, extension staff, and farmers can collaborate to develop and disseminate technology and that this collaboration is essential for achieving their goals (Fountas, 2006).

The primary objective of the PAE strategy is to empower farmers while improving communication among them, extension agents, and researchers. PAE approaches such as Participatory Technology Development and Extension (PTD &E), Participatory Rural Appraisal (PRA), and Participatory Learning and Action (PLA) have been used in Ghana to ensure that the technologies provided are adopted and to improve the sustainability of extension initiatives.

The decentralisation of general extension in Ghana aims to make extension more flexible and encourage participation by many farmers and other stakeholders, such as input suppliers, marketers, and credit providers. GIZ and MoFA worked with farmers and extension agents on Participatory Technology Development and Extension (PTD &E) and Integrated Pest Management in the Brong Ahafo Region. Farmers in Ghana's Northern Savannah Zone who participated in Sustainable Land and Water Management benefited from using PRA and PLA by extension agents to promote successful engagement and planning with rural communities.

The Integrated Pest Management/Farmer Field Schools (IPM/FFS) program was piloted on rice production in five irrigated sites in Ghana, and it was later scaled up with the assistance of UNDP and FAO. The FFS/IPM addressed various farmer groups, resulting in higher crop yields and lower losses and production costs.

Ghana has developed various 'quick appraisal' methodologies to promote participatory techniques. ACDI/VOCA, ACDEP, ADRA, CARE, Techno Serve, and World Vision have all worked on projects to include the PAE strategy in extension delivery. The PAE strategy is client-centred, indigenous, knowledge-based, and bottom-up, ensuring that farmers' objectives are met through program activities while using resources more wisely. However, involving customers in extension delivery may take time and interfere with their schedules, particularly during peak production periods. The PAE project is not under the authority of farmer groups or organisations on a local level (cooperatives). Experts from outside Ghana and officials from agricultural extension agencies are driving the PAE project.Top of FormBottom of Form

2.4.4 Project Approach

This approach focuses on achieving short-term results and is often used in rural development projects.

The success of the Project Approach is measured in the short term and is based on the belief that when extension activities are carried out in unusual conditions, they will significantly impact recipients and provide some continuity when the source of financial support is no longer available. Proponents of this approach argue that the bureaucracy involved with government public extension and other alternatives is unlikely to significantly impact agricultural production or rural people within a set period.

The Project Approach is frequently integrated into larger rural development projects, such as the Agricultural Development and Value-Chain Enhancement Project (ADVANCE) in Northern Ghana, supported by the United States of America through USAID and the Feed the Future initiative. The project aims to develop value chains in soya, maise, and rice and provides beneficiaries with farming inputs such as improved seeds, agricultural mechanisation services, and market access.

Several NGOs in Northern Ghana, such as World Vision, Action Aid, and Care International, have also used the Project Approach to offer extension services. The Association of Church-based Development Projects (ACDEP) brings together church-based NGOs such as Catholic Relief Services, Presbyterian Agricultural Services (PAS), Adventist Development and Relief Agency (ADRA), Methodist Agricultural (MAP), and others to provide extension services on vegetable production, low-input farming, and facilitate linkages between government and communities in Northern Ghana.

The Project Approach emphasises achieving superior results at a specific place, and activities are frequently planned outside of communities by the central government, donor agencies, and implementing agencies. Service providers' employees are typically well educated, having bachelor's or master's degrees in agriculture or similar professions. Many NGO field employees hold Diplomas or BSc degrees at the administrative level.

The employees of the Project Approach are highly compensated and given allowances, as well as transportation, adequate lodging, and other facilities and equipment to conduct comprehensive services. Short-term change at the project site, as seen by increases in productivity, is frequently used as a metric of success. The project approach has the benefit of achieving speedy outcomes because resources are delivered on schedule and

in the quantities required. Under this strategy, trying out new ways and strategies is simple.

The downsides of the Project Approach include that it is not long-term, and the expectation that the project's tenets will be extended to other areas is rarely realised. Usually, the assumption of continuity is unmet, and when a project's financing source runs out, it is common for its operations to halt.

2.4.5 Farming Systems Research and Extension (FSR/E) Approach

The FSR/E (Farming Systems Research and Extension) approach is a holistic program that promotes farming systems at the local level, with a focus on generating and distributing technologies that meet the demands of smallholder farmers. The approach assumes that suitable technologies for smallholder farmers do not exist and must be developed locally. To achieve this, the approach allows extension and research workers to collaborate with smallholder farmers to customise research results to the requirements and interests of local farming systems (Harwood, 2012).

The FSR/E approach is usually led by researchers stationed at agroecological zones with distinct agricultural systems. Their mission is to meet the requirements of smallholder farmers in Ghana. For instance, the Savanna Agricultural Research Institute (SARI) uses the FST/E approach to create appropriate food and fibre crop technologies to help farmers in the Upper East, Upper West, and Northern Regions boost their productivity.

The FSR/E approach is implemented by collaborating with farmers and extension agents at field stations in Northern Ghana, including Nyankpala, Manga, and Wa. This collaboration aims to develop soil fertility maintenance, drought, disease, pest-resistant millet, sorghum, rice, groundnut, and cowpea varieties and technologies. Other institutions, such as the Crop Research Institute (CRI) in Fumesua, Ashanti Region, the Animal Research Institute (ARI) in Accra, the University of Ghana Research Stations in Kade and Nungua, and scientists from Ghana's public universities, have also used the FSR/E approach to develop and disseminate various technologies for smallholder adoption.

The program design of the FSR/E approach considers the diverse climatic and agroecological ecosystems and Indigenous smallholder farmers' diversification of farming to develop crops, animals, and people in each place. Farmers, agricultural extension officers, and agricultural scientists all share the management of the program. Farmers'

fields in the communities are occasionally used, necessitating visits by research personnel and extension personnel to listen to and understand the farming system.

The success of the FSR/E approach is measured by the extent to which local people adopt and continue to use the technology developed through it. The approach has the advantage of being participatory and tailored to the needs of smallholder farmers in specific locations. The connectivity between farmers, extension, and research employees enables the efficient and effective addressing farmers' needs and interests. However, financial reporting and sponsorship administration can be challenging, and getting results and outputs takes a long time. Results are typically reported in scientific form, which might be costly when working with groups of agricultural researchers from other disciplines, extension workers, and farmers in diverse agricultural disciplines and requirements.

2.4.6 Cost-Sharing Approach

To deliver agricultural extension services in Ghana, recurrent expenditures are necessary, including salaries and emoluments for extension personnel, capital costs for office construction, and operational costs for materials, fuel, and supplies, as well as in-service training costs. Typically, the government covers these expenses through budgetary allocations, World Bank and other donor-supported loans and grants, and project finance. Private companies, international and local NGOs, and UN-sponsored institutions like FAO support agricultural extension services. However, due to the rise of commercial extension and government budget deficits, there is a growing call for beneficiaries of extension services to share in the cost of delivery.

The cost-sharing strategy aims to make extension operations more accountable to local needs and interests by sharing costs with beneficiaries (Chukwuone, 2006). Although this strategy is not widely used in Ghana, some examples of cost-sharing initiatives exist. For instance, Prep Eze, an IT firm, is developing an e-extension platform and a mobile application in collaboration with MoFA and farmers. MTN, a mobile phone and internet service provider, has developed an interactive voice response (IVR) mobile service that enables farmers to pay for calls, receive pre-recorded production, and market information. Esko Ghana provides market and weather information to farmers in selected districts in Ghana via SMS, which is paid for by farmers. The Africa Cashew Initiative offers farmers pricing, weighing, and other advice through SMS.

Furthermore, the 'Cocoa-link 'project, a partnership between the Hershey Corporation, the World Cocoa Foundation, and the Ghana Cocoa Board, delivers extension services on cocoa technology, agronomy, and minimizing child labour in cocoa production through voice and text messaging. Additionally, farmers contribute in-kind from the cocoa they sell to the Cocoa Abrabopa Association to secure current and future savings and pension services. The organization registers farmers, educates them on good agricultural practices and certification, and provides technical assistance.

In Ghana, service providers primarily plan and control cost-sharing models, with representation from agricultural leaders. Most extension personnel following this strategy have a diploma certificate, while those with bachelor's and master's degrees work as service providers' managers. Farmers' willingness to pay their share of the cost is crucial to the cost-sharing approach's effectiveness. Although this model ensures that the content and methodology are tailored to farmers' needs and interests, financial management and administration can be complicated and challenging.

2.4.7 Educational Institution Approach

The educational institution approach involves agricultural schools, colleges, and universities providing extension services to rural farmers. These institutions have a dual mission of researching to develop modern technologies and provide outreach to rural residents. This approach assumes that the staff of these institutions possess the necessary knowledge and abilities to help farmers, and their interactions with farmers also help them improve their job performance.

All state universities with agricultural departments in Ghana, including the University of Cape Coast, University of Ghana, University for Development Studies, Kwame Nkrumah University of Science and Technology, and the University of Education, have researchers amongst staff members. Some staff members provide informal extension services during open days and on-farm trials to share their experiences with farmers. In addition, several faculty members provide training on established technologies, and the University of Cape Coast's Supervised Enterprise Projects assist rural communities in learning about scientific agricultural practices. The institutions also train their staff and students on farming practices by inviting farmers to share their expertise at university research farms and stations.

The design of educational institution programs is supervised by professionals from training institutions, with occasional involvement from farmers' representatives. The implementation of the educational institution approach often follows non-formal education delivered to smallholder farmers in groups. The success of this approach depends on the extent of farmers' participation and the audience's size. Institutional staff frequently gather real-world data and information to supplement textbooks and other teaching materials, reducing the cost of agriculture extension in national budgets. However, this approach may foster unhealthy competition between qualified and academic personnel, and teachers may be more scholarly than practical when training field extension employees and farmers.

This approach may also result in job competition between individuals from the Ministry of Agriculture and the Ministry of Education, highlighting the need for clear administrative understandings of ownership of territories.

2.5.1 Socio-economic Factors Influencing Extension Service Contacts of Farmers with Disabilities

In the agricultural sector, farmers with disabilities face numerous challenges in accessing extension services. Socioe-conomic factors play a critical role in determining the frequency of contact between farmers with disabilities and extension service providers. According to Chataika et al. (2012), factors such as education, income, age, and gender influence the extent to which farmers with disabilities interact with extension services. In terms of education, farmers with higher levels of education are more likely to access extension services than those with lower levels of education. Similarly, farmers with higher incomes are more likely to access extension services than those with lower incomes. Age and gender also influence the frequency of contact, with older farmers and women being less likely to access extension services. The authors also noted that farmers with disabilities who were members of farmer organizations were more likely to access extension services. These findings suggest that extension services need to be more accessible and inclusive to farmers with disabilities, particularly those from disadvantaged socio-economic backgrounds. Extension service providers should tailor their services to meet the specific needs of farmers with disabilities and ensure they are not excluded based on their socio-economic status.

According to Scott et al. (2007), the education level and income of farmers with disabilities play a critical role in their access to extension services. The authors found that farmers

with disabilities with higher education levels were more likely to seek out extension services than those with lower levels of education. Additionally, farmers with higher income levels were more likely to access extension services, as they had more resources to invest in their farms and were, therefore, more interested in learning about modern technologies and techniques. The authors also noted that the availability and accessibility of extension services in rural areas was a significant factor in determining whether farmers with disabilities would seek these services. Finally, the authors found that the age of farmers with disabilities was another critical factor in their access to extension services. Older farmers were less likely to seek extension services than younger farmers, due to a lack of interest or motivation. These findings suggest that socio-economic factors influence access to extension services for farmers with disabilities. It highlights the need for targeted outreach and educational programs to ensure that all farmers can access the necessary resources to succeed.

According to a study by Loki et al. (2021), socio-economic factors significantly determine the frequency of extension service contacts for farmers with disabilities. The study found that farmers with higher levels of education tend to have more frequent extension service contacts. The authors suggest that education gives farmers the necessary knowledge and skills to effectively seek and utilize extension services. Similarly, farmers with a higher income are more likely to have frequent extension service contacts, as they have the financial resources to invest in their farming activities. However, farmers with disabilities with limited access to financial resources may be unable to afford extension services, which could hinder their productivity and profitability.

Additionally, the study found that social networks and membership in farmer groups positively influence extension service contacts. The authors suggest that these groups provide a platform for sharing experiences and knowledge, encouraging farmers to seek extension services. Therefore, extension services must consider the socio-economic factors influencing the contact of farmers with disabilities to improve their accessibility and effectiveness.

According to Grech (2009), the economic status of farmers with disabilities is a significant factor that affects their access to extension services. Farmers with disabilities are more likely to have a lower income than their counterparts with disabilities, which can limit their ability to access and benefit from extension services. Furthermore, Grech (2009) notes that social isolation is another factor that affects the access of farmers with disabilities to

extension services. Farmers with disabilities may feel isolated due to their disability, contributing to difficulties in accessing extension services.

Additionally, Grech (2009) suggests that the physical accessibility of extension services is also an essential factor. Farmers with disabilities may face barriers in accessing extension services due to the physical environment or the lack of appropriate transportation options. Therefore, policymakers and extension service providers must consider these socio-economic factors when developing and implementing extension services for farmers with disabilities. By addressing these factors, extension services can be more accessible and beneficial to farmers with disabilities, promoting their economic and social inclusion in the agricultural sector.

According to a study by Nakirijja et al. (2018), socio-economic factors play a significant role in the extension service contacts of farmers with disabilities. The study found that farmers with disabilities with a higher education level and income were more likely to have connections with extension services. This assertion of FWDs is because they were better equipped to access information and resources that could help them improve their farming practices and increase their productivity. On the other hand, farmers with disabilities with lower education and income levels were less likely to have contact with extension services. It is because they faced more barriers to accessing information and resources, such as a lack of transportation and financial resources.

Additionally, the study found that farmers with disabilities who had family or social support were more likely to have contact with extension services. It is because they had a support system that could assist them in accessing information and resources. Overall, this study highlights the importance of addressing socio-economic factors when designing extension services for farmers with disabilities, as these factors can significantly impact their ability to access and benefit from these services (Nakirijja et al., 2018).

According to a study conducted by Barnes and Mercer (2010), factors such as education, income, and access to transportation play a significant role in determining whether farmers with disabilities seek out and utilize extension services. The study found that farmers with lower education and income levels were less likely to seek out extension services, which can be attributed to a lack of knowledge about the benefits of these services and the financial resources to access them. Additionally, the study found that limited access to transportation made it difficult for farmers with disabilities to attend

extension events and workshops. It is a significant barrier, as extension services typically require farmers to participate in in-person events to receive the program's full benefits. Overall, the findings of this study suggest that socio-economic factors play a significant role in determining whether farmers with disabilities can access and utilize extension services. As such, it is essential for extension programs to consider these factors when designing outreach strategies and developing programs accessible to all farmers, regardless of their socio-economic status.

In conclusion, farmers with disabilities face numerous challenges in accessing extension services, due to socio-economic factors such as education, income, age, and gender. Access to extension services is critical in promoting inclusive agricultural practices and providing technical assistance to farmers with disabilities. It is evident from the literature that targeted outreach, and educational programs are necessary to ensure that all farmers have access to the resources they need to succeed. Extension service providers should tailor their services to meet the specific needs of farmers with disabilities and ensure they are not excluded based on their socio-economic status. Addressing these socio-economic factors will promote more inclusive agricultural practices, leading to more significant economic opportunities for farmers with disabilities.

2.5.2 Socio-Economic Characteristics of Agricultural Extension Officers

Extension officers are key personnel in implementing agricultural policies and programs in Ghana. They serve as a link between farmers and the researchers.

The purpose of the Nyarko and Kozári (2021) study was to assess the effect of socio-economic factors on the productivity of extension officers in Ghana. The study found notable discrepancies between the officers' socio-economic status and performance. The research indicated that socio-economic characteristics such as educational level, age, gender, and years of service influence the performance of extension officers.

For example, the study found that educational level is a critical factor in determining the performance of extension officers, with higher levels of education tending to have higher performance levels. Similarly, the study found that officers with more years of service had higher performance levels than those with less experience. Additionally, the research revealed that gender plays a role in the performance of extension officers, with female officers typically demonstrating higher performance levels than male officers. These findings suggest that the socio-economic characteristics of extension officers are

essential factors in determining their performance and should be considered when recruiting and developing extension officers.

In Ghana, the socio-economic characteristics of Extension Officers impact their performance. According to a study by Addo et al. (2013), the socio-economic factors of Extension Officers, such as educational attainment, income level, and work experience, can significantly influence their performance. The study found that Extension Officers with higher educational attainment had higher performance than those with lower educational attainment, while Extension Officers with higher incomes had outstanding performance than those with lower incomes. The study also found that Extension Officers with more work experience performed better than those with less work experience. These findings suggest that socio-economic characteristics can significantly affect Extension Officer performance in Ghana and that it is essential that Extension Officers be aware of the importance of these factors. Furthermore, employers must ensure that Extension Officers are provided with the necessary resources to meet their roles' demands so that they can be appropriately equipped to perform their duties.

The literature reviewed revealed that Ghanaian extension officers have a variety of socio-economic characteristics. They have educated males, with a higher proportion of officers having some combination of university degrees, diplomas, and certificates. Most officers come from poor or lower-middle-income backgrounds and experience various economic challenges, such as low job security, a lack of job-related benefits, and long work hours. Nevertheless, the majority remain dedicated to their work and strive to improve the agricultural sector of their country. Socio-economic factors play an essential role in extension workers' motivation and performance and can be used to improve the effectiveness of the extension system in Ghana.

2.5.3 Incomes of Farmers with Disabilities

While many people find agriculture an accessible source of income, people with disabilities sometimes find themselves in this industry out of necessity rather than choice. Agricultural employment is the primary source of income for rural households with a PWD member (Siedlecka et al., 2017). However, the nature of this interaction has its issues. For instance, 78.4% of PWDs who were employed in metropolitan China were shown to be working in precarious, low-paying agricultural jobs (Wang & Minteer, 2018). Research in northern Nigeria also found that people with impairments frequently engage in agricultural work for survival (Sango et al., 2022).

Several contributing factors can affect how much money people with disabilities make from agricultural work. The severity of the condition significantly shapes the dynamics of income, the length of the legally recognised disability status, and the availability of labour (Siedlecka et al., 2017). A farmer's education and experience and the amount of assistance they receive can significantly impact their revenue (Whelan et al., 2009).

For those with disabilities, agro entrepreneurship comes with its difficulties. For instance, developing small businesses in agriculture for individuals with disabilities in Russia is linked to higher financial risks (Trunin and Osokin, 2022).

The link between disability and poverty further muddies the picture of the disability and agricultural income relationship. According to a USDA survey, one-third of American homes with adults with disabilities that prevent them from working are more likely to experience food insecurity than other households with PWDs (Whittle et al., 2015).

Access to agricultural extension services and agricultural income have a well-established relationship (Emmanuel et al., 2016; Anang & Asante, 2020). However, when disability is factored in, the relationship gets more complicated.

Compared to their non-PWD colleagues, farmers with disabilities frequently have less access to extension services, which results in lower income and financial hardship (Friesen et al., 2010). Access to these services is restricted for several reasons, including limited availability of adaptive technology, education, and funding.

Access to extension services has a variety of effects on farmers' income. Farmers' capacity to use and benefit from extension services may be influenced by factors such as the availability of labour, the condition of the land, the level of support, and their knowledge and experience (Whelan et al., 2009).

In conclusion, individuals with disabilities actively work in agriculture, frequently out of necessity rather than choice. However, they encounter several difficulties that impact their ability to earn a living and feel secure, such as dangerous working circumstances, higher financial risks, and restricted access to agricultural extension services. The combination of disability, poverty, and food insecurity further complicates these problems. Future studies are required to understand these complex dynamics and the demands for better and lived experiences of FWDs in various geographical and socio-economic circumstances.

2.5.4 non-farm income for farmers and farmers with disabilities

Non-farm income plays a significant role in the livelihoods of farmers, particularly those with disabilities. Farmers with disabilities face economic and socio-cultural challenges due to their impairments (Sango et al., 2022). These challenges highlight the need for more research to be conducted on farmers living with disabilities, especially female farmers, to develop effective disability and gender-inclusive agricultural and entrepreneurship programs in Nigeria (Sango et al., 2022).

Research in the Chinese province of Yunnan on the effect of rural land rights on farmers' income discovered that those with confirmed land rights had higher total income and farm income than those without proven land rights (Xiang et al., 2022). The study also discovered that land rights did not significantly affect non-farm income, indicating that non-farm income is influenced by other variables, including personal traits rather than land rights (Xiang et al., 2022).

Smallholder farmers frequently feel pressured to diversify their businesses into non-agricultural endeavours to enhance their farming revenue (Otekhile and Verter, 2017). Smallholder rural farmers in African nations who receive non-farm income have some insurance against the dangers of farming, encouraging them to use innovative production techniques and increase productivity for their well-being (Otekhile and Verter, 2017).

According to research done in the Gopalganj District, farmers typically received 35.12% of their income from non-farm sources, while 64.88% came from farm sources (Mina et al., 2022). According to regression analysis, farm income was positively correlated with several variables, including age, household size, education, farm size, agricultural training, access to credit facilities, association with agricultural cooperatives, and distance to the nearest market.

Non-farm income also influences agriculture revenue (Mina et al., 2022). Young FWDs usually endure poverty and food insecurity since they mostly rely on small farms and unskilled labour for their livelihoods (Agole et al., 2021).

Non-farm income had an impact on agriculture revenue as well (Mina et al., 2022). Since they primarily rely on small farms and unskilled labour for their livelihoods, young FWDs typically experience poverty and food insecurity (Agole et al., 2021). Young farmers with

impairments work in less lucrative jobs and earn less money than those without disabilities (Agole et al., 2021). Musculoskeletal issues are regularly experienced by fruit tree farmers, which might lower their output and profitability (Kim et al., 2019). Despite having impairments, many fruit tree producers put in long hours, which could exacerbate their physical health problems (Kim et al., 2019).

Rural non-farm income diversification has enhanced household well-being and encouraged agricultural technology adoption (Danso-Abbeam et al., 2020). Increased non-farm income diversification increases the likelihood of adopting agricultural technology, vastly improving household welfare (Danso-Abbeam et al., 2020).

Farmers with higher and off-farm incomes are more likely to repay their loans than those with lower incomes (Kuye & Edem, 2019). Income from off-farm activities can support the family's needs and reduce dependence on farm profits during the loan period (Kuye & Edem, 2019).

Farmers with numerous sources of income and significant non-farm income frequently diversify their income (Malami & Suleiman, 2021). Greater income diversification among smallholder farmers might result from expanding sources of revenue and non-farm income (Malami & Suleiman, 2021).

Diversifying the agricultural sector can help increase climate change resistance. Comparatively to farmers who do not undertake agricultural diversification, those who do so may incur less loss in farm income (Kiani et al., 2021). The adoption of agricultural diversification can be influenced by institutional and demographic variables, including subsidies, education, and awareness-raising campaigns (Kiani et al., 2021).

In conclusion, non-farm income is crucial to farmers' livelihoods, especially for those who have disabilities. It offers a way to increase agricultural income, diversify sources of income, and lessen the hazards of farming. Land rights, personal traits, and access to resources and support systems are a few examples of the variables that might affect non-farm income and how it affects farmers' overall income and well-being.

2.6 Access of FWDs to Extension Services

Gaining access to extension services as a farmer with a disability can significantly impact a person's life. This review considers farmers' challenges with physical disabilities,

studies examining the ease of access to extension services, and efforts to make extension services more accessible to farmers with disabilities.

Agricultural extension services ensure farmers can access the most current information and resources to manage their farms and operations. Unfortunately, farmers with disabilities often have restricted access due to physical barriers, lack of awareness, and specialized training for extension personnel. With the right resources and support, however, farmers with disabilities can be empowered to increase their productivity and success. According to the U.S. Department of Agriculture, including inclusive services for farmers with disabilities is essential to ensure a prosperous agricultural economy (“Supporting Farmers with Disabilities”). Focusing on physical accessibility, such as ensuring people with physical disabilities can use structures, tools, and equipment, will help farmers with disabilities have easier access to extension services.

Awareness should also be encouraged to lessen the stigma and discrimination towards these farmers. Additionally, extension staff must receive training in working with farmers with impairments and know their unique needs. Finally, additional modifications must be made to guarantee that farmers with disabilities can participate in all workshops and educational activities. With the correct tools and assistance, the problem of enhancing accessibility to extension services for farmers with disabilities can be solved. Extension staff may help ensure farmers with disabilities can take advantage of the services and resources provided by improving physical accessibility, raising awareness, offering specialized training, and making specific adjustments. It will make it possible to guarantee that all farmers have equal access to the knowledge and assistance they require to succeed.

Consider improving access to extension services as the number of farmers with disabilities rises. For farmers, extension services are crucial since they offer information on best practices for crop production as well as other critical farming skills. Even though there are initiatives to help farmers with disabilities, more access to these services is still required. Recent years have seen much discussion about the necessity for accessibility and inclusion of extension services for farmers with impairments.

Tom (2024) asserts that it is evident that many barriers exist that hinder persons with disabilities from having access to agricultural services that are of the same kind as those provided to those without disabilities. The study demonstrated how physical barriers, such as restricted mobility, a lack of support, a lack of transportation, and a lack of essential resources, including adapted tools, human assistance, and financial resources, affect the

ability of people with disabilities to access extension services. The study also found that one factor in excluding farmers with disabilities from agricultural services is extension agents' and other service providers' ignorance of disability-related concerns. These results imply that for farmers with disabilities to have equal access to the same level of agricultural services as those without impairments, it is necessary to build an inclusive environment. To ensure that farmers with disabilities are included in agricultural activities, extension services must be specifically adapted to fit their needs.

In conclusion, this literature study has brought attention to the problem of farmers with disabilities access to extension services. Many nations lack the resources and regulatory framework to guarantee that persons with disabilities can access the same benefits as other farmers.

2.6.1 Factors Influencing Access to Agricultural Extension Services

Supplying farmers with essential knowledge, skills, and information, agricultural extension services play a significant role in boosting agricultural output. Nevertheless, a variety of geographic, socio-economic, and demographic factors frequently have an impact on farmers' access to these services. This review explores these influencing elements to add to knowledge about improving the usability and effectiveness of agricultural extension services.

There is a significant gender difference in access to agricultural extension services, as numerous pieces of literature have noted. According to Ragasa et al. (2013), women typically have less access to these services than their male counterparts. Such disparities result from pervasive gender conventions and responsibilities that frequently prevent women from actively seeking agricultural advice (Emmanuel et al., 2016). In some traditional settings, social restrictions make it harder for women to receive extension programmes (Emmanuel et al., 2016). Therefore, it is essential to include this gender dynamic in any efforts to expand the reach of agricultural extension services.

Age is another crucial demographic variable for determining farmers' access to agricultural extension services. According to Emmanuel et al. (2016), younger farmers, particularly those between the ages of 20 and 40, have more involvement with these services, whereas elderly farmers, particularly those over 60, demonstrate less accessibility. It emphasises the importance of age in determining engagement with extension programmes.

It is impossible to overstate the impact of household factors on access to extension services, including household size, agricultural experience, and income level. According to Anang and Asante's (2020) research, households with more members, farming expertise, and higher incomes tend to have better access to these services. Similarly, involvement in farming organisations is associated with improved access to extension services (Anang & Asante, 2020). It emphasises the demand for approaches considering these family factors when creating extension initiatives.

Their geographic location also influences farmers' access to agricultural extension services. Due to inadequate infrastructure and limited extension coverage, some areas, especially isolated ones, have limited access to these services (Karubanga et al., 2017). To guarantee that all farmers have equitable access to extension services, it is critical to improve coverage, especially in isolated and underserved areas.

Social factors, including caste and disabilities, significantly influence farmers' availability of extension services. Compared to non-marginalized castes, marginalised groups like scheduled-caste farmers frequently have limited access to extension services (Krishna et al., 2019). Similarly, farmers with disabilities encounter challenges in receiving these services due to a lack of inclusive services and extension workers' inability to meet their unique needs (Adeloye et al., 2022).

In numerous studies, access to extension services has been demonstrated to positively impact farmers' financial outcomes, such as crop output and productivity (Midamba et al., 2022). Extension services promote sustainable agricultural practices, including organic farming and soil conservation (Ge et al., 2022).

Innovative methods have been created to increase agricultural extension services' accessibility. Mobile phone-based extension programmes have been established in nations like Malawi, giving farmers pertinent and timely information (Mahata & Mhagama, 2022). The necessity for inclusive services that specifically address the requirements of farmers with disabilities is being emphasised as efforts are made to make services more accessible and responsive to the needs of agricultural communities (Adeloye et al., 2022; Karubanga et al., 2017).

A complicated interplay between gender, age, family characteristics, location, and social factors affects access to agricultural extension services. It is essential to address these issues to provide equitable access to promote sustainable agricultural development and

enhance farmers' living standards. Developing policies and initiatives to increase the reach and impact of agricultural extension services can be guided by this thorough understanding of these aspects.

2.6.2 Distance in Agriculture Extension Delivery in the Context of Farmers with Disabilities

Accessing agricultural extension services can be extremely difficult for farmers with disabilities. A study by Ragasa et al (2013) found that one prevalent barrier is the absence of physical accessibility to extension offices and training locations. Many FWDs are in remote locations, making it challenging for Extension officers to get there, mainly if they rely on public transport. This issue is worsened by the lack of specific amenities like ramps and accessible restrooms. Additionally, extension personnel might not know the needs of farmers with disabilities. It may lead to a failure to make the proper modifications during training sessions for farmers with disabilities to participate in programs. Language problems might sometimes be problematic, especially for people who are hard of hearing and need a sign language interpreter.

To overcome these challenges, use written resources in accessible formats or sign language interpreters must be engaged to assist with agricultural extension delivery. Finally, access to extension services for farmers with disabilities may hamper budgetary allocations. It may cover the price of travel, adaptive equipment, or specialist training. In conclusion, there are numerous and significant obstacles that farmers with disabilities must overcome to obtain agricultural extension services. These farmers must not be left behind in the growth process (Ragasa et al, 2013).

Agriculture has been concerned about how distance affects farmers with disabilities participating in extension programs. According to Hannum et al. (2008), farmers with disabilities' engagement in extension programs were negatively impacted by the distance between them and the programs. According to the study, farmers who resided far from extension programs had a lower involvement percentage than those who did. Hannum et al. (2008) discovered another obstacle preventing farmers with impairments from participating in extension programs: a lack of transportation options. According to the study, offering farmers with impaired transportation services may increase their involvement in extension programs.

Therefore, while developing extension programs for farmers with impairments, it is crucial to consider distance and transportation options. For farmers to have equal access to agricultural education and services and to participate, extension programs should offer transportation services and consider their location results of a national survey of extension educators: the delivery of programs to people with disabilities.

The significance of increasing accessibility and diversity in agricultural extension services has recently gained more attention. Increasing the participation of women and young people in extension activities is one method for attaining this objective. According to a study by Pérez, (2022), several socio-economic, cultural, and institutional hurdles frequently prevent women and young people from using agricultural extension services. The study suggests using youth-friendly and gender-sensitive approaches in extension service delivery to address this problem. These strategies should include actively involving women and young people in decision-making, delivering timely, pertinent information, and creating training plans specifically catered to their needs and interests. To increase accessibility and inclusion in agricultural extension services, ICTs like mobile phones and social media should be encouraged.

ICTs can aid in removing some of the physical, social, and economic obstacles that prevent access to extension services, particularly in rural regions, according to (Pérez, 2022). The report does point out that the usefulness of ICTs in the delivery of extension services depends on the accessibility of dependable and reasonably priced connectivity as well as the competence of extension workers to employ these technologies appropriately. To increase accessibility and inclusion in agricultural extension services, a multifaceted strategy must consider the various obstacles women, young people, and other excluded groups face. Extension services may become more responsive to the needs and ambitions of all farmers, regardless of their gender, age, or socio-economic level, by implementing gender-sensitive and youth-friendly approaches and encouraging the use of ICTs (Kingiri, 2021).

In conclusion, the delivery of agricultural extension services to farmers with impairments is significantly hampered by distance. Farmers with disabilities must have access to knowledge and services to increase their output and standard of living. However, their access to these services may be hampered by their physical distance from the service providers and the lack of accessibility infrastructure. As a result, it is crucial to create novel strategies that consider assistive technologies and ensure that extension services are

inclusive of and accessible to farmers with disabilities. By taking these steps, we can close the gap and advance sustainable agriculture in a more egalitarian and inclusive way.

2.6.3 Challenges in Accessing Agricultural Extension Services

A growing body of literature sheds light on the various barriers to agricultural extension services that farmers face, particularly smallholders and those with disabilities. The severity of these impediments varies depending on the socio-economic and geographical context.

In China, for example, the top-down administrative mechanism and linear technology transfer model of the extension system frequently results in a mismatch between the services provided and the actual needs of smallholder farmers (Liao, 2020). This mismatch is a significant impediment. Similarly, small land holdings, low education levels, and insufficient income in Kenya and Uganda are identified as primary barriers to farmers' access to digital extension and advisory services (Kansiime et al., 2022).

A study conducted in Lesotho identified extension staff inadequacy as a critical problem, rendering traditional farm and home visits ineffective. The study proposes using information and communication technologies (ICTs) to improve access to extension services in such situations (Mojaki & Keregero, 2019). In Nigeria, the extension system is plagued by numerous issues, such as insufficient funding, low motivation among extension staff, and poor accessibility due to numerous factors, further complicating matters (Manusia et al., 2018).

The scarcity of resources, particularly in infrastructure, is a common barrier to the availability of extension services. Smallholder farmers frequently face limited financial resources, limiting their ability to access extension services that may require fees or travel expenses (Kansiime et al., 2022). Furthermore, poor road networks and limited communication technologies impede farmers' access to extension services (Manusia et al., 2018).

Another layer of complication is the gender disparity in access to extension services. Empirical evidence indicates that extension services do not benefit male and female farmers equally because of differences in access to and control of production resources, participation in training programmes, and decision-making processes (Kansiime et al.,

2022). Such gender disparities frequently limit the effectiveness of extension services in addressing the specific needs and challenges those female farmers face.

Farmers with disabilities face unique challenges in gaining access to extension services. Physical barriers may be included, such as inaccessible infrastructure and a lack of assistive technologies. Attitude barriers such as stigma and discrimination complicate their situation (Liao, 2020). Extension services are frequently not tailored or equipped to meet the unique needs of farmers with disabilities, limiting their access to critical information and support.

Communication and information dissemination complications pose additional challenges. Farmers' limited literacy or language skills can impede their comprehension and application of extension services' information (Njenga et al., 2021). Furthermore, poor access to communication channels, such as radio and television signals in rural areas, can limit the reach of extension messages (Obidike, 2011). Furthermore, a lack of timely and relevant information may limit farmers' ability to address emerging challenges such as climate change and invasive pests and diseases (Kansiime et al., 2022).

Accessing extension services for farmers, particularly smallholders and those with disabilities, presents numerous challenges. These include resource constraints, insufficient infrastructure, gender disparities, barriers specific to farmers with disabilities, and communication and information dissemination issues. To overcome these challenges, targeted interventions and policy reforms that prioritize inclusivity, accessibility, and the specific needs of diverse farmer groups are required.

2.6.4 Prioritizing the frequency of extension visits to farmers with disabilities

It is crucial to consider some considerations when prioritizing the frequency of extension visits to farmers with disabilities to meet their unique needs adequately. The availability of resources and support, the significance of caregiver engagement, the nature and degree of disability, and the objectives and difficulties experienced by farmers with disabilities are a few of these issues.

Primarily, the kind and degree of disability should be considered. There may be various levels of care and help needed for various disabilities. Farmers with mobility issues may need aid moving their farms and utilizing specialized equipment, while farmers with visual impairments may need assistance obtaining and interpreting visual information.

Determining the frequency of extension visits can be made more accessible by being aware of the demands of a specific disability.

Second, the availability of resources and assistance is crucial in determining how frequently extension trips occur. To meet their needs, farmers with disabilities may need specialized tools, assistive technologies, or adjustments to their farming methods. To ensure that farmers have access to the resources and support systems they need to overcome their challenges, extension visits should be planned at a frequency that enables regular assessment of these systems. Another crucial factor is the involvement of caregivers.

Farmers with disabilities, especially those with more severe disabilities, depend heavily on their caregivers. During extension visits, caregivers should have the chance to receive the instruction, advice, and support they need to assist farmers with disabilities in their regular farming activities. Advising on caregiving methods, accessibility improvements, and resources for the caregiver and the farmer may fall under this category. Determining the frequency of extension visits should also consider the objectives and difficulties faced by farmers with disabilities.

For example, if a farmer with a disability is working towards implementing sustainable farming practices or transitioning to organic farming, more frequent visits may be necessary to provide guidance and monitor progress. On the other hand, if a farmer with a disability is already experienced and has specific needs related to a particular aspect of their farming operation, less frequent visits may be sufficient. It is also essential to consider the capacity and workload of extension agents.

Because of their limited time and resources, extension agents must balance their visits to different farmers and communities. Therefore, when determining the frequency of extension visits, a realistic assessment of the resources available and the number of farmers with disabilities in the area should be considered.

Rural farmers must use agricultural extension services to increase their productivity and income. However, the frequency of extension visits significantly impacts the effectiveness of these services. Farmers routinely receiving extension visits are more likely to adopt modern technology and practices that increase their income, Rahman & Connor (2022). According to the authors' research, farmers who received extension visits once a month or more earned much more money than those who had less frequent visits. Farmers can make knowledgeable decisions about their farming practices thanks to the timely

information and guidance they receive from frequent visits. Regular visits also improve communication and understanding of farmers' needs by building trust and rapport between farmers and extension agents.

The report also emphasizes how important it is for smallholder farmers to access extension services because they frequently lack the tools and information necessary to improve their farming methods. To guarantee that farmers get the assistance they need to improve their income and way of life, policymakers and extension service providers should prioritize upping the frequency of visits. However, depending on some variables, including the location of the farmers and the availability of resources, the frequency of agricultural extension visits may vary. For instance, a study by Maoba (2016) in South Africa found that only 24.36% of farmers in the study area visited frequently (fortnightly), 42.31% visited once per month, and 33.33% had visits from agricultural advisors.

The difference in visitation patterns seen in Maoba's (2016) study emphasizes the necessity to consider local factors that may impact the delivery of extension services. For instance, in some areas, farmers may reside in difficult-to-reach distant locations, while in others, the number of extension personnel may be constrained due to resource limitations. To guarantee that farmers receive essential assistance in such situations, policymakers and extension service providers may need to investigate alternative ways.

The frequency of extension visits to farmers, including those with disabilities, must be prioritized to increase agricultural productivity and income. Policymakers and extension service providers can assist farmers in improving their farming practices and achieving sustainable agricultural development by considering local factors and customizing extension services.

2.7 Impact of Agricultural Communication and Innovation

The creation of modern technologies and their effective use are made possible by agricultural communication, which plays a vital role in the diffusion and adoption of advances. With an emphasis on agricultural contexts, this literature review seeks to understand the changing role of communication in innovation processes. Early research stressed the significance of communication in the adoption and diffusion of innovations, including that of Rogers et al. (2014). At this time, communication was primarily seen as an intermediate between scientific developments and end users, converting complex

knowledge into a format that farmers and other stakeholders could understand and apply (Rogers, 2014).

New academic disciplines, such as "agricultural extension studies" and "health education," were created due to the recognition of communication's role in innovation. These disciplines have played a crucial role in bridging the gap between theory, invention, and real-world application. They have also emphasized encouraging discussions and information exchange between various stakeholders (Leeuwis et al., 2011). More holistic and interactive frameworks, like Strategic Niche Management, Actor-Network Theory, and Innovation Systems Thinking, have recently supplanted the prevalent linear model of innovation (Geels, 2002; Young, et al.,2012). According to these viewpoints, innovation is a socially embedded process affected by many actors and their interactions. For instance, the Innovation Systems approach sees innovation as the product of interactions between various system actors (Leeuwis et al., 2011). It has ramifications for communication, which is considered a means of learning and bargaining among a network of players and spreading information.

This change in perspective significantly affects how communication is thought of and used in the context of innovation. It highlights the need for more dialogic and participatory forms of communication that might encourage shared learning and knowledge co-creation. Nevertheless, despite these advancements, the function of communication in the innovation process has not yet been systematically examined. Future studies should investigate the complex interactions between communication and innovation in agricultural settings and integrate insights from various perspectives. Additionally, it should look at how various communication techniques and methods can aid in creating and effectively applying innovations. The adoption and spread of technologies are significantly influenced by agricultural communication. Strategies for fostering the development of sustainable agricultural systems can be improved by comprehending the changing role of communication in innovation processes.

2.7.1 Impact of Agricultural Extension Officers' Education on Farmers with Disabilities

Numerous research studies have highlighted the profound influence of agricultural extension Agents (AEAs') educational level on the farming community, including those with disabilities. The common trend in these investigations is that the education of AEAs

is directly proportional to their ability to provide effective extension services and improve farmer outcomes.

The study conducted by Zikhali et al. (2019) in South Africa demonstrated the importance of incorporating climate change knowledge into extension agent training programmes. Extension officers' educational competency significantly impacted their ability to provide helpful extension services, assisting farmers with climate change adaptation. Through well-structured training programmes, the officers play a critical role in facilitating access to information, strengthening agricultural skills, and providing rural development solutions. Thus, strengthening their educational foundation is the foundation of successful extension service delivery.

In another significant study, Ramdwar et al. (2015) investigated AEAs' attitudes toward farmers' groups in Trinidad. The findings revealed a strong link between AEAs' perceived technical prowess and their satisfaction with farmer groups. This relationship highlights the potential for AEAs to provide superior support to farmer groups, including those with disabilities.

Regarding social dimensions, Takemura et al. (2014) conducted a study in Japan that focused on the role of AEAs as social coordinators within agricultural and fishing communities. According to the study, extension officers' communication skills and ability to foster harmonious relationships significantly contribute to community residents' trust. As a result, extension officers with higher educational credentials can forge improved social coordination, resulting in trust-building that benefits farmers' outcomes.

Widayati et al. (2019) investigated the barriers to agricultural extension in Indonesia, including farmers' low educational attainment, to address the challenges farmers face. They discovered that AEAs with advanced education could better meet farmers' educational needs, promoting the adoption of novel technologies and practices.

In a recent study, Zikhali et al. (2021) investigated the compatibility of climate change information disseminated among South African smallholder farmers. Their findings emphasized that the educational level of extension officers directly impacts their exposure to climate change education and their choice of extension methodologies. The study advocated for broadening the educational horizons of extension officers by incorporating indigenous knowledge into their climate change extension work, thereby increasing the information's relevance and acceptance among smallholder farmers.

In conclusion, a clear pattern emerges from the academic literature correlating agricultural extension officers' educational level with their effectiveness in assisting farmers, particularly those with disabilities. Higher-educated extension officers are better equipped to demonstrate technical expertise, engage fruitfully with farmer groups, foster social coordination, and meet farmers' educational needs. As a result, continued investment in extension officers' education and training is critical to ensuring they have the necessary skills and knowledge to support farmers and foster agricultural development. This investment will not only empower extension officers but will also significantly improve farmers' resilience and productivity.

2.7.2 Impact of agricultural extension contacts on the farm income of FWDs

A problematic career, farming can be made more difficult for farmers with disabilities (FWDs). FWDs are frequently just as skilled and committed as their farmers without disabilities peers, despite any discrimination and preconceptions they may encounter. However, they can lack the tools and assistance needed to overcome obstacles.

The revenue of farmers with disabilities is significantly impacted by their connections with agricultural extension agents (FWDs). According to Kalargyrou (2014), the extension contacts give FWDs essential knowledge and training that can raise their income and increase the productivity of their agriculture. The extension programs' primary objective is to instruct farmers in various agricultural methods, including crop selection, soil management, insect control, and post-harvest handling. This information allows FWDs to improve production methods, cut costs, and raise yield. The extension contacts also make it easier for FWDs to access credit and other resources, enabling them to invest in their agricultural businesses and grow them. As a result, FWDs who take part in extension programs report higher income levels and better quality of life than those who do not. Therefore, it is crucial to support economic growth and fight poverty among FWDs through agricultural extension initiatives.

Rural farmers encounter numerous obstacles that reduce their output and income, such as restricted access to information, resources, and markets. Agricultural extension services work to address these issues by arming farmers with the knowledge and abilities they need to enhance their farming operations and standard of living. In Ethiopia, Hassink et al. (2015) study discovered that agricultural extension contacts significantly increase the farm income of households with female heads of household. The findings indicate that FWDs with more extension contacts earned more than those with fewer contacts. The

study also discovered a high correlation between access to extension contacts and the adoption of innovative agricultural practices, including better seed types and soil conservation methods. According to Hassink et al. (2015), agricultural extension services can eradicate poverty and advance gender parity in rural communities. The report also emphasizes the necessity for extension services to address FWDs' gender-specific problems, such as restricted credit and land access. The findings highlight the significance of agricultural extension services in fostering sustainable agricultural development and enhancing FWDs' quality of life in rural regions.

Extension services offer helpful knowledge about farming techniques, market trends, and technology improvements, claim Barnes & Mercer (2010). Farmers can adopt new techniques through these services, leading to higher yields and higher-quality produce. The government of Ethiopia has put in place several agricultural extension initiatives to connect with smallholder farmers and give them the knowledge and instruction they require. According to the Barnes and Mercer (2010) study, extension programs improved the farm income of Ethiopian farmers. According to the survey, farmers with frequent extension contacts earned more money than those without. As a result, it can be said that agricultural extension services are crucial for raising small-scale farmers' income in developing nations like Ethiopia. Extension services can assist farmers in adopting better methods, boosting productivity, and eventually enhancing their quality of life by supplying them with the necessary knowledge and training.

Agricultural extension services are essential for FWDs to raise their agricultural output and incomes, according to Watermeyer (2009). To increase production and revenue, FWD must have access to knowledge about new farming methods, crop varieties, and market prospects, which are made possible through agricultural extension services. Aside from this, agricultural extension programs give FWDs access to finance and other financial aid that they need to improve their farms and boost productivity. According to Watermeyer (2009), agricultural extension contacts significantly impact FWDs' farm income since they aid in reducing poverty and increasing their level of economic empowerment. Therefore, governments and other organisations must engage in agricultural extension programs to boost FWDs' agricultural productivity, incomes, and economic empowerment.

Considering the preceding, agricultural extension services are crucial for fostering economic development and alleviating poverty among FWDs. Extension services can assist FWDs in bettering their livelihoods and contribute to sustainable agricultural

development by giving them the appropriate information and tools. To meet the requirements of FWD farmers, policymakers and extension service providers should continue to fund and enhance these services. Comparatively to those who did not, individuals who participated in extension programs reported higher income levels. The extension contacts gave FWDs helpful knowledge and instruction that raised their agricultural productivity, decreased expenses, and enhanced their yield. The extension contacts also made it easier for FWDs to obtain loans and other resources, enabling them to invest in their agricultural endeavours and grow their businesses. The report emphasizes the value of agricultural extension services in fostering economic development and eradicating poverty among vulnerable groups like FWDs. To enhance the livelihoods of FWD farmers, governments and extension service providers should continue to invest in and strengthen these services. In summary, the research points to the importance of agricultural extension contacts in boosting the farm income of FWDs and smallholder farmers in developing nations. Extension services may help farmers access resources more efficiently, give them helpful information and training, and improve their quality of life.

2.7.3 Effect of Capacity Building on Farmers with Disabilities

Capacity building in agricultural extension services for all farmers, especially those with disabilities, is vital in Ghana. According to Asare-Nuamah et al. (2019), these services improve smallholder farmers' adaptation capacity to climate change.

Agricultural extension services may effectively support farmers in dealing with climate-related difficulties and improving their agricultural practices by providing them with critical skills, essential knowledge, and needed resources. Mobile phone-assisted services are one of agricultural extension services' most dynamic components of capacity building.

Nyaplue-Daywhea et al. (2021) discovered that the frequency of mobile phone use for obtaining and delivering agricultural extension services varied substantially across agricultural extension agents (AEAs) and smallholder farmers in their research conducted in Eastern Ghana. The study discovered that education level, phone usage expense, network quality, income level, and age significantly impacted this frequency. The study's findings emphasize the significance of comprehensive training and support programmes for AEAs and smallholder farmers to improve their competency in using mobile phones

for agricultural extension services, increasing the reach and effectiveness of these services.

Another essential part of capacity building is the transfer of skills, knowledge, technology, and innovative practices through extension services. According to Asare-Nuamah et al. (2019), Ghana's agricultural extension services employ various measures to strengthen farmers' resilience and adaptation capacity to climate change. These techniques include providing technical assistance, supplying crucial input, and even liaising with existing local institutions. The primary goal is to provide farmers with the knowledge and resources to adapt to changing weather patterns and increase agricultural productivity.

However, implementing these ideas is not without difficulties. Geographical, societal, and economic constraints place significant barriers in the way of these services supporting smallholder farmers. Addressing these limits necessitates enhancing extension services' institutional capacity and offering specialized training to extension officers, allowing them to provide superior support to farmers in adapting to climate change.

Crop-livestock diversification is also vital for capacity building in agricultural extension services. As Danso-Abbeam et al. (2021) mentioned, extension services are critical in educating farmers about the benefits of crop-livestock diversification and pushing for its adoption. Farmers can increase their food security and household income by diversifying their farming techniques. As a result, encouraging crop-livestock diversification should be a top goal for extension services. Other elements, besides capacity building, improve the performance of agricultural extension services and farmers' technical efficiency. Siaw et al. (2020) found that loan availability improves the technical efficiency of maize farmers in Ghana.

Government programmes such as the Agricultural Development Bank and the soil health project, which aim to provide finance and help farmers access production inputs, have proven tremendously helpful. Similarly, Mugonya et al. (2021) emphasized the importance of market information sharing and utilization in increasing farmer innovation and refining agricultural practices. Another critical consideration is recognizing and utilizing farmers' indigenous knowledge in agricultural extension activities.

According to Ali et al. (2021), neglecting this reservoir of wisdom can be an obstacle to enhancing agricultural output, particularly in developing nations like Ghana. To tap into

this wealth of indigenous knowledge, agricultural extension services must actively listen to and connect with farmers, ensuring the services are relevant and practical.

Finally, capacity building is essential for improving agricultural extension services for all farmers in Ghana, including those with disabilities. It is a comprehensive approach that includes cell phone-assisted extension services, the transfer of skills and knowledge, crop-livestock diversification, access to credit and market information, and the acknowledgement and assimilation of farmers' indigenous knowledge. Strengthening extension services' ability and appropriately addressing their numerous problems can empower farmers to improve their adaptive capacity to climate change, increase agricultural output, and significantly contribute to Ghana's food security and poverty reduction.

2.7.4 Changing Views of Innovation and Communication

Over the past decade, ideas about innovation have progressed significantly. There are different schools of thinking. Several studies have found that research-based ‘innovations' are seldom accepted by users and that practical innovations are often a constructive collaboration of ideas and facts from various sources, including scientists, users, intermediaries, and other social players, along with these changes about innovations about the aetiology of innovations, the principle of what innovation is changed as well. Previously, innovation was regarded as a new technical tool or principle, e.g., improved seed variety or farming system. Furthermore, the effect that the innovation transfer is accepted or rejected depending on social conditions (Rogers, 2014).

- **Pathways to Agriculture Extension**

  a. **Linear thinking model**

  Innovation is one-way research to the end-user (Kline & Rosenberg, 1986)

  b. **Transfer model’** (Chambers & Jiggins, 1985). This pathway recommends investment in agricultural research and technology development. It looks at innovation as the ‘delivery’ (a dead giveaway for this type of thinking) of science-based technologies to ‘ultimate users’ (another giveaway) and their spontaneous diffusion among them.

- **Farmer-driven innovation**

In this theory, farmers with disabilities acquire innovation through experimental knowledge, allowing them to improve farming systems, farming methodologies, and disease-resistant varieties that are effective for their work and adaptable to their environment and culture (McGuire and Manicad, 2003).

- **Participatory development**

Kristen Nygaard's pioneering work in the 1970s gave rise to Participatory Design (Rumanyika et al., 2022). End-users were asked to engage and contribute, not just as critics and assessors of product and system concepts, but as co-designers, through design and development methods known as participatory design. Participatory Design emerged partly as a means of addressing the issue that designers of technologies often know extraordinarily little about users' work and contexts of use.

However, Participatory Design ensured that technologies supported and enhanced users' knowledge and skills rather than redefining (or eliminating) people's jobs by introducing technologies into workplaces. Participatory Design emerged partly as a means of addressing the issue that designers of technologies often know little about users' work and contexts of use. However, Participatory Design ensured that technologies supported and enhanced users' knowledge and skills rather than redefining (or eliminating) people's jobs by introducing technologies into workplaces (Bannon and Ehn, 2012)

Participatory Design ensures that 'ordinary' users can contribute meaningfully to products and services. Participatory Design has developed several methods for involving stakeholders in co-design activities throughout innovation processes, such as the participatory design model (Röling, 2009). Participatory Design is a participatory design where participants create their own methodologies. It allows it to make business changes and implement the insights acquired via contact and user involvement.

Participatory development was a tool to ensure that technologies assisted and boosted farmers with disabilities (FWDs) knowledge and skills. Participatory development has developed several theories to engage stakeholders in co-design activities in the innovation process (Leeuwis & Aarts, 2011).

2.7.5 Communication of Farmers with Disabilities

The numerous studies provide significant insights into several communication-related issues with people with disabilities in agriculture. Agyei-Okyere et al. (2018) investigated the likelihood of developing long-term work possibilities for people with disabilities in Ghana's agricultural sector. They emphasised the need for policymakers to work with these people to find ways to support their involvement in agriculture. It also emphasised the difficulties that prevent people with disabilities from participating in agricultural activities, such as a lack of accessible land, money, farming equipment, and persistent unfavourable attitudes.

Saeed et al. (2022), concentrating on the healthcare industry, examined the perinatal care experiences of people with sensory, intellectual, and developmental disabilities. Due to healthcare professionals' ignorance and lack of awareness of disability, they found significant communication barriers. To ensure inclusive perinatal care, the study encouraged healthcare professionals to increase communication and knowledge.

Shifting the focus back to agriculture, Sango et al. (2022) examined the role and experiences of individuals with disabilities engaged in the agricultural sector in northern Nigeria. While the study revealed that these individuals are active participants in agricultural activities, it also exposed the economic and sociocultural challenges they encounter due to their impairments. The results call for extensive research and implementation of effective disability-inclusive agricultural programs in Nigeria.

Similarly, Minus et al. (2021) emphasised the importance of strengthening the support system for farmers with Disabilities. To improve staff communication with caregivers and farmers with disabilities, the study promoted individualised training and professional development. In addition, it suggested setting up areas where caregivers could express their worries and employees could respond appropriately. This study emphasises the importance of supporting caregivers and maintaining the agricultural pipeline for upcoming generations.

Agole et al. (2021), focusing on young people, examined the factors influencing young farmers in Uganda both those with and without disabilities to participate in agricultural capacity-building initiatives. The study exposed the prejudice and marginalisation that young farmers with disabilities experience, which causes poverty and food insecurity. The need to develop inclusive programmes and support systems for young farmers with impairments to improve their livelihoods is emphasised by this study.

Mairiga et al. (2019) examined the communication tactics employed by the Kebbi State Agricultural Development Agency in Nigeria to increase women's participation in sustainable agricultural development in the context of female participation in agriculture. The study concluded that conventional and local techniques could effectively increase women's participation and suggested additional initiatives to support women's involvement in agriculture.

Regarding urban agriculture, Schaffernicht (2023) investigated the procedures for including people with disabilities in urban agriculture in Vienna, Austria. Agro-ecological inclusion farms were proposed as a potential solution to the systemic impediments to inclusion that had been discovered. The study promotes inclusive strategies in urban agriculture to support people with disabilities' right to self-determination.

Hammell (2021) popularised the idea of "social farming" or "care farming" in Western European nations, which enables those with impairments to participate in the labour force in a natural setting. The study stressed the need for meaningful occupational activity participation in natural settings for people with disabilities to foster physical and mental health and social inclusion.

Schweitzer et al. (2011) evaluated the Arability Program in the United States and discussed the American setting. This programme assists farmers, ranchers, and members with disabilities of their families. The study emphasised how critical it is to address mental and behavioural health problems among farmers and their families, particularly in rural or agricultural regions with few mental health services and resources.

Lastly, Ior et al. (2021) examined how communal disputes in Nigerian conflict-prone regions impacted access to agricultural extension services. The study highlighted the need for increased access to extension services in conflict-affected areas to assist agricultural development by highlighting the poor access to extension services due to the frequency of conflicts.

In conclusion, these studies provide insight into the communication difficulties and opportunities that arise while working with people with disabilities in the agriculture industry. They emphasise the importance of using inclusive communication techniques, educating stakeholders, and putting supportive policies and programmes in place to increase the engagement and well-being of people with disabilities in the agriculture industry.

2.8 Prioritising the frequency of extension visits to farmers with disabilities

Danso-Abbeam et al. (2018) researched the effects of agricultural extension services on farm productivity and income.

This research demonstrated the economic benefits of participating in agricultural extension programmes, specifically those provided by the Association of Church-based Development NGOs (ACDEP) in Ghana's Northern region. According to the authors, such extension programmes significantly increase farm productivity and household income. They advocated for improved agricultural extension service delivery, including timely recruitment of new personnel, periodic training of existing agents, and adequate logistics to ensure service efficiency.

Manje et al. (2021) research provides a unique perspective on the role of gender in agricultural extension practices. This study, conducted in Ghana and Zambia, discovered that female farmers were likelier than male farmers to believe extension services were adequate. Increased female participation in agricultural activities can boost agricultural productivity and food security. The study emphasized the importance of incorporating gender dynamics into agricultural extension program design and implementation to ensure inclusivity and effectiveness.

Extension services have a significant market impact on access. Akrong et al. (2020) revealed through their study of small-scale mango farmers in Southern Ghana that those who had access to extension services were more inclined to partake in high-value markets. Extension services are an essential source of information about good agricultural practices, which helps farmers compete in high-value markets.

Another critical theme in the literature is the role of extension services in promoting the adoption of sustainable agricultural practices. According to Mahama et al. (2020), contact between farmers and extension agents during soybean production increased the adoption of improved agricultural technologies. In addition, Ankrah et al. (2021) discovered that farmer-to-farmer information exchange could compensate for a shortage of agricultural extension officers and significantly influence farmers' adoption decisions.

Aside from socio-economic outcomes, certain factors influencing agricultural practice adoption among Ghanaian farmers have been identified. According to Danso-Abbeam et

al. (2021) research, access to agricultural credit, participation in field demonstrations, and farm size all play a role in the adoption of sustainable practices. Similarly, Acheampong et al. (2021) identified age, education, extension visits, mass media exposure, and farmers' perceptions of the benefits of adoption as essential factors in adopting sustainable soybean production technologies in northern Ghana.

Finally, research unequivocally shows that agricultural extension services provide farmers in Ghana with positive socio-economic outcomes. Increased farm productivity, income, access to high-value markets, and adopting sustainable farming practices are among them. However, the literature emphasizes the importance of addressing issues such as gender dynamics in agriculture, strengthening extension service delivery, and the importance of access to credit and participation in field demonstrations. More research is needed to expand on these findings, to understand how these factors and outcomes intersect in the case of FWDs

2.9 Source and Causes of Farmers' Disabilities

Farmers' disabilities can have a variety of origins and causes, depending on several variables. The following references offer details on the causes and origins of farmers' disabilities: In Enugu State, Nigeria, farmers have a challenging time adjusting to the effects of climate change, according to Mohammed et al. (2014). The study found that the most challenging factors for farmers to adapt to climate change were the lack of improved agricultural technologies, low adaptive capacities, and inappropriate agricultural practices. Farmers may sustain injuries or disabilities due to these difficulties.

The increased risk of agricultural injuries among African American farm workers in Alabama and Mississippi is the focus of McGwin et al. (2000) study. According to the study, farmers who had previously reported suffering agriculturally related injuries been more likely to do so again. Farmers with disabilities from prior injuries may be more vulnerable to more recent injuries. The mental health of Peruvian farmers working in the sugarcane industry is examined by Bazo-Alvarez et al. (2022). In contrast to non-farmers, the study found that farmers had higher symptoms of mental disorders. Farmers with mental health issues were found to be affected by a heavy workload and long workdays. Mental health issues can impact Farmers' general well-being, which may also result in disabilities.

Farmers' occupational exposure to pesticides is highlighted by Ochilo et al. (2019) as a potential source of disabilities. Exposure to pesticides can have many adverse effects on health, including immunosuppression, cancer, hormone disruption, and abnormalities in reproduction. Due to their occupational exposure to pesticides, farmers and farm workers are particularly at risk. Benos et al. (2021) research focused on the biomechanical impact of joint agricultural work involving humans and robots on the lower limbs. The study emphasizes the incidence of musculoskeletal illnesses (MSDs), which can result in disability, among farmers. Farm owners incur enormous socio-economic expenses because of MSDs.

Weaver et al. (2017) compared the injuries caused by farming to those caused by animals. According to the report, machinery is responsible for 25% of farm-related fatalities and 50% of all injuries. Farmers often get injuries from tractor accidents. Farming operations may suffer significantly because of machinery-related accidents.

The pattern and epidemiological causes of agricultural hand injuries are examined by Ravikumar et al. (2017). The study stressed agriculture-related injuries' significant physical, psychological, and financial effects. Farmers frequently sustain hand wounds, which can result in impairments.

The sources and causes of disabilities in farmers can vary and include things like income levels, effects of climate change, prior injuries, mental health problems, pesticide exposure, animal-related incidents, musculoskeletal disorders, injuries caused by machinery, and particular types of injuries like hand injuries. To create interventions and support networks to stop domestic violence, it is essential to understand these sources and causes.

2.9.1 Access to Agriculture Extension Information

Farmers must have access to agricultural extension information to increase farming techniques and productivity. Farmers' access to and use of agricultural extension services is influenced by many factors such as geographical location, financial resources, infrastructure, education levels, language and cultural relevance, gender dynamics, government policies, availability of extension workers, trust and social networks, and crop specificity (Kacharo, 2007). The accessibility and effectiveness of extension services,

farmers' attitudes toward extension services, the use of new media and technology, and the function of agricultural organizations and institutions are some of these aspects.

The availability and type of extension services significantly influence farmers' agricultural knowledge access. Databases maintained by the United States Department of Agriculture (USDA), such as those found on the USDA website, contain a wealth of information on several agricultural topics, such as crop production, livestock management, and soil health (Durazzo et al., 2019). BASIS and Phenol-Explorer are other databases containing valuable data on agricultural subjects (Durazzo et al., 2019).

These databases are crucial informational resources for farmers, empowering them to choose farming methods wisely. Access to and use of agricultural knowledge by farmers can also be influenced by their opinions toward extension services. According to research, farmers in Egypt had poor perceptions of public agricultural extension programs (Qtaishat & AL-Sharafat, 2012). Opposing views can hamper farmers' willingness to seek knowledge and interact with extension personnel. Addressing their attitudes and perceptions about extension services is vital to increasing farmers' access to agricultural knowledge.

How farmers access agricultural information has been entirely transformed by new media and technology. With smartphones and internet access so widely available, farmers can now access agricultural websites, blogs, and apps to get pertinent and up-to-date information (Ogunsola et al., 2022). Using new media platforms, agricultural knowledge can be disseminated quickly and effectively, reaching more farmers. However, it is crucial to ensure that farmers have the digital literacy abilities to use these platforms effectively (Mtega et al., 2018). Agricultural organizations and institutions facilitate access to agricultural information. By encouraging effective and demand-driven extension services among farmers, the National Agriculture and Livestock Extension Program (NALEP) in Kenya, for instance, seeks to increase the contribution of agriculture and livestock to development and poverty alleviation (Kavita & Muthoni, 2018).

Similarly, governmental, and non-governmental agencies in Nigeria implement agricultural extension programs to bolster economic development, rural livelihoods, food security, and trade relations (Camillone et al., 2020). Farmers participating in these programs can obtain helpful resources, support, and pertinent agricultural information. Farmers must have access to agricultural extension knowledge to increase production and improve farming practices. Numerous factors influence farmers' access to agricultural information, including the availability and type of extension services, attitudes toward

extension services, new media and technology use, and the involvement of agricultural organizations and institutions. It is essential to address these issues and ensure that farmers have the tools and assistance they need to access and use agricultural extension services efficiently. Farmers participating in these programs can obtain helpful resources, support, and pertinent agricultural information. Farmers must have access to agricultural extension knowledge to increase production and improve farming practices.

Farmers' access to agricultural information is influenced by several factors, including the availability and kind of extension services, farmers' attitudes toward extension services, the use of new media and technology, and the involvement of agricultural organizations and institutions. It is essential to address these issues and ensure that farmers have the tools and assistance they want to access and use agricultural extension services efficiently.

2.9.2 Agricultural extension mediations that could enhance agricultural practices among farmers with disabilities.

Improving agricultural practices among farmers, especially those with disabilities, depends heavily on agricultural extension services. These services offer farmers advice, support, and access to information and tools to help them advance their knowledge and farming abilities (Chelule et al., 2022). Agricultural extension services can enhance knowledge of environmental issues and encourage the adoption of sustainable methods by enhancing farmers' cognitive abilities (Ge et al., 2022). According to a study in China, access to agricultural extension services can improve soil conservation among large-scale farmers by raising their degree of ecological cognition (Ge et al., 2022). Farmers who access agricultural extension services were more inclined to switch to organic fertilisers rather than chemical fertilisers to enhance the environment because they were more aware of the environmental contamination caused by excessive fertiliser application (Ge et al., 2022). This study emphasises the function of agricultural extension services in encouraging environmentally friendly farming methods.

Research in Nigeria's Lagos State found some barriers to the efficient provision of agricultural extension services (Cf, 2017). These limitations included poorly motivated extension personnel, inadequate government funding, poorly trained agricultural extension staff, inadequate training and retraining programmes for extension staff, inadequate numbers of extension agents to farm families, and high levels of farmer

illiteracy (Cf, 2017). The study suggested increasing the ratio of extension agents to farm families, holding regular training and retraining programmes for extension staff, offering incentives to motivate extension agents, and ensuring government commitment to the prompt implementation of policies and programmes to improve the efficacy of agricultural extension services (Cf, 2017).

Another study evaluated farmers' knowledge of and use of maize-producing technologies in Punjab Province, Pakistan (Muddassir et al., 2020). The study discovered that farmers' awareness of and adoption of better maize farming practices were significantly influenced by their access to agricultural extension services (Muddassir et al., 2020). Comparatively to farmers who visited the department frequently, those with a higher awareness of these methods were more inclined to implement them (Muddassir et al., 2020). The study also highlighted visits to the extension office, operational area, and farmers' education level as essential factors in determining technology adoption (Muddassir et al., 2020). It emphasises the significance of offering farmers easily accessible and efficient agricultural extension services to increase their knowledge and encourage the adoption of better practices.

In Kenya, research in Kericho County investigated how agricultural extension workers felt about financial support before and after devolution (Chelule et al., 2022). The study emphasised agricultural extension services' role in providing farmers with advice and assistance to improve their marketing and output (Chelule et al., 2022). Additionally, these services identify farmer concerns for agricultural policy research and development (Chelule et al., 2022). The study clarified that governments must spend money on agricultural extension services to boost rural development and aid farming communities (Chelule et al., 2022).

Additionally, agricultural extension services have been acknowledged as a non-formal education strategy to enhance farmers' contributions to producing environmentally responsible agricultural commodities (Prasetya et al., 2022). These services address agricultural-related difficulties and encouraged the use of innovative scientific and technological approaches in farming (Prasetya et al., 2022). The implementation of agricultural extension services has faced difficulties because of the COVID-19 pandemic, however, as some measures, such as social and physical segregation, have restricted access to agricultural services to farmers (Prasetya et al., 2022). To help farmers adopt sustainable practices and resolve farming concerns, it is essential to keep providing agricultural extension services through alternate channels, such as digital tools and

remote communication (Prasetya et al., 2022). Another crucial component of agricultural extension services is empowering farmer groups.

By enhancing their knowledge and abilities, extension professionals support farmer groups in increasing their welfare (Ramadhani, 2023). Additionally, they assist farmer organisations in gaining independence and resolving issues (Ramadhani, 2023). The roles of agricultural extension workers in empowering farmer groups are influenced by elements like the degree of independence of farmer groups, marketing independence, resource ownership, and company income (Ramadhani, 2023). Agricultural extension services can support the empowerment and growth of farmer organisations by addressing these issues. The performance of smallholder sugarcane farmers in Indonesia has been proven to benefit from access to agricultural extension services (Rokhani et al., 2021).

Agricultural extension is crucial in improving farmers' managerial and technical capacity, increasing farm production, minimising yield loss, and fostering technology adoption (Rokhani et al., 2021). By improving agricultural productivity and farm performance, agricultural extension services contribute to the overall welfare of farmers.

In the context of sustainable agricultural practices, a study conducted in Bayelsa State, Nigeria, analysed adopting sustainable agricultural practices among plantain farmers (Ji et al., 2022). The study found that extension services provided various sustainable agricultural practices, such as planting time, spacing, pruning, and new varieties, which were adopted by plantain farmers (Ji et al., 2022). The study also highlighted the importance of extension services in creating awareness among farmers about sustainable practices and providing them with the necessary knowledge and skills to adopt them (Ji et al., 2022).

In Ghana, a study modelled the factors influencing farmers' subscription to various agricultural extension methods (Azumah, 2020). The study found that farmer-to-farmer extension methods, demonstration farms, and household extension methods were the most effective mechanisms for communicating information to farmers (Azumah, 2020). Factors such as farm size, membership of farmer associations, years spent as an irrigation farmer, research, and location were found to influence farmers' subscription to agricultural extension methods (Azumah, 2020). These findings emphasize the importance of considering different extension methods and tailoring them to farmers' specific needs and contexts.

The use of digital tools to improve agricultural extension services has also been investigated. Southern India investigated how mobile-based advice affected farming practices (Singh et al., 2023). Compared to farmers who got videos, the study indicated that mobile channels significantly increased farmers' recollection, knowledge, and adoption of new practices (Singh et al., 2023). The study concluded that mobile-based services are a viable addition that can enhance farmer outcomes and increase the reach and inclusivity of agricultural extension, even if it did not uncover any beneficial effects on farmer production or yield (Singh et al., 2023).

Finally, it should be noted that agricultural extension services are essential for improving agricultural practices among farmers, especially those who have a disability. These services offer direction, assistance, and access to data and tools that can enhance farmers' expertise. Agricultural extension services support farmers' general growth and welfare by increasing awareness, advancing sustainable practices, and strengthening farmer groups. Nevertheless, there are obstacles and limitations to the efficient provision of agricultural extension services, including a lack of suitably qualified employees, low finance, and restricted access because of conditions like the COVID-19 pandemic. To ensure the availability and efficacy of these services, governments and other stakeholders must invest in agricultural extension services, provide proper training and resources, and investigate innovative strategies, such as the use of digital technologies.

2.9.3 Training Agricultural Extension Agents

A type of non-formal education for farmers, the agricultural extension provides advisory services to assist farmers in addressing their needs and overcoming obstacles in their socio-economic circumstances (Khan et al., 2021). People can gain the new skills they need through training to take advantage of both formal and informal possibilities. Agriculture extension service agents have traditionally been well-versed in all facets of their general program areas, including crops, animals, forestry, and livestock.

Training is one of the most essential factors in business organizations and institutions, which helps employees become more powerful and skilled. It is set up to help the employee familiarise with the job's parameters and establish its standards. Additionally, the trainee's morale will be raised by the training's challenges. Education and training are required to increase agricultural extension agents' performance. The ability to communicate with rural farm households is one of the significant responsibilities of the agricultural extension officer. According to Takemura, et al. (2014), cooperation with

farmers and the social effects of social interaction are crucial for agricultural extension. Institutions involved in agricultural extension encounter various difficulties due to the high competition among agricultural extension employees. According to the study of Mithal et al. (2012), there is a massive demand for extension workers to receive training.

All agents' individuals, businesses, or governmental entities must continuously invest in training and development to keep up with the unrelenting growth of technology. These investments ensure familiarity with emerging technologies and equip these agents with the necessary skills to leverage these technologies effectively (Belay and Abebaw, 2024).

In conclusion, a solid and continuous training program is no longer a luxury but a need in this period of rapid technological innovation. Agricultural Extension Agents (AEAs) can secure their survival and success by investing in their education and growth in the digital age.

2.10 Length of Employment of Agricultural Extension Agent and Retention at Post Impact on Farmers and FWDs

The number of years an agricultural extension agent works at the post and in a particular district, region, or country impacts farmers and people with disabilities involved in Agriculture. Many researchers have studied this relationship, and their results are discussed below. In Nigeria's Abia State, Ifeanyi-Obi and Ekere (2021) assessed the needs of agricultural extension workers regarding climate change-related training. They discovered that some agents were unaware of climate change, indicating a lack of knowledge and expertise in this vital field. The results emphasise the need for ongoing training programmes and knowledge upgrades to allow extension agents to address climate change concerns effectively. They can help farmers adapt to shifting climatic conditions and embrace climate-smart farming methods as they grow better equipped.

Jilito and Wedajo (2021) focused a different study on Ethiopia, looking at public sector agricultural extension agents' educational background and intended turnover. They exposed a pervasive unhappiness among these agents, many of whom stated their intention to investigate alternative employment offers from other companies. These findings have significant ramifications. The continuity and effectiveness of the extension services offered to farmers have a positive relationship with job satisfaction and retention rates among extension agents, which the period of employment may influence.

The effect of extension agents on farmers' technical efficiency was the subject of Tabe-Ojong and Molua's research in Cameroon in 2017. Interestingly, they discovered older farmers had higher technical efficiency levels, probably because they had more encounters with extension offers. This result suggests that the duration of an extension agent's employment may contribute to building confidence and rapport with farmers, resulting in increased technical efficacy and the adoption of good agronomic practices.

Furthermore, D'Silva et al. (2011) investigated how extension agents influenced crop farmers' views toward sustainable agricultural methods. The researchers emphasised the value of agricultural organisations and extension workers in educating farmers about various facets of sustainable agriculture. These include managing soil erosion, using fertiliser and pesticides appropriately, and stopping land degradation. Given this, extension agents who have been in their positions for longer can be especially beneficial because they have had more time to build trusting relationships with farmers and advocate for sustainable agricultural methods.

Chikaire et al. (2016) looked at the situation in Nigeria and investigated how extension agents affected farmers' participation and decision-making. Their findings showed how crucial extension agents are in enhancing the contributions of women farmers to household food security. This study suggests that the longer an extension agent works with farmers, including underserved groups like women and farmers with disabilities, the more likely they will develop reliable connections with them. The well-known AEA may encourage these groups to engage in agricultural activities actively.

Finally, a study by Huang et al. (2017) clarified the possible advantages of long-term climate change adaptations. They contend that failing to implement these long-term plans could lead to an overestimation of the harm that climate change might cause. It emphasises extension agents' crucial role in providing farmers with ongoing assistance as they adjust to changing climatic circumstances and incorporate sustainable agricultural practices into their daily routines.

In conclusion, an agricultural extension agent's employment duration is crucial and affects all farmers, including FWDs. It has an impact on how well-informed people are about crucial issues like climate change, job satisfaction and retention among extension agents, technical proficiency and the adoption of agronomic techniques among farmers, promotion of sustainable farming practises, developing trust and rapport with farmers, and supporting long-term adaptations to climate change. These observations highlight

the need for ongoing training, assistance, and financial support for extension services to maintain the viability and efficacy of agricultural extension programmes.

2.11 Effect of Extension Services on Farmers with Disabilities

Agricultural extension services provide farmers with the information, tools, and resources they need to improve their farming techniques and increase productivity. Factors like socio-economic features, social inclusion, intergroup disputes, and technology use significantly influence farmers' awareness of and access to these services.

Socio-economic conditions influence farmers' awareness of agricultural extension services. For example, a study conducted in Kitui County, Kenya, found that male farmers with higher levels of education and household wealth were more aware of these services than their female, less educated, and lower-income counterparts (Kyambo et al., 2021). This mismatch points to gender and socio-economic based barriers to accessing agricultural extension services.

Additionally, the extent of social inclusion influences how easily farmers may receive these services. According to a study conducted in Nigeria, the social involvement of landless farmers has a considerable impact on their productivity (Ofuoku and Ekorhi-Robinson, 2018). These findings highlight the need to ensure that all farmers can access extension services regardless of socio-economic status or location.

Conflicts between communities can also make it difficult for farmers to get agricultural extension services. Limited access to these services existed in Nigeria due to continuous communal strife (Ior et al., 2021). It emphasises the necessity of considering and dealing with community stability while planning agricultural extension services.

Technology advancements, particularly those related to mobile applications, present new opportunities for expanding access to agricultural extension services. For instance, in Malawi, businesses like the Department of Agricultural Extension Services, Airtel Malawi, and Farm Radio Trust use mobile technology to disseminate information and provide advisory services (Mahata and Mhagama, 2022). By utilising technology, it is possible to overcome obstacles like distance and a lack of resources and give farmers timely and pertinent information.

It is crucial to provide inclusive extension services that consider the needs of farmers with disabilities. A study in southwest Nigeria revealed that agricultural extension agents had

a high capacity for inclusive service, indicating a readiness to assist farmers with specific needs (Adeloye et al., 2022). The importance of such inclusivity cannot be overstated when helping farmers with disabilities succeed in their work.

The availability of agricultural extension services for farmers with disabilities, in contrast, is a significant concern in Uganda. Access is limited by impassable roads, structures, and communication tools and a lack of awareness and inclusion in service provision (Barungi et al., 2024). Farmers with disabilities are further discouraged from obtaining treatment by stigma and discrimination. However, Ragasa and Mazunda (2018) show that when FWDs can access these services, they may adopt modern agricultural techniques, increasing productivity, yield, and income. Accessible farming equipment also improves the farmers' standard of living overall.

These observations highlight the critical need for study on agricultural extension for farmers with impairments. Creating specialised plans that consider these farmers' particular requirements is crucial. To ensure the success of farmers with disabilities, discrepancies in access to services must be addressed.

The use of technology, social inclusion, intergroup conflict, and socio-economic issues all impact farmers' awareness of and access to agricultural extension services. These elements and the requirements of farmers with disabilities must be considered for agricultural extension services to be effective. Agricultural extension services can help farmers increase productivity by enhancing their agricultural methods.

2.12 Suitable Framework for Agricultural Extension Practices

Agricultural extension services are essential for raising farmer incomes, guaranteeing food security, and increasing agricultural production. However, due to physical, social, and economic limitations, farmers with disabilities frequently encounter difficulties obtaining extension services and resources (Tabereaux and Wheat, 2002). A proper framework for agricultural extension practice among farmers with disabilities must be developed to solve this problem. Prioritizing the use of assistive technologies, offering specialised training and assistance, and emphasising accessibility, participation, and empowerment should all be part of the framework (Sani et al., 2018; Minus, 2021; Yahaya et al., 2019; McNamara, 2007).

Farmers with disabilities should use the participant-centered approach as their primary framework for agricultural extension initiatives (Tabereaux and Wheat, 2002). Working

closely with farmers who have impairments to comprehend their unique needs and limitations is part of this strategy. To address the specific needs of farmers with disabilities, extension professionals must modify their agricultural techniques to consider their knowledge, abilities, and experiences. For farmers with disabilities to be able to use the methods effectively, the participant-centered approach also calls for continual training and assistance.

Farmers with vision or hearing impairments can obtain critical information with assistive devices like braille devices and text-to-speech software. Programs for training should also be created to specifically address the requirements of farmers with disabilities, such as offering tactile demonstrations to farmers with visual impairments. Finally, support services like accessible facilities and transportation assistance can ensure that farmers with disabilities fully participate in extension activities (McDaniels et al., 2018).

The framework for agricultural extension methods should put accessibility, participation, and empowerment at the forefront (Minus, 2021). Making agricultural extension services physically and sociably accessible to farmers with disabilities is part of accessibility. It involves making facilities wheelchair-accessible and offering assistive devices like audio and visual aids. Farmers with disabilities must be included in the conception, execution, and assessment of agricultural extension initiatives. They should be asked about their wants and preferences and included in the decision-making process. The empowerment process entails increasing the ability of farmers with disabilities to take part entirely in the agricultural industry. It involves giving them access to training and skills development opportunities, such as leadership and entrepreneurship training.

Farmers with disabilities should be included in the framework at every stage of the extension process, from planning to execution, using a participatory approach (Yahaya et al., 2019). The framework should also include aids and gadgets that allow farmers with disabilities to participate entirely in extension activities. To effectively address these obstacles, extension staff need to be thoroughly aware of the difficulties experienced by farmers with disabilities. Farmers with disabilities should receive individualised extension services based on their unique needs, considering their physical and cognitive capabilities and social and economic circumstances (McNamara, 2007).

Recognizing the broad spectrum of incapacitating conditions that might afflict farmers in agriculture is an important consideration. These may include cerebral palsy, rheumatoid arthritis, spinal cord damage, amputations, hearing and vision loss, and respiratory

problems (Trauger et al., 2010). All forms of disabilities must be included in the design of extension services, which must also offer solutions expressly customised to each farmer's needs.

The financing and execution of extension efforts are crucial considerations as well. These can be carried out through public and private channels, with farmer groups and online networks growing in spreading technology (Norton et al., 2020). To connect with and engage farmers with disabilities, extension services should use these networks and the most current information and communication technology (ICT) techniques.

In addition to these aspects, agricultural extension programmes should prioritise educating farmers in techniques and technology that encourage sustainable agricultural practices while avoiding detrimental effects on the quality of the land, water, and air (Shen et al., 2013). Education initiatives can boost local food availability, farmer income, and the sustainability of agricultural techniques.

Arability initiatives can be used to give farmers who have disabilities or ongoing health issues the resources and assistance they need to live independently and carry on working in producing agriculture (Field and Jones, 2006). These initiatives can include equipment adaptations, assistive technologies, and other assistance to enable farmers with disabilities to overcome obstacles and fully engage in agricultural pursuits.

The crucial role that farmers play as observers, analysts, experimenters, monitors, and evaluators should also be acknowledged in extension operations, and this function needs to be strengthened through innovative strategies and techniques (Leeuwis, 2013). Farmers with disabilities should have access to extension services that will enable them to actively participate in creating and implementing initiatives that directly affect them.

In conclusion, inclusive services should be prioritised in the framework for agricultural extension practises among farmers with disabilities. Regardless of their challenging conditions, it will guarantee that all farmers have access to the tools and services they need to succeed in production agriculture. It includes offering customised solutions to address each person's particular needs. To connect with and involve farmers with disabilities, the most up-to-date information and communication technology (ICT) strategies should be used, including virtual networks and farmer groups.

2.13 Chapter Summary

This chapter delves into the existing literature, focusing on agricultural extension services and their interactions with Farmers with Disabilities (FWDs) in Ghana. The extensive literature review in this chapter begins with the theoretical framework that will guide this study, which will employ concepts such as self-determination theory, participation theory, and the influence of contextual variables. These concepts are critical in tailoring agricultural extension services to FWDs' unique needs and circumstances, ensuring their concerns are effectively addressed.

The chapter then examines disability in Ghana, describing the several types of disabilities that farmers face and the causes of these disabilities. The unique communication needs of FWDs are also addressed.

The chapter examines Ghana's agricultural sector, discussing its history, current practices, and various agricultural extension approaches.

A key focus is socio-economic characteristics and their impact on FWDs' experiences with extension services. It includes factors influencing FWDs' engagement with these services, the socio-economic characteristics of Agricultural Extension Officers, and income disparities for FWDs. In addition, the role of non-farm income sources was also investigated.

The chapter then focuses on the accessibility of extension services for people with disabilities. The numerous factors influencing this access, the role of distance in service delivery, and the difficulties encountered by FWDs are thoroughly examined.

The effects of agricultural extension services on FWDs are examined, including the impact of extension contacts on farm income, communication and innovation, overall income, market and productivity, and Extension Officer education level.

The chapter then examines the importance of prioritising frequent extension visits to FWDs and the available agricultural information sources. The availability of extension information and how mediation can improve agricultural practices among farmers with disabilities are also discussed.

The literature review also includes an investigation of Agricultural Extension Agent training and how the length of their employment and retention at their post affects FWDs.

The chapter concludes with a discussion of the impact of capacity building on FWDs and the development of an appropriate framework for Agricultural Extension Practices.

This chapter provides a comprehensive understanding of the complexities of providing agricultural extension services to FWDs in Ghana through a thorough review of the relevant literature, laying the groundwork for future scholarly activities.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

Chapter three focuses on the research methodology that was used in the study. The chapter presents the study area outlined based on geographical information, demographic representation, population size, and general information on Farmers with Disabilities. After that, the chapter presents and describes the conceptual framework and research design, which paints a picture of how the study was conceived. The chapter provides information on data collection instruments used in the study, sampling procedure, enumerator selection, and training. Furthermore, the chapter outlines the analytical methods used in the study based on the objectives they are addressing, and this is followed by the measurements of variables for each analytical method.

3.1 Study Area:

The researcher conducted a study on farmers with disabilities in all sixteen regions of Ghana to gain a comprehensive and unbiased understanding of the challenges and needs of this population.

Ghana is a country in West Africa with a diverse and dynamic economy and a rich cultural heritage. Ghana, located in the Gulf of Guinea, has a population of about 31 million people and is known for its agricultural, mining, and manufacturing industries. The country has a long history of democratic governance and has made considerable progress in recent decades in reducing poverty and improving living standards.

Most rural households in Ghana rely on agriculture, an essential contributor to the country's economy. According to the Ghana Census of Agriculture (GCA, 2019), the population of farmers with disabilities is 122,209, approximately 1.1 percent of all agricultural holders.

The prevalence of all types of disabilities is higher in cities than in rural areas, and physical disability is more prevalent in cities, with approximately 46.1 percent of agricultural workers suffering from physical disabilities. The report shows that approximately 25.9 percent of agricultural workers are visually impaired.

Furthermore, the proportion of males with disabilities is slightly higher than females for hearing and speech disabilities, while the opposite is true for physical disabilities, according to the report. This pattern can be found in both urban and rural settings.

According to the GCA report, Ghana's agricultural sector is diverse, with various crops produced, including cocoa, maize, rice, and oil palm. However, the sector faces several challenges, such as climate variability, economic stressors, and a lack of access to inputs and technology. Ghana's mining industry is also an essential contributor to the economy, with the country being a significant producer of gold, diamonds, and bauxite. The manufacturing sector, which includes food processing, textiles, and pharmaceuticals, is also essential to the economy.

Ghana has significantly improved access to quality healthcare services in recent years. The country has a well-developed healthcare system, including public and private facilities. However, like many other developing countries, Ghana faces maternal and child health challenges infectious and non-communicable diseases. Ghana is a diverse and dynamic country with a rich cultural heritage and a growing economy. It presents numerous opportunities and challenges for researchers and offers a valuable case study for various fields, including agriculture, mining, manufacturing, and healthcare.

Below is a map of Ghana's sixteen regions for the study.

Figure 3.1: Ghana Map Source: Ghanamissionun.org

3.2. Research design

The framework for Agricultural extension practices among farmers with disabilities was meticulously crafted to provide a comprehensive plan for investigating and understanding the unique challenges this specific group of people encountered. The study followed the positivism philosophy, deductive approach, quantitative methodological choice, and survey strategy with a cross-sectional time horizon to collect empirical evidence and statistical data to effectively address the research questions and the study's specific objectives.

A cross-sectional design was used to collect data, which involved obtaining information from various farmers with disabilities at a specific time. This method provided a snapshot of the current situation and aided in exploring relationships and patterns in the data.

A survey instrument was carefully developed to ensure a representative sample of validated scales and targeted questions focusing on critical aspects of the framework for farmers with disabilities. The questionnaire was sent to farmers with disabilities in all sixteen regions in Ghana, considering factors like geographical distribution and demographic characteristics.

The collected data was then subjected to inferential analyses, specifically regression models, allowing the researcher to gain meaningful insights and draw conclusions about the study population. The researcher identified significant factors influencing farmers' experiences, needs, and aspirations with disabilities by examining the relationships between variables. Furthermore, regression models allowed for predicting future trends and outcomes, providing policymakers, organizations, and other stakeholders involved in supporting farmers with disabilities with valuable insights.

Ethical considerations were considered throughout the study. Informed consent protocols were followed to ensure that participants understood the purpose of the study and the potential consequences of their participation. Anonymity and confidentiality were guaranteed to protect participants' privacy and encourage trust and openness in the research process.

In summary, the framework for the farmers with disabilities study used a quantitative approach, with cross-sectional data from a survey and inferential analyses such as regression models. This comprehensive and methodical design enabled reliable and valid data collection, addressing the research questions effectively and providing valuable

insights into the experiences and needs of farmers with disabilities. Ethical considerations were carefully integrated throughout the study, ensuring the participants' well-being and confidentiality.

3.3 Data Collection Instruments for the Study

The data collection method was rigorous and meticulous, intending to capture all essential data from the target populations. Two unique semi-structured questionnaires were designed. One was intended to gather information from officers by exploring their knowledge, attitudes, and practises about agricultural extension and the requirements of farmers with disabilities. The other questionnaire was designed for farmers with disabilities, with questions aimed at understanding their experiences, challenges, and needs concerning agricultural extension programmes.

Given the Department of Agriculture's potentially limited reach, alternative techniques were used to ensure that the questionnaire reached as many farmers with disabilities as possible. The choice to partner with the social welfare department stemmed from their direct and frequent connection with people with disabilities in the district and municipal assemblies. This method produced many results, offering a large pool of respondents who would not have been available through the Department of Agriculture alone.

Another method used to maximise the reach of the data collection procedure was a collaboration with Jehovah's Witness evangelism teams. They were able to aid in locating farmers with disabilities due to their grassroots contacts and constant contact with varied population segments. This novel approach to targeting the target group resulted in a larger, more representative dataset. All the respondents identified and interviewed were among the sample randomly selected from the list obtained from the Department of Social Welfare.

Before distributing the questionnaires to the farmers with disabilities, their permission was obtained. The study's goal, the nature of their involvement, and the confidentiality of their responses were all clearly explained. This transparency met ethical study norms, generated confidence, and promoted involvement, increasing the number and quality of data collected.

3.4. Sample Size and Sampling Methods

The population for this study consists of 122,209 farmers with disabilities from the sixteen (16) regions in Ghana (GCA, 2019). To determine the sample size for this group, the following formula from Krejcie & Morgan (1970) was used:

$$S = \frac{X^2NP(1-P)}{d^2(N-1)+X^2P(1-P)}$$

S = Required Sample size X = Z value (e.g., 1.96 for 95% confidence level)

N = Population Size (122,209 in this case)

P = Population proportion (assumed to be 50%, or 0.5)

d = Degree of accuracy (5%, or 0.05), representing the error margin.

By plugging in these values, the sample size was determined to be 386 respondents. The researcher selected the sample; the list of all farmers with disabilities was obtained from the Department of Social Welfare and Department of Agriculture in the various (Metropolitan, Municipal, and District Assemblies (MMDAs) in all sixteen regions of Ghana. The researcher used a simple random sampling stratified by region and district. Agricultural extension officers serving farmers with disabilities in all 16 regions were interviewed for the study. A total of sixty-two (62) agricultural extension officers who work with farmers with disabilities were interviewed.

Table 3.1: Regional distribution of farmers with disabilities and agricultural officers interviewed.

Region	Number of FWDs interviewed	Number of Agricultural Officers
Ashanti	26	4
Brong-Ahafo	24	4
Central	24	4
Eastern	24	4
Greater Accra	24	2
Northern	24	4
Upper East	24	4
Upper West	24	4
Volta	24	4
Western	24	4
Western North	24	4
Bono East	24	4
Ahafo	24	4
North East	24	4
Oti	24	4
Savannah	24	4
TOTAL	**386**	**62**

3.5. Enumerator Selection and Training

The duty of collecting data from farmers with disabilities was assigned to a team of professional enumerators and sign language interpreters in this study, which was done across all sixteen regions of Ghana. The team comprised three sign language interpreters, three enumerators, and the researcher.

The enumerators, who are well-versed in agricultural extension delivery, were chosen based on their university graduate education. Their selection was also impacted by their acquaintance with the local languages, knowledge of Ghana, and previous involvement with the populations under study.

A three-day training session was performed before the data collection process to familiarise the team with the questionnaire and the purpose of the study. This session was led by the researcher, who ensured that everyone on the team had a thorough

comprehension of the questionnaire. This session contributed to standardising the data-gathering procedure and the consistency of the information gathered. A field pretesting exercise was undertaken on the second day of instruction. It gave the team hands-on experience with the questionnaire (which had been validated by the experts in Agricultural extension) and allowed them to iron out any potential difficulties. Following that, the final day of training was devoted to post-testing reflections. It allowed the team to share their experiences, provide feedback, and make any necessary changes to the questionnaire based on the results of the pretesting.

The enumerators also provided strategies for approaching and communicating effectively with farmers, including those with disabilities and agricultural officers. The team was able to effectively communicate with farmers who have hearing and speech disabilities with the use of sign language interpreters, assuring their inclusion in the study. The data collection process lasted three months, allowing for complete coverage of all sixteen regions of Ghana. This rigorous strategy, which included pre-testing and focused training, ensured the dependability of the obtained data and, as a result, the legitimacy of the study's findings.

3.6. Analytical techniques

The Statistical Package for Social Scientists (SPSS) Version 28 was used to analyse the data. Research objectives one, two, and three were analysed using graphs, histograms, and descriptive statistics, including mean, standard deviation, frequencies, chi-squares, and percentages. Descriptive analysis is a fundamental approach in social research, allowing for a comprehensive overview of the data distribution and key characteristics (Babbie, 2013).

The Fractional Outcome Regression Model was used to analyse the determinants of farmers with disabilities' access to agricultural extension services per year. A multiple Linear Regression Model was used to assess the influence of agricultural extension practices/services and other socio-economic/demographic factors on the farm income of farmers with disabilities. The study also assessed the factors associated with the six essential challenges of the FWDs in the study area using the Pearson correlation coefficient. The suitable extension framework for farmers with disabilities was developed by synthesizing all the results obtained from the study, including inputs from the agricultural extension officers who participated in the study.

3.6.1 Regression Model Specifications

1) The Fractional Outcome Regression Model was used to analyze determinants of farmers with disabilities' access to agricultural extension services per year. This model is particularly suited for handling fractional response variables, which are common in studies involving proportions or rates. The application of this method allows for a nuanced understanding of the factors influencing access levels (Papke & Wooldridge, 1996).

Fractional Outcome Model: Fractional responses concern outcomes between zero and one. It captures non-linear relationships, especially when the outcome variable is near 0 (zero) or 1 (one). Fractional response estimators fit models on continuous zero-to-one data using probit, logit, heteroskedastic probit, and beta regression. Since the response variable, the Y is a proportion that is naturally a fraction bounded between 0 and 1. Thus, this model deems fit. Fractional probit outcome was used to estimate the factors influencing the number of actual extension visits made to a farmer with a disability out of an expected number of agricultural extension visits for a season/year. The model is expressed as:

The proportion of visits received by a farmer with disability $E(y \mid x)$ is given by

$EY|X=G(X\theta)$ ……………………………………………………………(10)

Where:

y represents the dependent variable, which is bounded between 0 and 1; the average number of extension visits expected in a year to the farmers with disabilities was obtained from the Department of Agriculture, which was four per week. Each farmer with a disability indicates the number of extension visits received during the 2021 normal production season. Then, an index of the number of extension visits divided by the expected number of extension visits/season constituted a fraction and served as dependent variable values for the respective respondents (Yi).

Xi is the explanatory variable of the socio-economic and demographic characteristics of the respondents.

θ is a vector of parameters

$G(.)$ is a cumulative distribution function of the standard normal distribution, which takes several forms, such as the probit—$G(x\theta) \equiv \Phi(x\theta)$ or log-log—$G(x\theta) \equiv e^{-ex\theta.}$

The statistics to be used for the model include:

The number of observations, Wald chi2, Prob > chi2, Pseudo $R^{2,}$ and Log pseudolikelihood, was obtained from the analysis, which was then interpreted. The independent variables (socio-economic and demographic factors) considered in the study are, as presented in Table 3.1

Table 3.2: Variable labels and their expected effects on the fractional outcome model

Variable	Description	Effect
X1	Gender (1=Male, 0=Female)	+
X2	Age (years)	-
X3	Source of Disability	-
X4	Household dependents	+
X5	Education Level	+
X6	Non-farm employment (1=Yes, 0=No)	+
X7	FBO membership (1=Yes, 0=No)	-
X8	Farming experience (years)	+
X9	Engage in non-farm activities (1=Yes, 0=No)	+
X10	Type of production 1=veg 2=Grains 3=Aquaculture 4=Livestock 5=Root and Tuber	+
X11	Farm size (Ha)	+
X12	Proportion of output sold (0=1. 1-50%=2. >50%=3)	-
X13	Proportion of inputs purchased (0=1. 1-50%=2. >50%=3)	+
X14	Do you have rreliable market (1=Yes, 0=No)	+
X15	Do you have aaccess to credit (1=Yes, 0=No)	+
X16	Do you keep farm record keeping (1=Yes, 0=No)	+
Y (dependent variable)	Fractional variable: Number of extension visits / expected number of Extension visit per year	

No special data adjustments are needed for the extreme values of zero and one, and the conditional expectation of y, given the explanatory variables, is estimated directly. The quasi-likelihood method of estimation is fully robust and efficient under the GLM assumption.

- 2) The Multiple Linear Regression Model specification was employed to examine the demographic and socio-economic factors (predictors) associated with the generation of farm income by the respondents. This method enables the evaluation of the relationship between multiple independent variables and a single continuous dependent variable, providing insights into how various factors collectively impact farm income (Kutner et al., 2005).

  The assumptions of the multiple linear regression model are

  - Linear relationship between the outcome variable and the independent variables.
  - Multivariate normality of the residuals.
  - No or little multicollinearity between the independent variables.
  - No autocorrelation of the residuals.
  - Homoscedasticity of the residuals.

The dependent variable, income, is continuous. As a result, to model a continuous dependent variable, a linear multiple regression model was employed. The OLS estimates are linear, unbiased, low variance, consistent, and distributed in this regard (Gujarati, 2003). The model may be expressed as

$$Y_i = \beta_0 + \beta_i X_i + \varepsilon_i \quad (1)$$

Where "Y_i is the amount of annual income of respondents, β_i are parameters to be estimated, β_0 is a constant, and X_i is the demographic and socio-economic factors that influence the farmer's income as shown in Table below. The Ordinary Least Squares principle states that the sum of the squares of the deviation for all values of population Y_i and sample $\hat{Y}_i$ is to be a minimum". i.e.

$$\Sigma^{n}_{i=1}(Y_i - \hat{Y}_i)^2 \quad (2)$$

Where n is the number of data points comprising the sample.

Since Y is considered to be dependent upon more than one variable, then,

$$Yj = \alpha + \beta 1X1j + \beta 2X2j + \beta 3X3j + \ldots + \beta mXmj + \epsilon j . \quad (3)$$

or, more succinctly,

$$Yj = \sum_{i=1}^{m} \beta jXij + \epsilon j,$$

Therefore, all the endogenous variables were removed, and the assumptions of linearity, normality, homoscedasticity, and independence of error were studied to ensure aid in testing the reliability and validity of the framework. The Durbin-Watson statistical analysis was used to test for Autocorrelation, and VIF was used for the study's multicollinearity analysis. The normality test was also performed. The semi-log, double logs and the exponential models would have been employed if the above assumptions were violated. The quantitative analysis of the study was conducted using the Statistical Package for Social Sciences (Version 27.0) to test the model and other parameters, including Regression coefficients βi, constant, standard error, R^2, adjusted R^2, VIF, Residual analysis, Durbin-Watson, t-values, and the F-test. The independent variables (socio-economic and demographic factors) considered in the study are presented in Table 3.3.

Table 3:3 Variable labels and their expected effects multiple regression model

Independent variables	Variable description	Expected effect
X1	Gender (male=1 female=0)	+
X2	Age in years	-
X3	Source of Disability	-
X4	Household dependents	+
X5	Level of education	+
X6	Non-farm employment (Yes =1 No=0)	+
X7	FBO membership (Yes =1 No=0)	-
X8	Years of farming experience (number)	+
X9	Engage in non-farm activities (Yes=1, No=0)	+
X10	Type of production (1=Veg. 2=Grains. 3=Aquaculture. 4=Livestock. 5=Root and tuber.)	+
X11	Size of the farm (Ha)	+
X12	Proportion output sold (0=1. 1-50%=2. >50%=3)	-
X13	Proportion of farm inputs purchased (0=1. 1-50%=2. >50%=3)	+
X14	Do you have a reliable market? (Yes=1. No=0)	+
X15	Do you have access to credit? (Yes=1. No=0)	+
X16	Do you keep farm records? (Yes=1. No=0)	+
Y (dependent variable)	Continuous variable: Amount of farm Income obtained by the respondent in the 2021 season.	

3) The factors associated with the challenges of the FWD were analyzed using the Pearson correlation model, as presented below.

The **Pearson correlation coefficient** measures the strength of a linear association between two variables — it measures linear correlation between two sets of data where the value **r** = 1 means a perfect positive **correlation** and the value **r** = -1 means a perfect negative **correlation** (Cohen et al., 2013).

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Where,

r = correlation coefficient

x_i = values of the x-variable in a sample

x= mean of the values of the x-variable

y_i = values of the y-variable in a sample

y= mean of the values of the y-variable

The factors considered in the analyses are presented in Table 3.4 below.

Table 3.4 Factors for Pearson correlation coefficient

Xi VARIABLES	Expected sign	Yi VARIABLES
Age (years)	-	Discrimination
Gender (Male=1, Female=0)	+	Inferiority
Type of disability (ordinal)	+	Building design
Source of disability (ordinal)	+	Special training
Being household head (Yes=1, No=0)	-	Sign language
Household dependents (scale)	+	Braille
FBO membership (Yes=1, No=0)	+	
Non-farm activity (Yes=1, No=0)	+	
Years of farming experience (scale)	-	
Land size for grain farm (Scale)	-	
Income from grain farm (Scale)	+	
Land size of vegetable farm (scale)	-	
Income from the vegetable farm (scale)	+	
Access to training (Yes=1, No=0)	-	
Distance travelled by AEA (scale)	-	
Access to Ext Service (Yes=1, No=0)	-	

3.7. Reliability and validity of data collection instruments

All data collection instruments were rigorously validated to ensure that relevant and precise data were collected for this study, concentrating on FWDs. Agricultural Extension specialists from Unisa evaluated the semi-structured questionnaire and interview guide. This evaluation followed the study's research question and objectives to ensure their relevance and accuracy.

A pretest was conducted involving 20 farmers with disabilities (FWDs) and 3 Agricultural Extension Officers (AEAs) selected from the target population. The purpose of this pretest was to assess the reliability of the instruments used, particularly the questionnaire. The farmers involved in the pretest were not included in the main study.

The pretest aimed to identify any potential challenges in the design, structure, or content of the questionnaire that could hinder effective data collection. This step was crucial in refining the instruments and ensuring their suitability for gathering accurate data from the intended respondents.

Any concerns discovered during the pretest were thoroughly reviewed, and any necessary changes were made to the questionnaire. This extensive validation and reliability testing helped verify that the data-collecting devices were trustworthy and valid for the study's particular context, focusing on agricultural extension techniques among Ghanaian farmers with disabilities. The procedure also contributed to increased trust in the quality and usefulness of the data obtained.

3.8 Ethical Considerations

The researcher ensured the respondents' and their information's anonymity and confidentiality. The respondents received no monetary reward for completing the questionnaire. The respondents' permission was secured prior to the interview. Respondents were free to leave the interview at any point during the process. Interviews were conducted as scheduled, and all COVID-19 guidelines were followed entirely. Before beginning data collection for the study, the researcher obtained ethics clearance/approval from UNISA (University of South Africa).

3.9 Chapter Summary: Research Methodology

This chapter provided a detailed overview of the methods used in researching the agricultural extension framework among farmers with disabilities across Ghana's sixteen regions.

The chapter began by defining the research area and explaining the conceptual framework that guided the investigation. It then described the research design and use of a survey approach to collect primary data systematically.

The study's data-gathering instruments, including the development and use of semi-structured questionnaires for the survey, were discussed in this chapter. The rigorous sampling procedures and sample size determination were then focused on stratified random sampling to ensure a representative sample of farmers with disabilities across Ghana's sixteen regions.

A section of the chapter was also devoted to the selection and comprehensive training of enumerators and sign language interpreters. The process of training them with the questionnaires and strategizing on the approach to data collection was outlined, including the necessary pretesting and later modifications to improve the instrument's reliability and performance.

The research's analytical procedures were briefly addressed, providing insight into how the acquired data will be handled and analyzed. Another critical topic highlighted in this chapter was ensuring the reliability and validity of data-gathering tools. An agricultural economics specialist carefully validated the tools, which were then modified through pretests with selected responders.

Finally, the chapter finished by discussing the research's ethical considerations, such as respecting the participants' rights and confidentiality and conducting the research honestly and carefully.

In summary, this chapter thoroughly detailed the research methodology, claiming the robustness and dependability of the procedures used while ensuring ethical standards were observed throughout the research.

CHAPTER FOUR

DESCRIPTIVE STATISTICS AND CORRELATION RESULTS

4.0 Introduction

The study's findings on the demographic and socio-economic determinants of access to agricultural extension services for farmers with disabilities in Ghana are presented and discussed in this chapter. The study is based on information gathered from 386 samples, including male and female farmers with disabilities of various ages over 18. The chapter also discusses the difficulties these farmers have in obtaining extension services and the socio-economic drivers and impact of extension contacts on farm income. The study also assessed the factors associated with the six essential challenges of the FWDs in the study area using the Pearson correlation coefficient.

4.1 Socio-economic characteristics of the Farmers with Disabilities (FWDs)

The study's 386 respondents were given 386 questionnaires in all. All the questionnaires distributed were returned, yielding a 100% response rate, which is more than adequate for statistical inferences and analysis. Descriptive statistics such as percentages, frequencies, and standard deviations were used to assess the demographic and socio-economic factors. Figures and tables were used to present the findings.

4.1.1 Gender of the Respondents

Figure 4.1 represents the gender distribution of the farmers with disabilities in the study area. According to the study's findings, the sample size comprised 68.7% male and 31.3% female respondents.

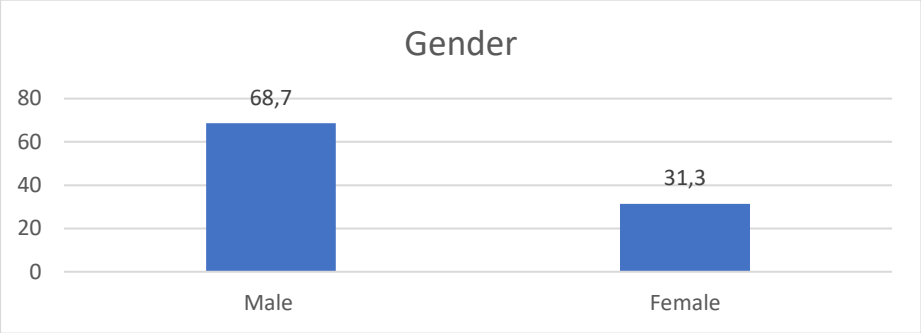

Figure 4.1: Gender of the FWDs in the study area

Source: Field Data, 2022

This data analysis can provide vital information on the difficulties experienced by farmers with disabilities, particularly gender disparities. It can also identify improvement areas in extension service delivery to farmers with disabilities.

According to Sango et al. (2022), the combination of gender and disability can generate a unique set of hurdles that make it difficult for female people with disabilities to get the resources and support they need. Access to land, finance, and other financial resources, and limited access to proper technologies are examples of such impediments. Furthermore, cultural, and social conventions can pose extra problems for female FWDs.

These norms can place greater expectations on women to succeed in agricultural pursuits while limiting their access to the resources and support needed to meet those expectations.

Md et al. (2022) sought to study gender discrepancies in agricultural employment for FWDs. According to the study, specific disabilities increase the likelihood of exclusion from the agricultural labour market, particularly for women with disabilities. This exclusion is due to a lack of access to resources and services necessary for agricultural employment, such as farming implements and training.

Furthermore, the study discovered that a lack of suitable support services and a failure to recognize farmers with disabilities by other stakeholders, such as employers, can contribute to gender discrepancies in agricultural employment for farmers with disabilities. According to this data analysis, male respondents comprise most of the sample size of farmers with disabilities.

It demonstrates that, despite increases in gender diversity and equality in the farming sector, men remain the dominating group. As a result, it is critical to strive for more gender

diversity and equality in agriculture to guarantee that women have equal access to agricultural resources and training. Furthermore, given that farmers with disabilities are already disadvantaged regarding access to resources and opportunities, promoting gender equality in this sector is critical for development and food security.

4.1.2 Educational Level of the Respondents

The findings in Figure 4.2 show that respondents come from various educational backgrounds, highlighting obstacles and potential areas for assistance.

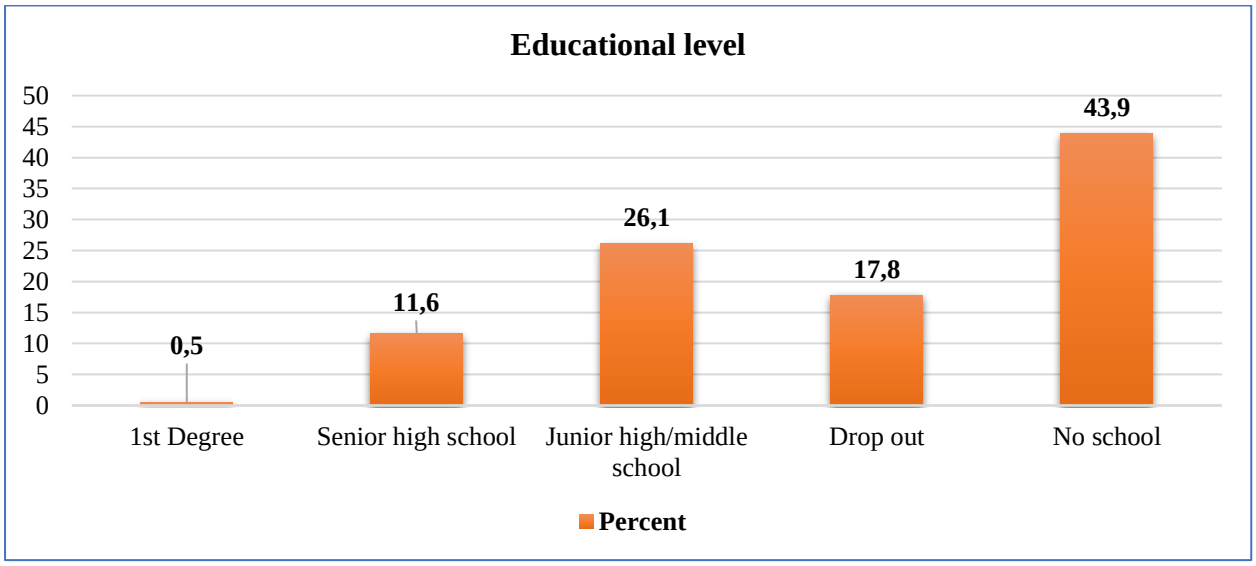

Figure 4.2: Educational level of farmers with disabilities in the study area

Source: Field Data, 2022

The fact that only 0.5 % of respondents had a first degree demonstrates how farmers with disabilities have restricted access to higher education opportunities. This meagre percentage indicates a huge gap in educational achievement compared to the general population. According to the findings, individuals with disabilities in the farming community experience significant challenges in obtaining higher education, due to a lack of support, poor infrastructure, or societal views regarding disability.

Furthermore, according to the report, 11.6 % of respondents had completed senior high or junior high/middle school. While this represents a slightly higher number of farmers with disabilities who have completed secondary education, the percentage remains low. According to the report, it is critical to remember that even after completing secondary school, 11.6 percent of respondents had completed senior or junior high/middle school. While this represents a slightly higher number of farmers with disabilities who have

completed secondary education, the percentage remains low. It is important to note that even finishing secondary school can be difficult for people with disabilities, and efforts should be made to remove the hurdles they face in accessing and completing this level of education.

The fact that 17.8 % of respondents had dropped out of school demonstrates the difficulty that farmers with disabilities confront in continuing their education. Dropping out of school can be impacted by various causes, including financial restraints, a lack of suitable housing, or the desire to emphasize agricultural employment. This conclusion emphasizes the need to establish comprehensive support systems that address the unique requirements and problems that people with disabilities encounter while pursuing an education. The fact that 43.9 % of respondents had no formal education is the most noteworthy and alarming statistic. It emphasizes a considerable proportion of farmers with disabilities who have never received formal education. Individuals with disabilities may suffer from socio-economic disadvantages due to a lack of access to education. It is essential to acknowledge the critical need for focused interventions, legislation, and inclusive educational programmes to promote equal educational opportunities within the agricultural community, specifically to address the specific obstacles experienced by farmers with disabilities.

The study's findings highlight the importance of comprehensive and focused efforts to improve educational opportunities for farmers with disabilities. Efforts should be made to improve accessibility, provide inclusive learning settings, and provide the appropriate support systems to help those with disabilities in the farming community with their educational journey. By addressing these issues, society may empower FWDs to improve their skills and knowledge and increase their socio-economic well-being. More research and collaboration among stakeholders are required to develop successful solutions to improve the educational landscape for individuals with disabilities in the farming community.

4.1.3 Type of Disability of the Respondents

According to the findings in Figure 4.3, 52.5% had a physical disability, 13.2% of respondents had a speech disability, 1.3% had autism, 12.4% had a virtual/sight disability, 9% had skin/albinos, 10.1% had hearing impairment, 1.6% had mental health issues such as depression.

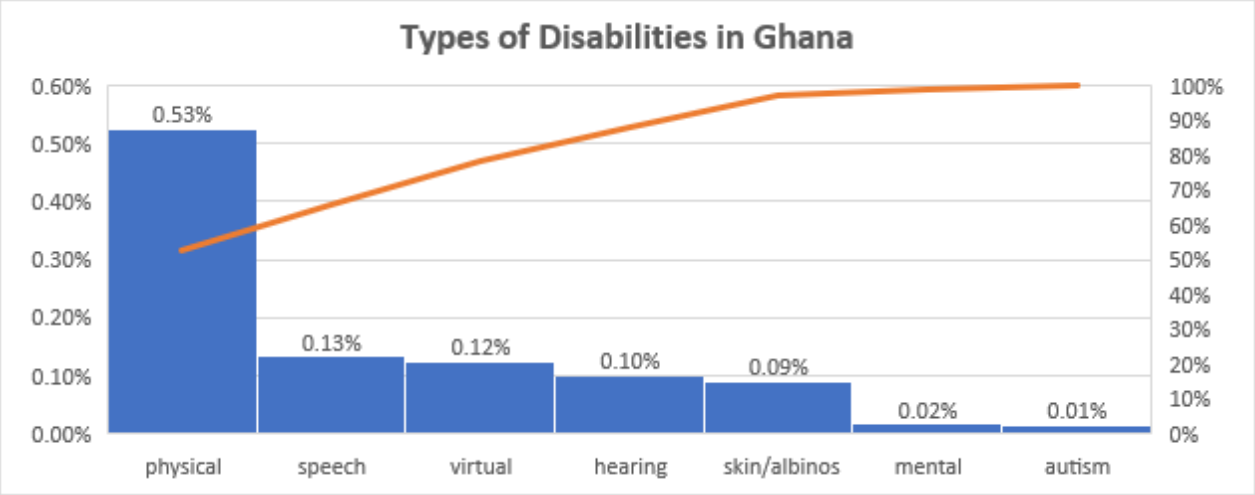

Figure 4.3: Type of Disabilities in Ghana

Source: Field data, 2022

Farmers with disabilities face extraordinary obstacles because farming is a physically demanding career. The study's findings on the frequency of physical disability among farmers are similar to earlier research. Kalargyrou (2014) discovered that farmers who perform manual labour are more likely to suffer from physical disabilities. These impairments might range from chronic pain to musculoskeletal disorders, influencing the farmers' overall quality of life. Farming's repetitive and physically demanding duties can contribute to illnesses like tendinitis, lower back discomfort, and carpal tunnel syndrome. It supports existing research findings about the frequency of physical disabilities among farmers.

Farmers' respiratory health is also an issue due to their exposure to dust, pesticides, and other air pollutants. Farmers are more likely to have respiratory disorders such as chronic obstructive pulmonary disease (COPD). These disorders can compromise lung function and make it difficult for farmers to do physically demanding jobs. Addressing these respiratory dangers and applying appropriate safety measures is critical to preserve farmers' health and well-being.

Aside from physical disabilities, the new research identifies mental health difficulties as a significant issue in the farming community. Farmers are subjected to high stress levels, isolation, and financial demands, all of which can lead to depression, anxiety, and other mental health issues. According to Cole and Bondy (2020), the stressors associated with farming, such as unexpected weather patterns and shifting commodity prices, might contribute to chronic stress and exhaustion among farmers. Farmers may struggle to seek

timely and adequate treatment due to constraints such as stigma and a lack of facilities in remote farming areas, further compounding the problem.

The new study's findings are consistent with earlier research, underlining the significance of addressing mental health issues in the farming community. Farmers' well-being can be improved by making mental health treatments and support groups more accessible. It is critical to foster an environment where farmers feel comfortable seeking assistance, and mental health is de-stigmatized within the farming community. Furthermore, activities that encourage mental health awareness and resilience-building tactics customised to farmers' specific circumstances can contribute to overall better mental health outcomes.

Finally, the current study illustrates the enormous problems that farmers with disabilities confront regarding their physical and mental well-being. The prevalence of physical disabilities in farming and their associated risks highlight the need for suitable safety measures and support structures to ensure the well-being and success of farmers with disabilities. Furthermore, addressing mental health issues and making mental health resources available are critical for improving farmers' overall quality of life. Stakeholders may collaborate to create a more inclusive and supportive farming environment that allows farmers with disabilities to thrive by recognising and addressing these challenges.

4.1.4: Source of disability of respondents

Figure 4.4 highlights that illnesses account for 44% of disabilities, disabilities at birth total 34%, injuries or accidents account for 17%, and “Old age “causes 5%.

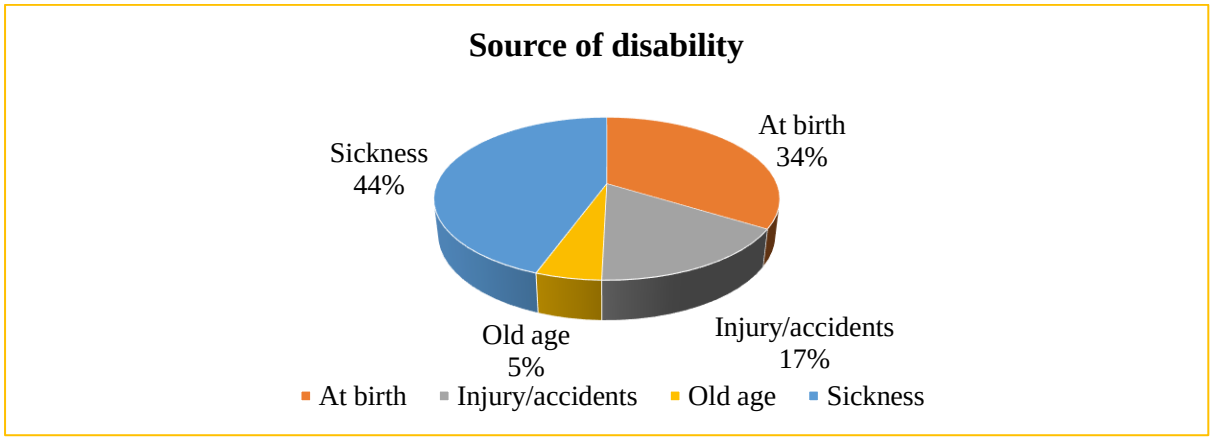

Figure 4.4: Source of disability of farmers with disability in the study area

Source: Field data, 2022

The impact of injury or accident-related disabilities on farmers in Ghana is a critical issue that requires attention. Disability can significantly impact farming in Ghana, as demonstrated by Agyei-Okyere et al. (2019). In this study, the researchers explored the causes of disabilities among farmers in Ghana, and the results showed that disabilities are more common in rural areas than urban areas. They identified many factors that could contribute to the high rate of disabilities in rural areas, including inadequate access to healthcare, a lack of educational opportunities, poverty, and access to modern farming equipment and technology.

Furthermore, they found that disabilities can lead to a decline in the productivity of farms, which can further exacerbate the poverty experienced by many in rural areas. This study highlights the need for further research into the impact of disability on farming in Ghana and the development of strategies to address the causes of disabilities among farmers. The impact of disability at birth, injuries, and accidents on Ghana's farmer population is critical to examine and discuss. According to Mock et al. (2003), it is clear that these issues have had a significant impact on the Ghanaian agricultural sector. They noted that disability at birth could decrease farmers' productivity and significantly impact their ability to provide for their families.

Additionally, Mock et al. (2003) suggest that injuries and accidents can result in the loss of a farmer's ability to work, which can severely limit their ability to provide for their families. As such, there is a need to assess the impact of disability at birth and injury/accidents on Ghana's farmer population to understand better how to address the issue. Overall, the research on farmers with disabilities in Ghana provides a detailed analysis of the sources of their disabilities.

4.1.5: Household head status of the respondents

The current study looked at household headship status among farmers, focusing on farmers with disabilities. According to the findings in Figure 4.5, 57 % of respondents were household heads, while 43 % were not. This discovery throws insight into the distribution of family tasks and decision-making authority within the farming community, particularly among FWDs.

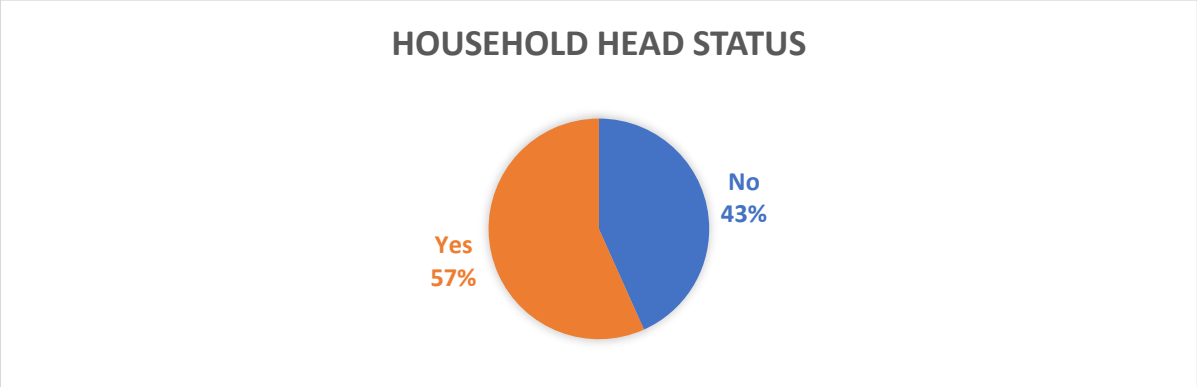

Figure 4.5: Household head status of the farmers with disabilities in the study area

Source: Field data, 2022

The high proportion of farmers with disabilities who are household heads (57 percent) implies that many people with disabilities are actively involved in managing their households and taking on leadership positions within their families. This research calls into question the concept that people with disabilities rely entirely on others for their daily needs, emphasizing their ability to contribute to their households' general functioning and decision-making processes.

The fact that 43 percent of respondents were not household heads suggests that there are many farmers with disabilities who do not have primary decision-making authority in their homes. Household headship could be because of cultural standards, societal expectations, or the severity of their disability. Individuals with disabilities may encounter additional difficulties and problems while taking on household headship positions, influencing their autonomy and decision-making authority. According to the data, a sizable proportion of farmers with disabilities are household heads who are actively involved in managing their households and making choices. However, a considerable proportion of farmers with disabilities do not hold household headship responsibilities, indicating the presence of constraints and challenges that may limit their autonomy and decision-making capacity. These findings highlight the importance of inclusive policies and support systems that enable people with disabilities to participate actively in household decision-making and have their voices heard.

4.1.6: Number of household dependents

The current study sought to investigate the number of dependents among farmers, mainly focusing on FWDs. According to the findings in Figure 4.6, the distribution of dependents varied among the farmers interviewed. 39.9 percent of respondents had 3-5 dependents, 22.9 percent had 6-7 dependents, 18.8 percent had more than ten dependents, 12.8 percent had 8-9 dependents, and 5.5 percent had 1-2 dependents.

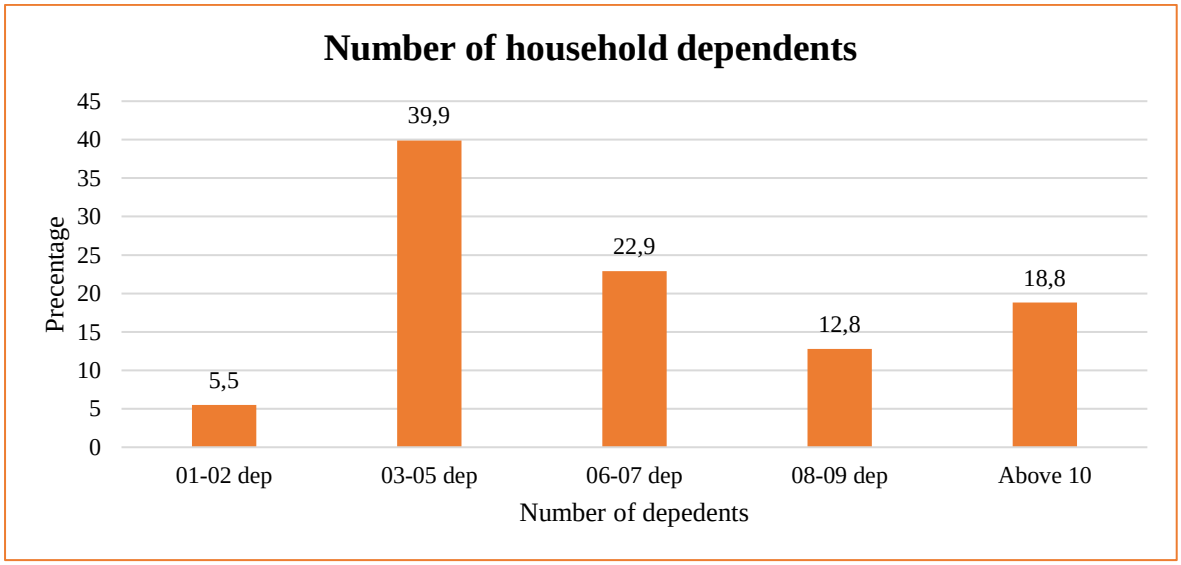

Figure 4.6: Number of household respondents of the farmers with disabilities in the study area

Source: Field data, 2022

The high percentage (39.9 percent) of FWDs with 3-5 dependents demonstrates that many farmers, especially FWDs, sustain a reasonable number of dependents. According to this finding, these farmers are responsible for providing for their families and addressing the requirements of their dependents. It emphasizes the economic and social burden put on farmers, who must ensure the well-being and lives of many people.

This research highlights the difficulties these farmers confront in addressing the needs of a big household, including financial, logistical, and emotional support. It is critical to assess how this load may affect farmers' general well-being and quality of life, as it may impact their physical and mental health and capacity to engage in agricultural operations effectively. According to the statistics, 12.8 percent of farmers had 8-9 dependents, while 5.5 percent had 1-2 dependents. These percentages depict farmers with varied levels of

dependency, with some bearing a disproportionately higher burden of dependents and others bearing a disproportionately lower burden of dependents.

Appreciating the diversity of the farming community and the particular conditions that individual farmers, including PWDs, face regarding household composition and responsibilities is critical. The study's findings have significant implications for policy and support services aimed at farmers, particularly those with disabilities. Recognizing farmers' various levels of dependency and understanding the obstacles they encounter in satisfying the requirements of their dependents is critical for establishing tailored interventions and support programmes. These may include financial aid, access to resources and training, and social support networks designed to relieve farmers' burdens and increase their general well-being. Finally, the current study sheds light on the distribution of dependents among FWDs. The findings emphasize the varied dependency levels and farmers' hardship in supporting their homes.

These findings highlight the importance of customized support services and policies that address the unique situations and problems that farmers, particularly those with disabilities, confront in addressing the requirements of their dependents. By identifying and resolving these issues, policymakers and stakeholders can work to improve farmers' livelihoods and well-being while also supporting sustainable farming methods.

4.1.7: Framer group /FBO Membership

Figure 4.7 depicts the level of participation in group activities among farmers with disabilities. According to the study, just 28.7 percent of farmers with disabilities belong to a group, while the rest, 71.3 percent, do not participate in group activities.

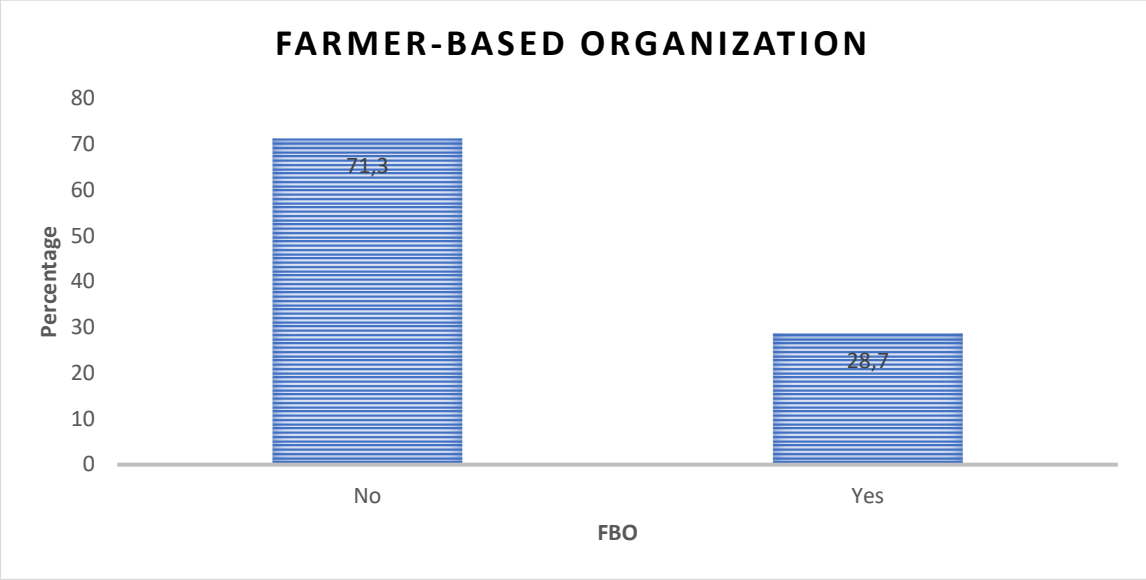

Figure 4.7: Farmer-based organization/ Farmers group membership of farmers with disability

Source: Field data, 2022

This finding is consistent with prior research on farmer engagement in various agricultural activities, both with and without disabilities. For example, a study conducted in Uganda investigated the factors that influence young farmers' engagement in agricultural capacity-building programmes, including those with disabilities. The study discovered that young farmers with disabilities were less likely to participate in community capacity-building activities than their non-FWD counterparts (Agole et al., 2021).

Gomda et al. (2021) also support the current research that farmers with disabilities (FWDs) in Ghana face significant challenges in participating in farmer groups and FBOs. The study found that 71.3% of FWDs are not members of any farmer group or FBO, and only 28.7% are. These results can be attributed to the exclusion of FWDs from access to agricultural resources and services and social and economic opportunities.

A variety of circumstances might influence farmers' engagement in group activities. The accessibility and inclusivity of group settings are crucial considerations. Farmers with disabilities may have physical or logistical problems that make participation in group activities challenging. Individuals with mobility disabilities, for example, may have difficulty accessing group meeting places that are not wheelchair accessible. Farmers with sensory impairments may also have difficulty participating in group conversations or activities that rely significantly on verbal communication (Altarawneh et al., 2012). Social and behavioural hurdles can also limit involvement among farmers with disabilities. Stigma,

prejudice, and a lack of understanding about the skills and contributions of people with disabilities can all contribute to a hostile or unwelcoming climate inside groups.

These challenges may deter farmers with disabilities from joining groups or actively participating in group activities (Altarawneh et al., 2012). To address these issues and promote more inclusion and engagement among farmers with disabilities, initiatives that improve accessibility and remove barriers within group settings must be implemented. Addressing the issues: increasing group members' awareness and comprehension of disability issues can contribute to a more inclusive and supportive environment (Altarawneh et al., 2012).

Furthermore, it is critical to acknowledge and embrace the distinct viewpoints and contributions that farmers with disabilities can bring to group events. Groups can benefit from the expertise and experiences of farmers with disabilities by actively involving them in decision-making processes and offering chances for their active involvement (Altarawneh et al., 2012).

Finally, the study depicted in Figure 4.7 shows that farmers with disabilities have a low level of participation in group activities. This research emphasizes the need for inclusive and accessible group settings and techniques for overcoming physical, logistical, and social obstacles. Farmers with disabilities can benefit from the support, information sharing, and resources that group memberships can provide by promoting more inclusion and engagement. More study and efforts are required to understand and address the unique problems farmers with disabilities encounter when participating in group activities.

4.1.8: Non-farm activity

Figure 4.8 depicts the level of non-farm income among farmers with disabilities. The study results indicate that only 32% of the farmers with disabilities have non-farm income and activities, while the remaining 68% are entirely devoted to farming.

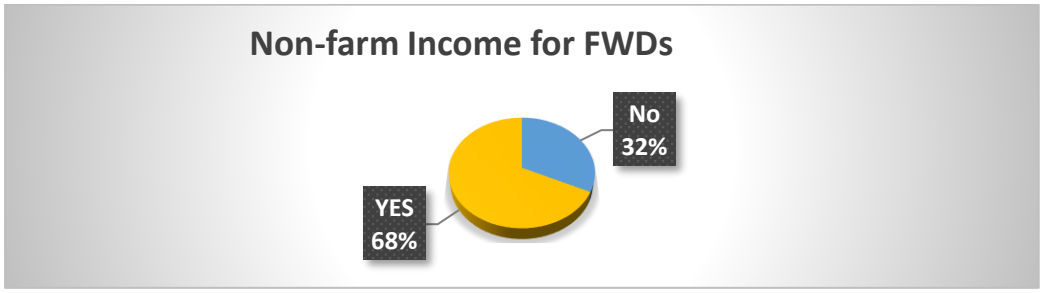

Figure 4.8: Non-farm activities for farmers with disability

Source: Field data,2022

The study's findings regarding the challenges faced by farmers with disabilities and the significance of non-farm income diversification align with previous literature. The data supports the idea that smallholder farmers rely on non-agricultural activities to supplement their farming revenue (Otekhile and Verter, 2017). Additionally, the importance of non-farm income in improving household well-being and facilitating agricultural technology adoption is consistent with prior research (Danso-Abbeam et al., 2020). The findings also corroborate previous research demonstrating the financial difficulties and particular obstacles faced by young farmers with impairments (Agole et al., 2021).

Furthermore, the study's observations regarding income diversification, loan repayment, and agricultural technology adoption align with existing literature. Income diversification has been found to improve household welfare and encourage the use of agricultural technology (Malami & Suleiman, 2021; Danso-Abbeam et al., 2020). Similarly, a correlation has been established between greater income levels, particularly non-farm income, and improved debt repayment. (Kuye & Edem, 2019).

Finally, the study depicted in Figure 4.8 focuses on non-farm income among farmers with disabilities. According to the statistics, many farmers with disabilities rely primarily on farming for a living. This assertion highlights the economic hurdles that farmers with disabilities confront and the importance of tailored interventions and assistance to enhance their economic involvement and well-being. More research is required to understand better the specific economic constraints and opportunities faced by farmers with disabilities and develop practical solutions to address them.

4.1.9: Experience in farming

The results in Figure 4.9 shed light on the farming experiences of farmers with disabilities. The study found that 28.9 percent of farmers with disabilities had 10 to 19 years of farming experience. Furthermore, 26.4 percent had 1-9 years of experience, 17.1% had 20-29 years of experience, 11.5 percent had 30-39 years of experience, 9.3% had 40-44 years of experience, and 6.8 percent had more than 45 years of experience.

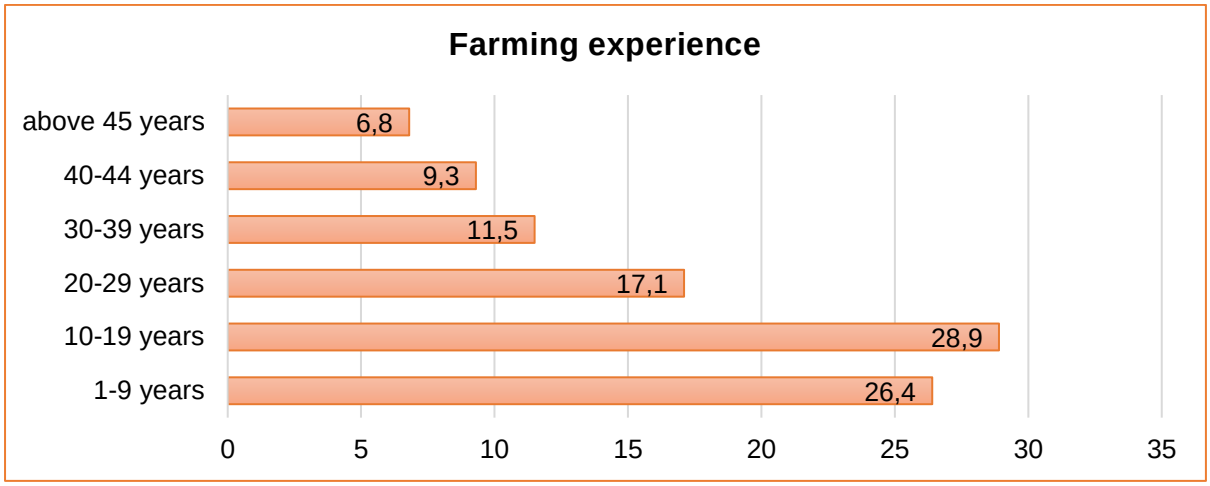

Figure 4.9: Years of farming experience of the farmers with disability

Source: Field data, 2022

The findings of this study are consistent with previous research on the relationship between farming experience and various agricultural practices. For example, a study conducted in Nigeria examined farmers' perceptions of the contribution of vegetables to livelihoods and discovered that 90% of farmers had farming experience ranging from 6 to 21 years and above (Effiong et al., 2021). Similarly, a study in Kwara State, Nigeria, assessed rice farmers' postharvest handling practices and found that only 1.7 percent had 36-40 years of farming experience, while 42.1 percent had 5-10 years of experience (Aremu et al., 2022).

The literature has also explored the relationship between farming experience and adopting agricultural technologies or practices. Other studies conclude that more farming experience increases farmers' chances of farmers adopting agricultural technology disseminated (Ofori et al., 2020). Furthermore, another research has found an inverted-U connection between adoption and farming experience, indicating that adoption rates may go high with a period experience level and then decline (Ofori et al., 2020). The level

of farming experience can affect various aspects of agricultural operations, including knowledge, skills, and decision-making. Farmers with more experience may better understand local conditions, crop management practices, and market dynamics.

They may also have devised effective ways to overcome obstacles and optimise their farming operations. However, it is crucial to emphasize that farming expertise does not ensure success or efficiency. Access to resources, knowledge, training, and support systems are essential to agricultural productivity and sustainability. For example, a study on resource usage efficiency in part-time food crop production discovered that education and years of farming experience were essential predictors of farm-level technical efficiency (Amodu et al., 2011).

Finally, the findings in Figure 4.9 demonstrate the breadth of farming experience among farmers with disabilities. According to the findings, many farmers with disabilities have years of farming expertise. However, the relationship between farming experience and other agricultural practices or outcomes might be complicated and influenced by other factors. More research is required to investigate the effects of farming experience on the livelihoods and agricultural practices of farmers with disabilities.

4.1.10 FWDs Access to Agricultural Extension Agents

The findings from the current research in Figure 4.10 indicate that among the farmers surveyed, 30% reported having access to extension agents, 68% reported not having access, and 2% were unsure. These results highlight farmers' varying access to extension services, which can affect their agricultural practices and productivity.

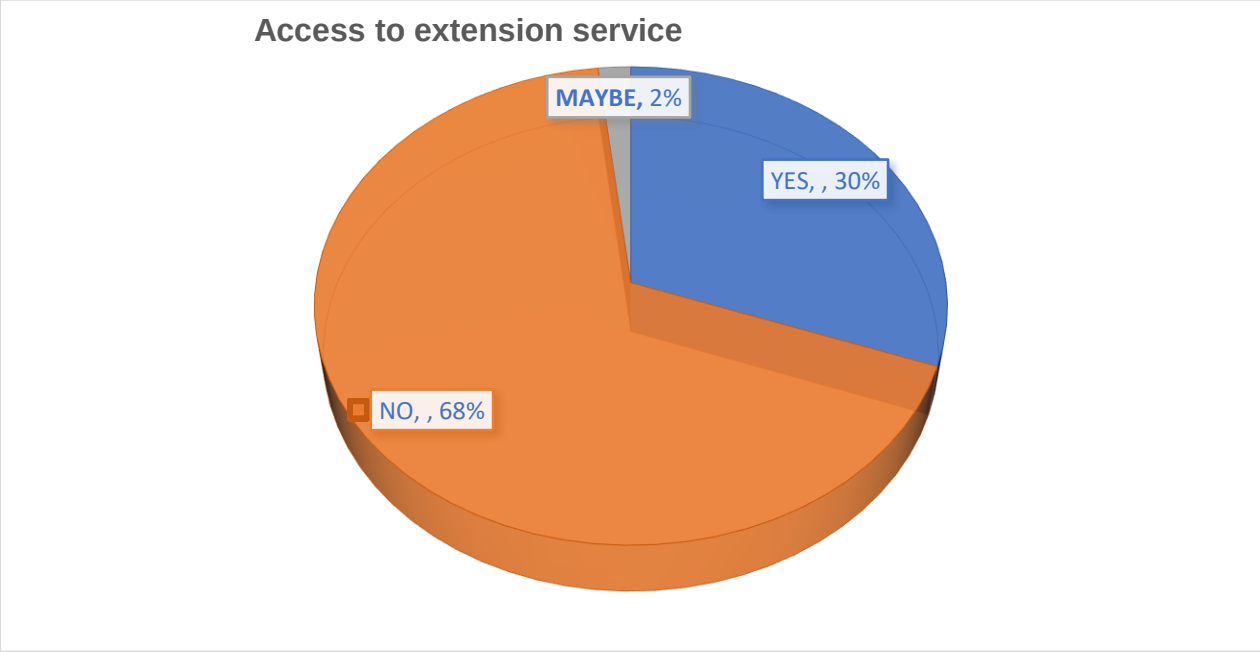

Figure 4.10: FWDs access to Extension Services

Source: Field Data, 2022

Nasrullah et al. (2022) researched the estimation of nitrogen use efficiency, profitability, and greenhouse gas emissions using different fertilization methods. Although this study does not directly address access to extension agents, it underlines fertilization's relevance in enhancing productivity. Fertilization is agricultural assistance or guidance supplied to farmers by extension agents. Deep placement (DP) fertilization was more profitable, less expensive, and more efficient than top dressing (TD) fertilization. These results show that farmers who have access to extension agents and obtain fertilization advice may be able to increase their agricultural profitability and efficiency.

Haile (2016), on the other hand, did a study on the factors influencing women farmers' engagement in agricultural extension services. The study discovered that farmer engagement with agricultural extension agents positively and significantly influenced male farmers and all respondents, but not female farmers. These results show that access to extension services may be gendered, with women farmers being neglected. This data challenges the idea that having access to extension agents can improve agricultural production for all farmers.

Buehren et al. (2017) examine the impact of extension services and draw attention to the gender disparity in access to extension agents. According to the analysis, female farmers are underserved, with much less access to extension agents than male farmers. This

finding backs up the findings of the current study, which show that a higher proportion of farmers reported not having access to extension agents and worse in the case of farmers with disabilities in this study.

Sule et al. (2021) investigated farmers' perceptions of the efficacy of information and communication technologies (ICTs) in transmitting agricultural information. The study discovered that farmers' awareness of ICTs varied depending on their socio-economic status and region. This result implies that farmers' access to extension services, including ICTs, may vary depending on their traits and geographical location.

Olajide and Meroyi (2014) investigated extension agents, and farmers' perceptions of using entertainment education (EE) for agricultural knowledge distribution. According to the study, most researchers, extension agents, and farmers were men. This data suggests that there may be gender differences in the composition of extension agents, which may affect farmers' access to extension services.

The factors influencing farmers' participation in a crop intensification program in Rwanda are discussed by Nahayo et al. (2017). According to the study, one of the main factors discouraging farmers' participation in agricultural extension programmes is a lack of trust in agricultural extension agents. This research suggests that the extent to which farmers seek out and utilize extension services is influenced by their trust in the extension agents.

Baiyegunhi (2014) investigated the factors influencing farmers' decisions to use rainwater harvesting technology (RWHT) in South Africa. Contact with extension agents was statistically crucial in explaining farmers' adoption of RWHT in the study. This result implies that farmers with access to extension agents are likelier to adopt modern technologies and techniques.

Overall, the findings from the current research align with previous studies that highlight the disparities in access to extension services among farmers, particularly for women farmers. The studies also emphasize the importance of gender, education, socio-economic characteristics, trust, and cultural affinity in influencing farmers' access to extension agents and the information and support they provide. These findings underscore the need for targeted efforts to improve access to extension services, explicitly targeting farmers with disabilities and addressing the barriers that hinder farmers' participation and engagement with extension agents.

4.1.11 Sources for FWDs Agricultural Information

According to the results in Figure 4.11, most farmers with disabilities (FWDs) do not rely on extension personnel as their primary source of agricultural information. Only 18% of FWDs seek agricultural information from extension officers. FWDs instead rely on a variety of other sources for agricultural knowledge. These sources include Community opinion leaders (12%), radio (12%), TV (15%), Disability Associations (8%), and leaflets (16 %)

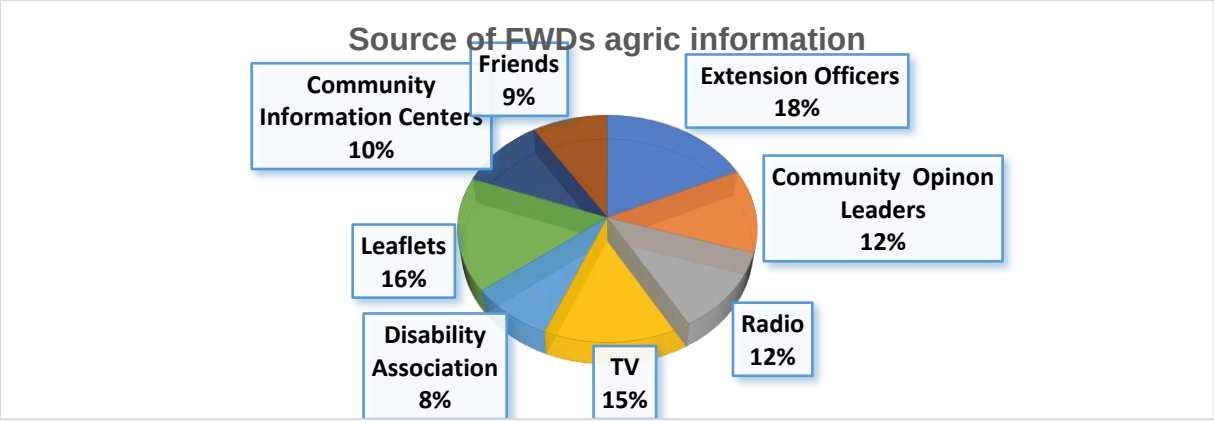

Figure 4.11: Source of FWDs Agricultural Information

Source: Filed Data, 2022

In Sri Lanka, the use of computer-based learning materials (CBLMs) in agricultural extension has been investigated. CBLMs were found to be used by extension officers to receive and transmit agricultural information, whereas farmers mostly used them to receive information (Dissanayake et al., 2010). The implication is that CBLMs can be a valuable tool for farmers, even those with disabilities, regarding agricultural knowledge. It should be noted, however, that this study concentrated on using CBLMs.

A study conducted in Nigeria on farmers with disabilities in the agricultural industry emphasized the economic and societal obstacles they confront due to their impairments (Sango et al., 2022). This study underlines the importance of conducting additional research with FWDs, particularly female farmers, to design effective disability- and gender-inclusive agricultural and entrepreneurship programmes (Sango et al., 2022). While this study does not directly address agricultural information sources for farmers with impairments, it does provide valuable insights into their experiences and challenges.

Another study, this time in Imo State, Nigeria, investigated the agricultural information sources available to farmers, including those with impairments (Opara, 2008). According to the study, agricultural extension agents were the most cited source of information, with 88.1 percent of farmers citing them as such (Opara, 2008). This research implies that agricultural extension agents, including those with disabilities, are essential in informing farmers. However, it is crucial to highlight that this study did not target farmers with disabilities, and more research is needed to investigate their specific information requirements and sources.

A comparison of agricultural knowledge and information systems (AKIS) for adopters and non-adopters of good agricultural practices (GAPs) in Turkey revealed that the primary sources of agricultural information for adopters of GAPs were district agricultural managers/personnel, advisers of farmers' union associations, and pesticide/fertilizer dealers (Abdurahman et al., 2016). This research implies that farmers who use GAPs rely on specific agricultural information sources. However, the study also emphasized improving information sources such as research institutes, universities, and cooperatives to strengthen information transmission (Abdurahman et al., 2016).

A study on the current state of agricultural information needs and accessibility for women farmers in Sri Lanka discovered that extension agents and successful women farmers were the primary sources of agricultural information for women farmers (Rathnachandra et al., 2022). This research implies that extension agents and other experienced farmers provide agricultural information to women farmers, including those with impairments. However, the survey found that ICT equipment was the least essential source of agricultural knowledge for women farmers (Rathnachandra et al., 2022). This assertion emphasizes the importance of considering the accessibility and usefulness of technology-based information sources for farmers with impairments.

In summary, recent field data on farmers with disabilities show that they do not rely much on extension officers for agricultural information. Instead, they rely on various media, including community opinion leaders, radio, television, disability organizations, and leaflets. This finding is consistent with earlier research highlighting farmers with disabilities' minimal utilization of extension officers. However, it is worth noting that using computer-based learning materials (CBLMs) in agricultural extension has shown the potential to give agricultural information to farmers of all abilities. More research is needed

to investigate the individual information demands and agricultural information sources for farmers with disabilities in various circumstances.

4.2: Socio-economic characteristics of the extension officers

A total of 60 extension officers who have contact with FWDs were sampled for the study; they were administered the 60 questionnaires, and all the questionnaires were retrieved, giving a 100% response rate, which is highly adequate for statistical inferences and analysis. However, the socio-economic variables were analyzed using descriptive statistics such as percentages, frequencies, and standard deviations. The results were presented in the form of figures and tables.

4.2.1: Gender distributions of the extension officers in the study area

Figure 4.12 shows the number of men and women who work as extension officers in the study area. The results showed that males comprised the majority of extension officers in the study, making up 87 % of the entire sample size. However, their female counterparts made up the remaining 13%.

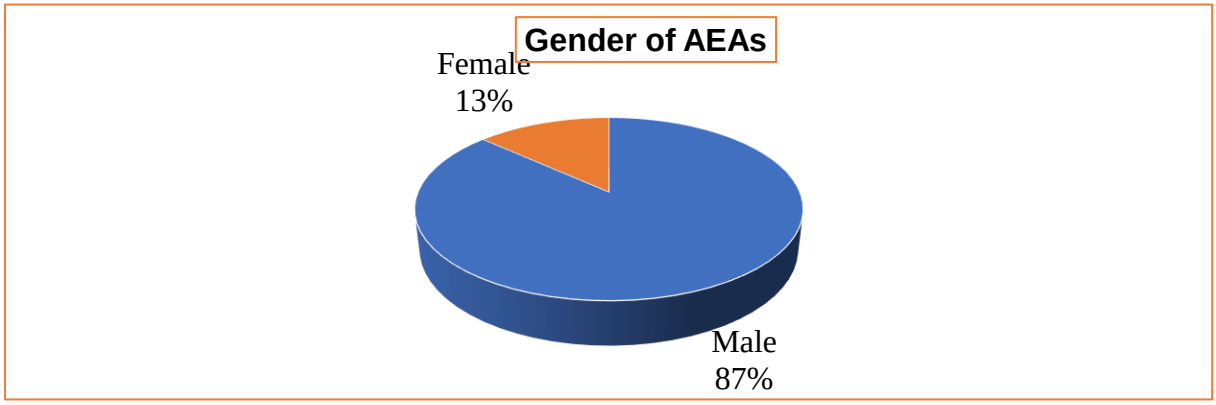

Figure 4.12: Gender of the extension officers in the study area

Source: Field data, 2022

Kigatiira and (2019). The narrative focuses on the significant gender imbalance among agricultural extension workers working with farmers with disabilities (FWDs) in the research area. Female FWDs are disproportionately underserved due to a preponderance of male extension officers, highlighting stark disparities in access to required resources and the availability of vital services. The consequences of this imbalance go beyond simple resource allocation, including the ease of access to services,

the effectiveness of support mechanisms, and the overall quality of care that these farmers receive.

Gender roles and expectations often influence extension officers' capacity to provide adequate support and guidance. Due to common gender identities, male extension officers may find it easier to empathize with the issues experienced by male farmers and give appropriate solutions. In contrast, their female colleagues may be better qualified to comprehend and solve the unique challenges that female FWDs face. Furthermore, extension officers who share farmers' gender identities are more likely to have access to gender-specific resources and information. This familiarity can significantly improve their capacity to assist farmers and establish a more trusting and understandable connection. This harmony can considerably contribute to the farmer's more successful and fulfilling farming experience.

The importance of gender imbalance in the effectiveness of extension officers dealing with people with disabilities cannot be stressed. This disparity, manifested in resources, opportunities, and power dynamics, can result in a complicated web of inequities. Extension officers' effectiveness can increase if male officers disproportionately assist male farmers and female officers assist female farmers. This assertion could result from ingrained gender norms, economic inequities, or social marginalization, all of which contribute to unequal access to resources and opportunities.

The findings of this study highlight the critical need to increase the proportion of female extension officers in the field. This strategic adjustment would enable a broader covering of FWDs' different demands. Such advancements are possible with more vital institutional support and improved access to initiatives focused on empowering female agricultural extension officers.

Finally, the findings of this study serve as a clear reminder of the importance of confronting and mitigating gender disparity in the endeavour to improve the extension services supplied to FWDs. Achieving this will ensure that these farmers, regardless of gender, have equal access to resources and opportunities, paving the way for a more inclusive agricultural landscape.

4.2.2 Age Distribution of the extension officers

Figure 4.13 shows that most extension officers are 39–48 years old, accounting for 53.3%. 30% of the officers are between the ages of 26 and 38, with the remainder between the ages of 49 and 59.

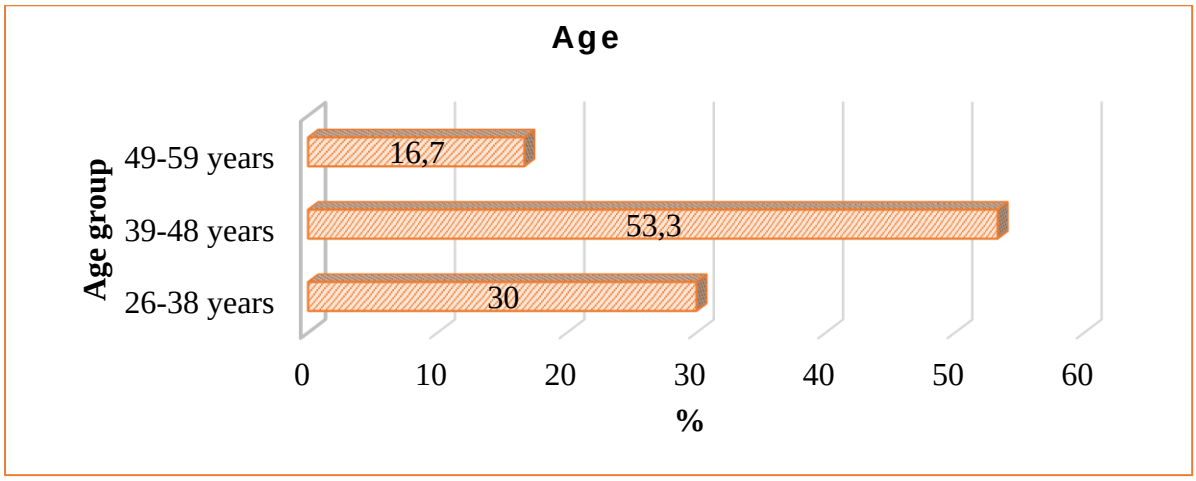

Figure 4.13: Age distribution of the extension officers

Source: Field data, 2022

The current data support the findings of Pilgeram and Amos (2015), who found that the age distribution of extension officers substantially impacted the accessibility and support provided to farmers with disabilities. The mean age of agricultural extension agents (AEAs) in this study was much higher than the national average, with most AEAs being 45 and older.

This demographic trend has far-reaching implications for how people with FWDs receive assistance. At the same time, older officers may be seasoned and skilled but unfamiliar with emerging technologies and adapted equipment designed to help FWDs. Furthermore, such officers may not have the most up-to-date resources to address the needs of farmers with disabilities, such as current research, teaching materials, and guidance approaches.

In addition to this discovery, de Carvalho's (2008) research looked into how the age distribution of extension officers can affect access to agricultural services for farmers with disabilities. According to this study's findings, the age demographics of AEAs play a significant effect in determining access to services. Because of their experience and

familiarity with the disability environment, older AEAs were likelier to provide services to farmers with disabilities. In contrast, due to inexperience and a knowledge gap, their younger counterparts were shown to be less likely to deliver the same level of service.

Surprisingly, the study discovered a favourable relationship between the age of the AEAs and the quality of services provided. Older AEAs were shown to be more likely to deliver high-quality, comprehensive services, most likely due to their significant expertise. Younger AEAs, on the other hand, were found to deliver services that were more limited and of worse quality.

AEAs, in essence, serve as a critical link in the information and support network for farmers with disabilities. As a result, employees must undergo continual, relevant training to equip them with the essential knowledge and abilities. The study discovered a higher concentration of AEAs between the ages of 39 and 48, meaning they are at the peak of their careers and are better equipped with modern tools and resources. This group of AEAs can boost the success rate of farmers with disabilities by helping them comprehend and utilize available government resources.

Farmers with disabilities can deliberately develop partnerships that will improve their agricultural outcomes and, as a result, boost their revenue by studying the demographics and capabilities of AEAs.

4.2.3: The educational level of the extension officers

The study analysed the extension officers' educational level (Figure 4.14). First-degree staff had the highest responses, which amounted to 36.7%; post-graduate staff were 26.7%; and 28.3% had diploma qualifications.

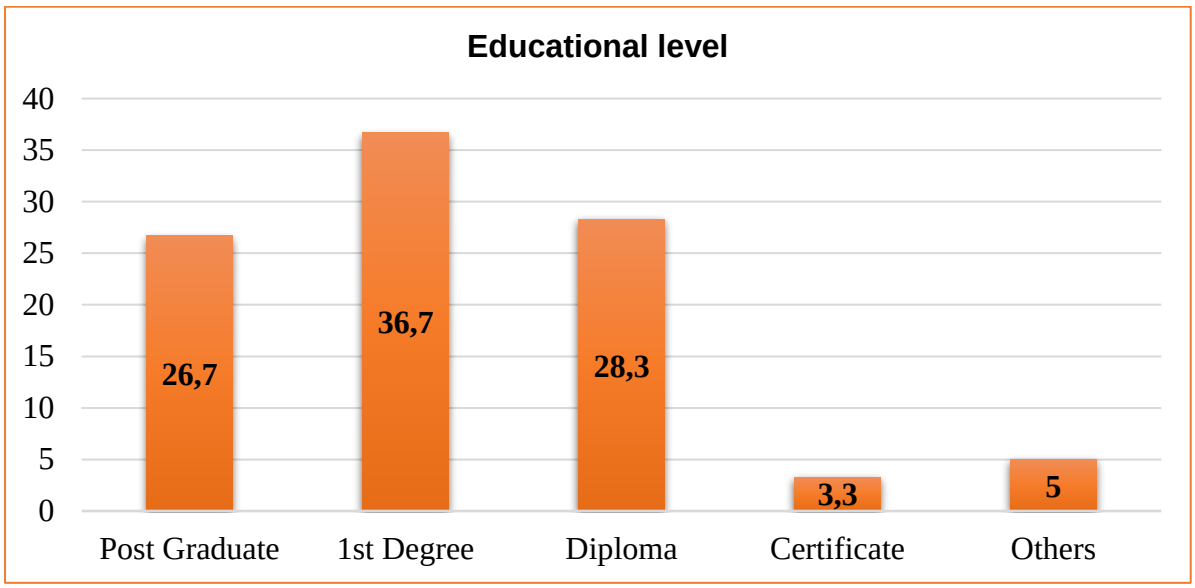

Figure 4.14: Educational level of Extension officers in the study area

Source: Field data, 2022

A careful examination of the educational background of extension officers in the study area found that, while other kinds of education and certifications are held by a minority of officers (by 5% and 3.3%), a significant number of officers with higher educational degrees exist. This frequency of highly educated officers underlines their greater capacity to absorb and apply modern technologies and advances, which is a significant advantage for FWDs in the context of this research.

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Similarly, Kinyangi (2014) found that extension officers with higher educational degrees were more effective in transmitting new knowledge and skills to farmers, facilitating the adoption of innovative technology and agricultural practices. According to Aker (2011), an extension officer's education quality is as important as the agricultural information they transmit to farmers. According to Aker's research, a lower educational background could reduce the value of the shared information, regardless of the officer's practical farming experience.

However, as extension service delivery paradigms evolve, specialised education and training for extension employees become increasingly important. The education of AEAs ensures that extension officers are prepared to address their jobs' ever-changing difficulties and expectations.

The presence of highly trained agricultural extension staff can be attributed to focused initiatives like the Sasakawa Africa Fund for Extension Education. This ambitious programme, which began in 1993 at the Department of Agricultural Economics and Extension (DAEE) at the University of Cape Coast in Ghana, has an annual enrolment objective of 25-30 students. Its primary goal is to provide agricultural officers access to world-class higher education. The impact of such measures can be seen in the present crop of extension officers, who have a noteworthy level of education and improve the quality and effectiveness of extension services accessible to farmers in the region.

4.2.4: Extension officer period of service

The results in Figure 4.15 indicate that most of the officers have been in the extension service for 11–15 years, which is 30%. However, 1–5 years and 6–10 years gain recognition as periods of service in the extension service, accounting for 18.3% and 18.3%, respectively. Irrespective of the significance of an extension officer's education level, the years or period of service cannot be undermined. As the extension agents' service period increases, experience in extension delivery is also expected to increase.

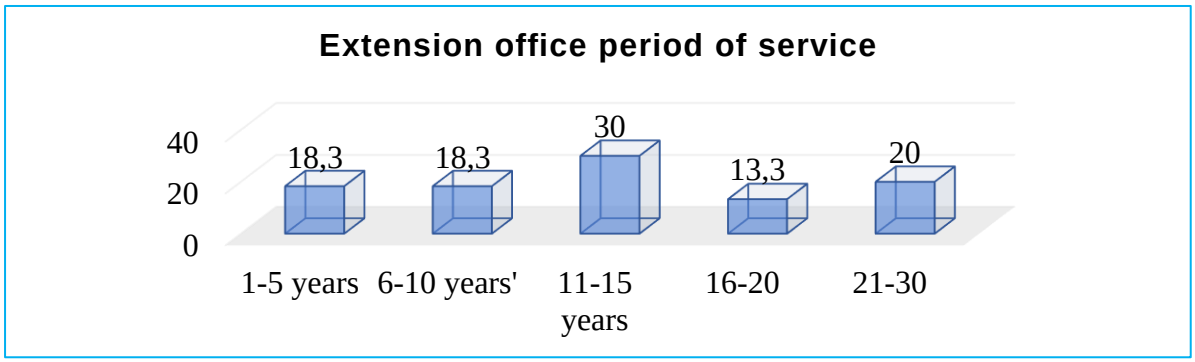


Figure 4.15: Extension Agent's period of service in the study area

Source: Field Data, 2022

The length of time agricultural extension agents work affects their job satisfaction, turnover, and the effectiveness of extension services. Jilito and Wedajo's (2021) research highlighted job satisfaction and turnover among extension agents. Job satisfaction and

retention rates are crucial for guaranteeing the continuity and efficacy of extension services, and employment terms may influence these characteristics.

Gustafson et al. (2015), who conducted a study in Tanzania on the impact of extension agents' experience on cattle disease management strategies, support this viewpoint. Their findings demonstrated that an extension agent's experience in cattle disease control influenced the execution of various disease control techniques. This study suggests that the longer an extension agent works, the more knowledge and competence they get, resulting in increased effectiveness in providing cattle disease control services.

Similarly, the study conducted by Shaffril et al. (2010) in Malaysia supports the idea that their experience influences extension agent competency in extension delivery. Their findings indicate that as an extension agent's experience increases, their competency in extension delivery improves. This assertion suggests that the years of service as an extension agent contribute to accumulating knowledge, skills, and expertise vital for providing effective extension services to farmers.

These research findings imply that the experiences accumulated by extension agents during their work are critical for providing quality extension services. The length of employment can Favor work satisfaction, retention rates, and extension delivering competency. More extended periods of employment allow extension agents to obtain practical expertise, strengthen connections with farmers, and build a better awareness of the agricultural community's difficulties and needs.

Finally, the length of employment of agricultural extension agents affects job satisfaction, turnover, and the effectiveness of extension services. According to studies, more extended periods of employment can lead to increased expertise, better service delivery, and greater efficacy in meeting farmers' demands. As a result, efforts that improve job satisfaction and encourage the retention of experienced extension agents are critical, as their accumulated knowledge and expertise play an essential role in delivering significant support to farmers.

4.2.5: Prioritising FWDs visit by extension officers

One socio-economic factor that significantly affects farmers with disabilities (FWDs) is the prioritization of their visits by extension officers. The data presented in Figure 4.16 reveals

that 53% of extension officers prioritize their visits to farmers with disabilities (FWDs), while 42% do not.

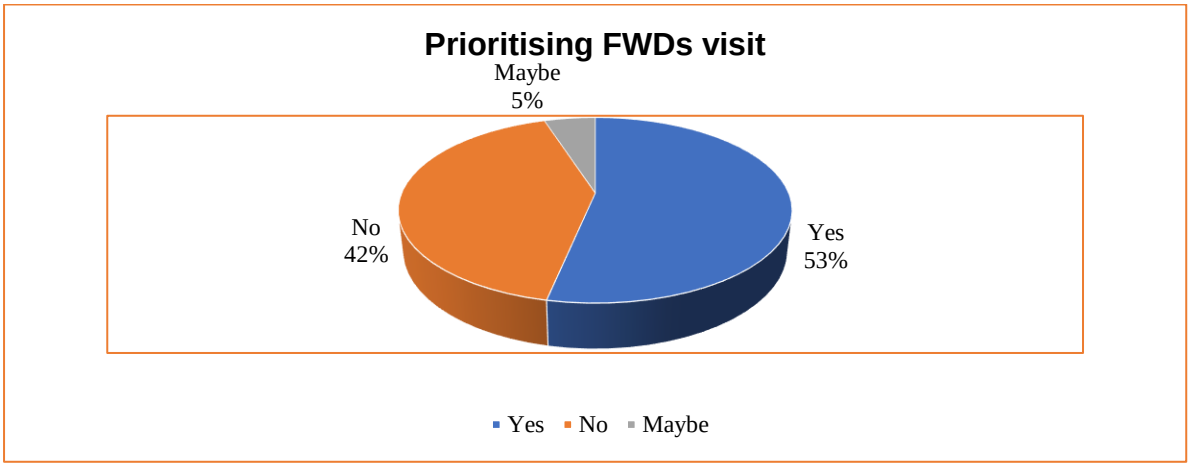


Figure 4.16: Extension officers prioritizing FWDs visit in the study area

Source: Filed Data, 2022

This finding emphasizes the significance of extension officers prioritizing visits to FWDs to ensure they receive the necessary support and services for their farming activities (Gomda et al, 2021). Similar studies in Ghana's northern region have found that FWDs from farmer groups receive more agricultural extension training and visits from extension agents, highlighting the positive impact of prioritizing FWDs (Ankrah et al., 2021). However, it is essential to note that the availability of extension services for FWDs can be influenced by various factors, including the type of disability and the presence of interpreters and farm demonstrations (Ankrah et al., 2021). Furthermore, Ghana's unbalanced extension agent-to-farmer ratio complicates the effective delivery of extension services (Ankrah et al., 2021).

The literature shows that agricultural extension services improve farm productivity and income. Danso-Abbeam et al. (2018) researched Ghana's Northern region to demonstrate the economic benefits of participating in agricultural extension programmes. They advocated for more effective extension services delivery, such as timely recruitment, training, and adequate logistics. In summary, the data in Figure 4.14 supports the importance of prioritizing visits to FWDs by extension officers.

4.2.6: Distance to visit travelled to visit FWDs

The study highlights the significant distance extension officers must travel to reach farmers with disabilities (FWDs). According to the results in Figure 4.17, FWDs frequently live in isolated or dispersed settlements, with extension officers travelling more than 6 kilometres (3.7 miles) to meet them. According to the study, 22.9 per cent of extension officers travel 1-3 miles, 20% travel 2-5 kilometres, 17.1 per cent travel 4-7 miles, and only a few officers travel 8-11 kilometres. These findings suggest a significant gap in access to agricultural extension services for FWDs due to the remote nature of their settlements, which necessitates extension officers travelling long distances to reach them.

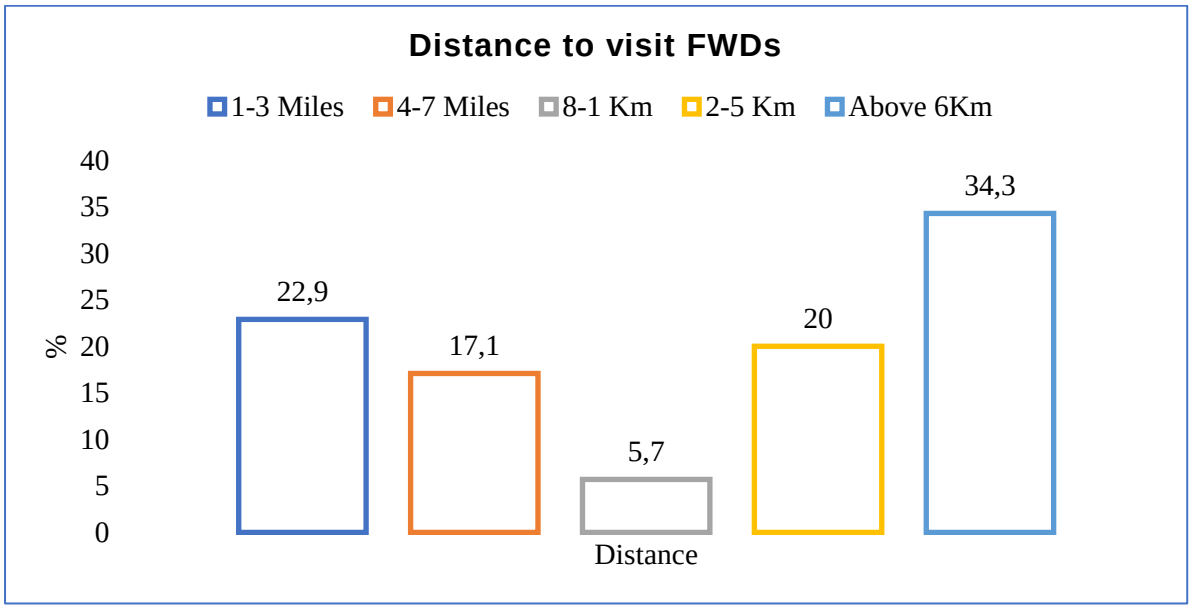


Figure 4.17: Distance to visit FWDs in the study area

Source: Field Data, 2022

According to the study, FWDs prefer to live alone, often in isolated areas near their farmlands. Their desire to live near their farmlands is motivated by a desire to reduce the distance between their homes and farms. However, this presents difficulties for extension agents in providing extension services, as the greater the distance between farmers and the central point, the more difficult it is for extension officers to assist. According to Antwi-Agyei and Stringer (2021), extension agents in Ghana face significant challenges in providing extension services due to limited transportation and financial resources. The implication is that extension agents are more likely to prioritize visits to FWDs who live

closer to the centre of their operations, potentially depriving those who live further away from extension services.

The findings highlight the need for creative solutions to the accessibility issues that FWDs face in remote or dispersed settlements. These findings could include looking into alternative methods of providing extension services, such as mobile extension units or using technology to bridge the distance gap. Furthermore, addressing extension agents' resource constraints, such as providing adequate transportation and financial support, is critical to enabling them to reach and support FWDs in more remote areas effectively.

In conclusion, the study's findings highlight the significant distance extension officers must travel to reach FWDs, indicating a gap in agricultural extension service access. The findings are consistent with previous research on the impact of isolation on farmers with disabilities and the difficulties extension agents face when reaching out to remote areas. It is critical to address these access barriers by experimenting with innovative approaches and providing the resources required to ensure that FWDs receive the assistance and services required for their farming activities.

4.3 Communication between farmers with disabilities and Extension Agents

This study examines the interaction between agricultural extension officers and farmers with disabilities. The research results show a significant disparity in communication quality opinions between extension officers and FWDs when using a Likert scale measuring "best," "better," "good," "average," "poor," and "very poor." While extension officers are overwhelmingly positive about their communication with FWDs (Figure 4.18), with only 20.7 per cent claiming it is the best and a total of 36.2 per cent claiming it is “better”, FWDs believe their communication with extension officers is abysmal, with 53.3 per cent claiming “abysmal” communication and only 0.9 per cent claiming it is the best. With such opposing viewpoints, further investigation is required to determine the precise nature of communication between these two groups.

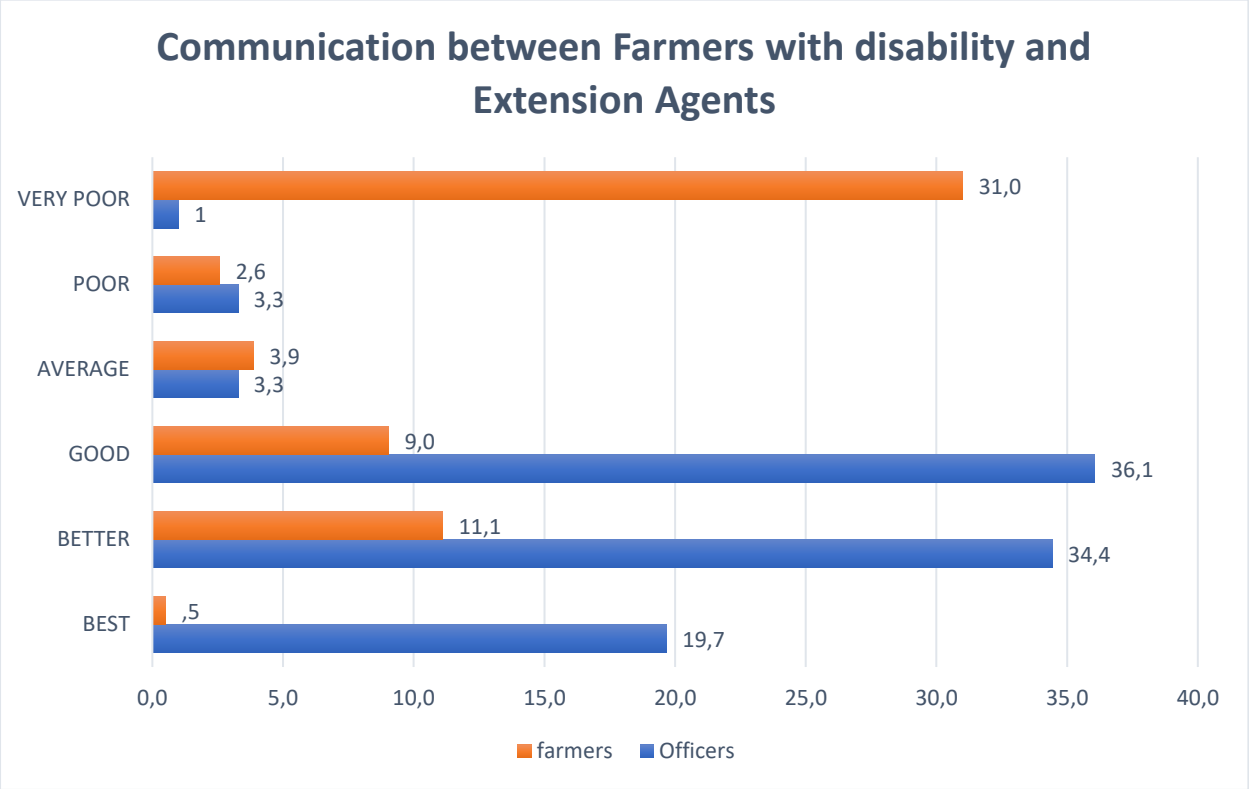


Figure 4.18: Communication between Farmers with disabilities and Agricultural Agents

Source: Field Data, 2022

Kigatiira (2019) conducted a study that revealed extension officers' limited understanding of communication needs when interacting with farmers with disabilities (FWDs). This lack of understanding impedes effective communication, resulting in FWDs' restricted access to necessary resources and services for agricultural success. Furthermore, the study found that extension officers frequently lack the knowledge and skills to effectively communicate with FWDs, leading to misunderstandings and further complicating the situation.

Maake and Antwi (2022) investigated the communication dynamics between agricultural extension officers and farmers. The findings indicated that, while communication between these two groups was generally effective, some areas needed improvement. Face-to-face meetings, phone conversations, and emails were the most effective communication strategies, while text messages and social media were less effective. This valuable information can be used to inform extension officers' communication strategies, particularly in serving the unique needs of FWDs. However, the disparities in perspectives between extension officers who claim robust communication and FWDs who report poor

communication highlight the need for additional research and improvements in communication practices.

The study's findings emphasize the importance of providing comprehensive training to extension officers to improve their understanding of FWD communication needs and ensure effective engagement. This training should include strategies for breaking down communication barriers and promoting inclusion. Furthermore, policy and legislative changes in the agricultural sector are critical to ensuring adequate support for FWDs and influential meeting of their needs.

Finally, effective communication between extension officers and farmers with disabilities is critical to their success and inclusion in the agricultural sector. The research findings emphasize the need for a deeper understanding of communication dynamics, targeted training for extension officers, and continuous improvement in communication practices. Changes in policy and legislation are also required to establish a supportive framework that addresses the specific needs of FWDs and promotes their participation and success in agriculture.

4.4: **Agricultural extension mediations that could enhance agricultural practices among farmers living with disabilities in Ghana**

The third objective of the study was to investigate agricultural extension mediations that could improve agricultural practices among farmers with disabilities in Ghana. Table 4.1 presented information on extension mediations that could help farmers with disabilities improve their agricultural practices.

The agricultural extension agents (AEAs) were asked questions using a Likert scale format, which provided a structured framework for gathering their opinions on the potential effectiveness of various mediations in improving agricultural practices among farmers with disabilities in Ghana. The AEAs were explicitly asked to indicate their level of agreement or disagreement with each of the presented mediation factors, which included home and farm visits, disability training tools and equipment, farm input supply, connecting farmers with disabilities to the market and other actors along the value chain, and farmers' field schools.

The findings revealed a strong agreement among the AEAs on the effectiveness of home and farm visits as moderators for improving agricultural practices among farmers with disabilities. A sizable proportion, 86.7 per cent, strongly agreed with this statement, while 11.7 per cent agreed and 1.7 per cent were undecided. Similarly, 74.6 per cent of AEAs strongly agreed with providing tools and equipment to facilitate training for farmers with disabilities, while 22.0 per cent agreed and 1.7 per cent were undecided.

Regarding the supply of farm inputs as a mediation factor, 72.4% of the AEAs agreed, emphasizing its potential to enhance agricultural practices among farmers with disabilities. Furthermore, 60.3% of the AEAs recognized the importance of linking farmers with disabilities to the market and other actors along the value chain, indicating its positive impact on their agricultural practices.

Surprisingly, opinions on using farmers' field schools as a moderator in improving agricultural practices among farmers with disabilities were divided. Only 29.1 per cent of the AEAs agreed with the idea, while 34.5 per cent agreed and 29.1 per cent were unsure about its effectiveness.

In summary, the findings in Table 4.1 show that AEAs agree on the potential of home and farm visits, provision of tools and equipment, supply of farm inputs, and connecting farmers with disabilities to market and value chain actors as effective mediations to improve agricultural practices among farmers with disabilities in Ghana. However, there is less agreement and uncertainty about using farmers' field schools as mediators. These findings provide important insights into the extension mediations that could be prioritized to improve agricultural practices for Ghanaian farmers with disabilities.

Table 4.1: Agricultural extension mediations that could Enhance Agricultural practices among farmers living with disabilities in Ghana.

Agricultural extension mediations	SA	A	N	D	SD
Home and farm visit	86.7	11.7	1.7	0	0
Farmers field school	29.1	34.5	29.1	7.3	0
Linking FWDs to the Market and other actors along the value chain	60.3	36.2	1.7	1.7	0
Supply of farm input, i.e. PFJ, PERD, RFERD	72.4	24.1	3.4	0	0
Field days participation	42.6	40.7	14.8	1.9	0
Provision of tools and equipment to facilitate Farmers with disability activities	74.6	22	1.7	1.7	0
Provision of particular extension education programmes for farmers with disability	45.8	39	13.6	1.7	0
Formation of rural agricultural cooperatives, associations or groups of farmers with disability	50	27.6	20.7	1.7	0
inclusivity of FWDs into programs	58.6	31	10	0	0

SA=Strongly Agree, A=Agree, N=Neutral, D=Disagree, SD=Strongly Disagree

Source: Field Data, 2022

Extension mediations are an essential social intervention in Ghana that promotes agricultural development and increases the employability of people with disabilities. Individuals, households, and communities are provided with the information, skills, and resources they need to make informed economic and social development decisions through these mediations. Extension mediations are used in agricultural practices among farmers with disabilities to assess the current state of agricultural practices and identify areas for improvement. These mediations could include introducing modern technologies, improving access to resources, and offering training and assistance to farmers with disabilities.

Extension mediations can significantly increase the productivity, income, and overall well-being of farmers with disabilities by providing the necessary support and resources. For example, by providing farmers with disabilities with tools and equipment, they can overcome physical limitations and adopt more efficient farming techniques, resulting in higher yields and incomes. Furthermore, farm inputs such as seeds, fertilisers, and pesticides can help to improve agricultural practices and increase productivity. Connecting farmers with disabilities to the market and other value chain actors can open

up economic growth and market access opportunities, ensuring their agricultural produce reaches appropriate markets and fetches fair prices.

The study's AEA responses confirm the efficacy of certain medications in improving agricultural practices among farmers with disabilities. Home and farm visits emerge as the most strongly supported mediation factor, emphasizing the importance of personalised support and guidance provided directly at farmers' homes and farms by extension officers. The provision of tools and equipment also receives much attention, emphasizing the importance of having the right resources to help farmers with disabilities. Similarly, to improve agricultural practices, the supply of farm inputs and the connection of farmers with disabilities to market and value chain actors receive significant support.

It is worth noting, however, that support for farmers' field schools as a mediation factor is relatively low. The implication is that additional research and considerations are required to assess the effectiveness and feasibility of this specific approach in improving agricultural practices among farmers with disabilities. To ensure its success, it may necessitate tailored implementation strategies and the involvement of relevant stakeholders.

Furthermore, the study emphasises the importance of addressing discrimination and increasing the acceptance of farmers with disabilities in agricultural activities. Overcoming societal prejudices and encouraging inclusive practices are critical for farmers with disabilities to advance in agriculture. Strategies for eliminating discrimination, creating supportive environments, and increasing the participation and integration of farmers with disabilities in the agricultural sector should be developed.

Finally, extension mediation can potentially improve agricultural practices among farmers with disabilities in Ghana. Home and farm visits, provision of tools and equipment, supply of farm inputs, and linkage to the market and value chain, among other identified mediation factors, promise to improve agricultural productivity, income, and overall well-being. However, additional research, implementation strategies, and anti-discrimination efforts are required to fully leverage the benefits of extension mediations and ensure the successful inclusion and empowerment of farmers with disabilities in the agricultural sector.

4.5 Challenges to accessing agricultural extension services by farmers with disabilities and the impact of agricultural extension practices on their farm income.

The second objective was to identify the barriers that farmers with disabilities face in accessing agricultural extension and to assess the socio-economic determinants and impact of agricultural extension contacts on farm income. The findings on the challenges farmers with disabilities face in accessing agricultural extension services are summarised in Table 4.2 using Kendall's coefficient of concordance.

Approximately 16% general agreement between the responses indicates that the farmers' results are strongly related. Kendall's coefficient of concordance typically ranges from 0 to 1. Several challenges are presented to the farmers in the study area to determine their stance on the difficulties they face accessing agricultural extension services as farmers with disabilities and the impact of agricultural extension practices on their farm income. With a score of 5.58 on a scale of 6, discrimination was ranked first as the most challenging factor impeding FWDs' access to extension services. Farmers with disabilities face workplace discrimination due to their marginalized status, and the belief that disabilities make people less productive (Nord, 2007) has resulted in several extension officers ignoring them in their activities. Of awareness or understanding of the needs and rights of people with disabilities, by extension, officers induce discrimination against FWDs (Chibaya et al., 2021).

These barriers can limit farmers' ability to access and benefit from extension services, affecting their participation and success in agriculture. Farmers reported feeling inferior in the presence of other farmers and being concerned that their opinions would not be taken seriously, making it difficult for them to access extension services, earning a rating of 5.39 and placing it second overall. The absence of programming and planning by agricultural workers and local assemblies for FWDs received a 4.55 average score as the third identified challenge. Another barrier to accessing agricultural extension services for people with disabilities was the design and accessibility of buildings, which made it difficult for them to go to public places. With an average score of 4.44, this was the fourth most challenging factor.

Farmers also reported that ineffective communication made accessing agricultural extension services difficult, evidenced by a 4.42 average score and fifth-place ranking. With an average score of 4.11 and a sixth-place ranking, the farmers also stated that a

lack of braille documents for providing agricultural information to the visually impaired was a significant challenge. With a score of 4.02, the agricultural extension staff's lack of equipment to train FWDS was ranked seventh. Finally, the lack of skilled agricultural employees to interpret sign language for the hearing impaired was challenging, ranking 8th with a 3.49 average score.

Table 4.2: Challenges to accessing agricultural extension services by farmers with disabilities, as well as the impact of agricultural extension practices on their farm income

Challenges to accessing extension services	N	Mean	SD	Min	Max	Rank
lack of training equipment for training Farmers with Disabilities	236	4.02	0.564	1	3	7th
Ineffective communication	236	4.42	0.578	1	3	5th
Building designs and accessibility	236	4.44	0.674	1	3	4th
Discrimination	236	5.58	0.866	1	3	1st
Inferiority	236	5.39	0.806	1	3	2nd
Lack of programs for FWDs	236	4.55	0.649	1	3	3rd
Sign language interpreters	236	3.49	0.504	1	3	8th
Braille documents for educated virtually impaired	236	4.11	0.63	1	5	6th
Kendall's Wa	0.158					
Chi-Square	261.6					
Df	7					
Asymp. Sig.	0					

Source: Field Data, 2022

Surprisingly, this is the most significant barrier most FWDs face in accessing extension services, yet it is the least addressed issue. Such flaws are almost certainly present in small-scale farmers with disabilities. Gomda (2018) found that extension service delivery to farmers with disabilities remains a significant challenge for their farming activities in the Savelugu-Nanton Municipality. According to Gomda (2018), the primary source of these difficulties is embedded in societal norms and cultural attitudes toward people with disabilities. At all resource access and use levels, these societal and cultural norms prejudice and discriminate against farmers with disabilities.

Because of this discrimination, FWDs have low self-esteem (an inferiority complex) and, in most cases, move to remote areas, making extension access and delivery difficult. Furthermore, Hoffmann, et al (2017) discovered in Nepal that the significant barrier to

accessing extension services for people with disabilities is that extension agents freely offer extension services to non-FWDS; this assertion makes FWDs unwilling to use and participate in most extension service activities. Furthermore, Agole et al. (2021) reported that FWDs were more likely to be excluded from extension activities due to societal discrimination and the difficulty extension has communicating with FWDs.

4.6 The factors associated with the challenges of the FWD were analysed using the Pearson correlation model

The results of the Correlation analyses of factors associated with the six essential challenges of the FWD in the study area are presented in Table 4.3 below. The challenges include Poor Building designs, Discrimination, Inferiority complex, Special training for Extension agents, Sign language interpretation and Braille documents for the virtually impaired.

Table 4.3 Results of the Correlation analyses of factors associated with the challenges of the FWD in the study area.

	Age	Gender	Type of Disability	Source of Disability	Household Head	No. of Household Dependents	FBO Membership	Non-farm Activity	Experience in Farming	Land Size of Grains	Income on Grains/ Cereals	Land Size Vegetables	Income on Vegetables	Access to Training	Distance Travelled by AEA	Access to Extension Service
Building Design	-0.038	-0.005	0.11	.325**	-0.055	.198**	.285**	-0.023	.167**	-.138*	0.056	-.236*	-0.028	-.169**	-0.048	0.078
Sig. (2-tailed)	0.533	0.93	0.069	0.000	0.37	0.006	0.000	0.715	0.006	0.03	0.382	0.025	0.795	0.005	0.647	0.197
N	273	273	273	271	271	195	265	261	269	247	243	90	88	273	93	273
Discrimination	0.063	.166**	-0.018	.318**	.228**	.545**	.275**	-0.078	.481**	-.580**	.418**	-.432**	.250*	-.497**	-.247*	.406**
Sig. (2-tailed)	0.258	0.003	0.749	0.000	0.000	0.000	0.000	0.17	0.000	0.000	0.000	0.000	0.017	0.000	0.011	0.000
N	323	323	323	321	319	197	309	307	291	251	249	93	91	321	104	321
Inferiority	-0.043	.152**	-0.077	.305**	.121*	.454**	.265**	-.157**	.339**	-.500**	.258**	-.414**	.312**	-.552**	-.383**	.513**
Sig. (2-tailed)	0.458	0.008	0.183	0.000	0.037	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000
N	301	301	301	299	297	186	289	287	273	238	235	86	84	299	92	297
Special Training	0.081	-0.07	-.208**	.281**	.118*	.407**	.134*	-0.108	.298**	-.487**	.287**	-.299**	.392**	-.240**	-0.15	.213**
Sig. (2-tailed)	0.176	0.238	0.000	0.000	0.047	0.000	0.028	0.077	0.000	0.000	0.000	0.004	0.000	0.000	0.124	0.000
N	283	283	283	281	281	198	271	269	277	246	245	92	90	283	107	281
Sign Language	-0.016	0.02	-0.116	0.079	0.038	0.039	0.001	0.068	0.103	-.171**	0.072	0.142	-0.107	0.071	0.011	-0.104
Sig. (2-tailed)	0.8	0.745	0.059	0.199	0.541	0.595	0.989	0.281	0.097	0.008	0.268	0.186	0.327	0.25	0.92	0.09
N	267	267	267	265	265	189	257	255	263	241	238	88	86	267	87	265
Braille	.244**	.199**	-0.008	.351**	.224**	.454**	.207**	-.327**	.487**	-.714**	.355**	-.359**	.269*	-.319**	-.227*	.321**
Sig. (2-tailed)	0.000	0.001	0.9	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.014	0.000	0.039	0.000
N	268	268	268	266	266	185	258	256	257	240	240	85	83	268	83	266

Source: Field Data 2022

4.6.1 Correlation between the Age of Farmers with Disabilities and Their Agricultural Challenges

The study results indicate a strong positive correlation between age and the challenge of accessing Braille documents (r = 0.244, p 0.001). The positive relation implies that the challenges related to braille documents with disabilities tend to increase with age. This research shows that older Farmers with Disabilities may face more challenges of not having braille documents in agriculture than younger Farmers with Disabilities.

This finding is consistent with prior research demonstrating that age might be a key factor determining the difficulties people with disabilities have when accessing Braille documents. The positive correlation found in this study suggests that older farmers with disabilities may have more difficulty accessing agricultural Braille documents than their younger counterparts.

The study's findings shed light on the unique problems that older farmers with disabilities encounter when accessing Braille materials in the agricultural context. These difficulties may include educational levels, diminished visual acuity, and cognitive changes associated with ageing, all of which might impair their ability to access Braille documents.

Lang et al. (2020) evaluated the reading fluency of German-speaking pupils and young people with visual impairments. They discovered that reading fluency decreased with age, as seen by growing gaps between the study and norming samples as age grew. The study did underline, however, that early introduction to Braille and persistent practice could help reduce this decrease and maintain reading fluency.

Given these findings, it is critical to address the specific problems that older farmers with disabilities have when attempting to read Braille materials in agriculture. Strategies for improving accessibility could include providing Braille documents in larger font sizes, using tactile visuals and diagrams, making user-friendly Braille reading devices, and giving training programmes for older farmers to enhance their Braille skills.

Furthermore, it is critical to note that the difficulties connected with accessing Braille materials may go beyond age-related problems. Other factors, such as the type and degree of disability, educational background, and access to assistive technologies, can all impact the problems that farmers with disabilities have in properly using Braille materials.

Finally, this study adds to the current literature by emphasizing the strong positive correlation between age and the challenges faced by people with disabilities in accessing agricultural Braille materials. Stakeholders in the agricultural sector can implement targeted strategies to improve accessibility and ensure that older farmers with disabilities can fully participate and benefit from agricultural information provided in Braille text, if available, for reading fluency by understanding and addressing these challenges.

4.6.2 Correlation between the Gender of Farmers with Disabilities and Their Agricultural Challenges

These findings provide valuable insights into the complex dynamics at work by correlating gender and various agricultural challenges faced by farmers with disabilities. Although the correlation values are not strong, they are statistically significant, indicating that gender influences these farmers' challenges.

Regarding discrimination, the correlation value of 0.166, significant at the 0.01 level ($p=0.003$), indicates a weak but substantial association. Even though the correlation is not strong, it is statistically significant, showing that discrimination can be experienced differently by men and women. This conclusion is consistent with the more extensive sociological literature, which frequently documented varied discrimination experiences depending on gender in various fields.

Regarding sentiments of inferiority, the data reveals a minor link with a correlation of 0.152 and a p-value of 0.008. These results could be due to gender-specific societal standards or expectations, which can cause sentiments of inferiority to differ between genders. The results highlight the importance of gender-sensitive programmes that address farmers' unique emotional and psychological needs with disabilities while cultivating an environment of empowerment and equal merit.

Regarding braille document availability, the correlation of 0.199 with a p-value of 0.001 indicates a meaningful, albeit weak, link between gender and access to braille resources. While braille documents are essential for visually impaired farmers, the disparity in availability based on gender may be due to broader cultural biases or differential access to educational resources for women and men with visual impairments.

Several studies in the field show how gender discrimination, feelings of inferiority, and the availability of resources like braille papers affect the experiences of farmers, particularly those with disabilities. The current findings of this analysis are consistent with and extend these studies.

Sadiq et al. (2021) discovered that gender discrimination affects women rice farmers' risk attitudes in North-central Nigeria, notably through limited access to productive resources and specific socio-cultural barriers. These gender-related restrictions are consistent with our findings, which show a correlation between gender and felt discrimination among farmers with impairments.

Furthermore, research has shown that female farmers have higher levels of psychological discomfort than their male counterparts (Jones-Bitton et al., 2019), possibly due to a sense of inferiority. This psychological aspect is consistent with our finding of a weak but significant correlation between gender and feelings of inferiority among farmers with difficulties.

Climate change is another intersecting factor that has a gender-differentiated impact on farmers. As Rakgase and Norris (2015) highlight, a farmer's gender can influence their awareness of and responses to climate change. Though not a direct comparison, this finding reiterates the role of gender in experiencing agricultural challenges, resonating with the trends identified in our data.

Finally, regarding the accessibility of braille documents for blind and visually impaired people, research has investigated the issues of presenting information in a format appropriate for their needs (Hu et al., 2015; Liu et al., 2010). This element is directly related to this discovery of a slight correlation between gender and the availability of braille papers among farmers with impairments, demonstrating gender disparities in access to required resources.

Overall, the research and analysis presented highlight the critical role that gender plays in shaping the challenges faced by farmers, including those with disabilities. While weak, the correlations in this data highlight the importance of considering gender when assessing these challenges.

4.6.3 Correlation between the type of disability of Farmers with Disabilities and their Agricultural Challenges

The Pearson Correlation Coefficient (r) between Farmers with Disabilities disability and their Agricultural Challenges, specifically the need for special training, is -0.208. This negative number implies that the variables have an inverse correlation. In other words, the ability to adapt without specific training decreases as the severity or complexity of the condition grows. On the other hand, the correlation value of -0.208 is relatively poor, indicating that the relationship between the variables is not very strong.

At all typical threshold levels, such as 0.01, 0.05, or 0.10, the p-value of 0.000 is significant. This low p-value implies that the significant relationship did not happen by chance, giving credibility to the possibility of an actual relationship between the type of disability and the need for specific training.

This analysis implies that increasing the availability of special training is necessary to solve the agricultural issues faced by farmers with disabilities. Such training can empower these farmers by providing them with the skills to adapt to their circumstances and fulfil their farming obligations.

The negative correlation here could be related to the fact that types of disabilities make it more difficult for farmers without particular training to adapt to agricultural jobs. For example, farmers with significant mobility impairments may require more specialised tools or equipment requiring special training. Those with less severe or more common disabilities, on the other hand, may already have more widely available tools and strategies to alleviate their issues, decreasing the need for specialised training.

Overall, this analysis emphasises the need to identify the unique requirements of farmers with disabilities and offer personalised tools and training to assist them in navigating their agricultural challenges. It also emphasises the significance of ongoing research and policy activities to foster a more equitable and accessible agricultural economy.

4.6.4 Correlation between the source of disability of Farmers with Disabilities and their Agricultural Challenges

The correlation coefficient (r) between the source of disability and poor building design is 0.325, with p=0.000 indicating statistical significance. These results reveal a moderately positive link, implying that farmers with specific disabilities may find poorly planned buildings more difficult than others. It means that accessibility may be a more pressing issue for people with specific disabilities, underlining the importance of adaptable infrastructure.

The significant correlation with inadequate building design shows a critical need for adaptive infrastructure that responds to the different demands of FwDs, ensuring that they may attend training programmes, gain quick access to state institutions, and efficiently navigate their work environment.

The connection between the cause of disability and discrimination was found to be 0.318, with p=0.000 indicating significance. This somewhat positive correlation suggests that specific causes of disability may be stigmatised more than others, resulting in increased discrimination levels. This discrimination could be because of cultural attitudes and prejudices about specific disabilities.

The correlations found in this study show that the cause of impairment significantly impacts the agricultural issues experienced by people with disabilities. While all of the correlations are moderate, they highlight the varied nature of the issues and the significance of identifying the underlying causes of impairment to give appropriate intervention.

There is a moderate positive relation between the cause of disability and sentiments of inferiority, with a correlation coefficient of affected at a significance level of p=0.000. The result shows that farmers with disabilities from specific sources may face increased feelings of inferiority, maybe due to cultural attitudes or the problems associated with their disability.

Discrimination and sentiments of inferiority are more psychological, pointing to deeper societal problems. Addressing these problems will necessitate community sensitization and actions to boost FWDs' self-confidence.

The correlation coefficient between the source of disability and the need for special training is 0.281, with p=0.000 indicating significance. This positive relationship suggests that some disorders may necessitate more specialised training, emphasizing the importance of individualised treatments in agricultural operations.

The requirement for specialist training and braille papers emphasises the significance of accessibility and inclusivity in agricultural practices. Personalized interventions, training, and resources can help every FWDs capitalise on their strengths while mitigating obstacles.

With an R-value of 0.351 and a p-value of 0.000, the strongest correlation was found between the source of disability and the availability of braille texts. This result demonstrates that certain types of disabilities may be closely related to visual impairments, emphasizing the importance of accessible material.

Finally, this study provides important insights into the relationship between the source of disability and the agricultural issues faced by people with disabilities. It underlines the significance of addressing these issues holistically, considering both disabilities' physical and psychological components. To design more tailored solutions, future research should go deeper into understanding the individual sources of disabilities and their distinct constraints.

4.6.5 Correlation between the household headship of Farmers with Disabilities and their Agricultural Challenges

Discrimination: A correlation coefficient (r) of 0.228 indicates a moderately positive connection between the household headship of farmers with disabilities and the discrimination they suffer in their agricultural activities. The p-value of 0.000 implies that the possibility of these results occurring by chance is essentially nil, confirming that the association is statistically significant. It implies that if the number of farmers with disabilities leading households grows, the discrimination they confront in the agricultural context will also increase.

Inferiority: The correlation coefficient (r) of 0.121 indicates a weak positive relationship between the family headship of FWDs and emotions of inferiority. The p-value of 0.037 is smaller than 0.05, showing that this connection is statistically significant, albeit weaker

than the discrimination correlation. It shows that feelings of inferiority may increase as more FWDs head households.

The absence of braille documents: The correlation coefficient of 0.224 indicates a moderately positive association between the household headship of farmers with disabilities and the absence of braille documents. This correlation, like the one with discrimination, is statistically significant with a p-value of 0.000. It suggests that as more farmers with disabilities become household heads, the lack of braille documentation in agricultural activities becomes more significant.

4.6.6 Correlation between the Number of Household Dependents of Farmers with Disabilities and their Agricultural Challenges

The correlation between the number of household dependents of farmers with disabilities and their agricultural issues is an intriguing area for research. Poor architectural designs, discrimination, inferiority, a lack of particular training, and a lack of braille documentation are among the issues raised.

Discrimination (r=0.545, p=0.00) suggests that as the number of dependents in the families of farmers with disabilities grows, so does the degree of discrimination suffered by these farmers in their agricultural activities. It could be attributed to a variety of factors. Farmers with more dependents, for example, may be more prominent in their communities and, hence, more vulnerable to discrimination. Alternatively, they may be required to deal with agricultural services or organizations more frequently, increasing their exposure to potential discrimination.

The positive correlation between the number of dependents and the feeling of inferiority ($r = 0.454$, $p = 0.000$), on the other hand, implies that as the number of dependents in the household increases, so does the feeling of inferiority among farmers with disabilities. Sango et al. (2022) discuss the social problems these farmers confront, which may lead to feelings of inferiority, but they do not expressly link this to household size.

The positive correlation ($r = 0.407$, $p = 0.000$) between the number of household dependents and the requirement for special training may indicate the growing demands and pressures that come with bigger household sizes, demanding more specialised skills

to provide for the family adequately. However, Agole et al. (2021) emphasize the necessity for particular training but not concerning household size.

The demand for braille papers is also strongly related to the number of dependents (r = 0.454, p = 0.000). This result could imply that larger families may have more visually impaired people who require braille materials.

Finally, the relationship between the number of family dependents of farmers with impairments and evil building designs is intriguing. The positive correlation (r = 0.196, p = 0.000) indicates that as the number of dependents in a home grows, so does the difficulty of lousy building design.

Poor building design may impair farmers' capacity to carry out their agricultural obligations properly. This issue could be because of inaccessible designs that do not accommodate the farmer's disability or a lack of necessary adjustments to support their farming operations and increased household size.

In conclusion, the available evidence supports the correlation between the number of family dependents and the agricultural challenges faced by farmers with disabilities.

4.6.7 Correlation between the Farmers-Based Organization (FBO) Membership of Farmers with Disabilities and Their Agricultural Challenges

The analysis revealed a significant positive correlation between FBO membership and poor building designs (r=0.285, p=0.000), implying that as FBO membership among farmers with disabilities increases, so will the challenges associated with poor building designs. Poor building designs may suggest more than just architectural flaws; they may also show a systemic indifference or ignorance of the requirements of farmers with disabilities. As a result, inclusive and accessible built environments are critical for agricultural production success (World Bank, 2019).

Another significant positive correlation was found between FBO membership and reported discrimination (r=0.275, p=0.000) and sentiments of inferiority (r=0.265, p=0.000), indicating that more FBO membership increases these concerns.

The discriminatory findings are consistent with a larger body of studies demonstrating that societal prejudices and assumptions about disability can cause discrimination and inequity (Habtamu & Abebaw, 2016). This discrimination may make it difficult for farmers with disabilities to access possibilities within FBOs, aggravating their agricultural difficulties. In the same way, emotions of inferiority may be a psychological mirror of systemic prejudice. Alternatively, separate FBOs with only FWD memberships should be created to mitigate discrimination and inferiority in the FBO groups.

A weaker, statistically significant positive correlation was discovered between FBO membership and a lack of special training ($r=0.134$, $p=0.000$), implying that the lack of extraordinary training increases as FBO membership increases.

The lack of a strong correlation between FBO membership and special training suggests that farmers with disabilities may be underserved by capacity-building initiatives, even if they are FBO members. It highlights the importance of developing targeted training strategies to increase the participation and empowerment of farmers with disabilities (Bruijn et al., 2013).

Lastly, there was a strong positive correlation between FBO membership and a lack of braille papers ($r=0.207$, $p=0.001$), implying that as FBO participation increases, farmers with disabilities will have more difficulty acquiring braille materials.

The substantial difficulty of a shortage of braille papers implies that visually impaired farmers cannot access critical agricultural information. It underscores the critical necessity to enable information accessibility in inclusive formats such as braille, audio, and simplified language to meet the different requirements of farmers with disabilities (UNESCO, 2009).

In conclusion, while the research provides strong evidence suggesting a relation between FBO membership and agricultural challenges faced by farmers with disabilities, it is critical to interpret these correlations in the context of systemic discrimination, exclusion, and inequalities faced by farmers with disabilities.

4.6.8 Correlation between Non-farm activity(income) of Farmers with Disabilities and Their Agricultural Challenges.

When the relationship between non-farm activity and agricultural issues faced by farmers with disabilities is examined, it becomes clear that sentiments of inferiority and the lack of accessible braille documents significantly impact their non-farm activity and revenue.

Feelings of inferiority, which may result from cultural attitudes, self-perception owing to disabilities, or experiences of discrimination, had a slight negative correlation with non-farm income of -0.157 (significance level p=0.008). It suggests that when these sensations deepen, there is a minimal but evident decrease in non-farm activities. It implies that when farmers with disabilities deal with this emotional strain, they may engage in fewer non-farm activities, reducing their overall income from these activities.

On the other hand, the absence of braille documents for visually impaired farmers has a moderate negative connection with non-farm activity of -0.327 (significance level p=0.000). Farmers who do not have access to critical information in a usable format are disadvantaged when engaging effectively in non-farm activities or pursuing options for income diversification. This restriction has a more significant impact on their non-farm incomes.

Addressing these agricultural difficulties could result in an increase in non-farm revenue for farmers with disabilities. Actions such as fostering inclusivity, running awareness campaigns to minimise social discrimination, giving psychological support, and making agricultural and entrepreneurial information available in accessible formats such as braille could improve these farmers' financial situation. This accomplishment would help individual farmers and contribute to community development and poverty reduction efforts.

However, it is essential to remember that numerous factors might influence non-farm activity. Income can also be affected by factors such as education level, loan availability, and farm size. As a result, more extensive research may be required to fully understand these complicated linkages and develop the most effective solutions to improve the livelihoods of farmers with disabilities.

4.6.9 Correlation between the experiences in the farming of Farmers with Disabilities and their Agricultural Challenges

The correlation between farming experience and the numerous problems faced by farmers with disabilities provides a fundamental insight into their lived experiences. Poor building designs positively correlated with farming experience (r=0.167, p=0.006). This positive connection could be read as a signal that if farmers with disabilities continue to farm over time, they are likely to encounter more challenges related to poor building designs, which are not accessible to them in their quest to seek information on agriculture.

Discrimination positively correlated with agricultural experience (r=0.481, p=0.000). This result could suggest that as farming experience increases, so does the level of discrimination these farmers face. This result is consistent with Agole et al. (2021), who found that farmers with impairments encounter ongoing and possibly rising discrimination as they continue to farm. One possible explanation is that farmers with disabilities have ingrained cultural biases that do not necessarily lessen with improved skill and confidence. The correlation suggests that, regardless of years of experience, farmers with disabilities face ongoing discrimination, highlighting the critical need for programmes that address discriminatory attitudes and behaviours in the farming sector.

Feelings of inferiority (r=0.339, p=0.000) and a lack of specialised expertise (r=0.298, p=0.000) also correlated positively with farming experience. This result demonstrates that as the number of years of farming experience increases, so do the difficulties. As mentioned by Agole et al. (2021) the persistence of feelings of inferiority worsens over years of experience and could indicate deeply rooted societal norms (2021). Furthermore, the significant correlation between a lack of special training and farming experience shows that training possibilities for farmers with disabilities may not improve over time, limiting their ability to adopt new farming practices and technology.

Lastly, a significant positive correlation was observed between the lack of braille documents and farming experience (r=0.487**, p=0.000). This result may imply that as farmers with visual impairments gain more experience in farming, their lack of access to agricultural information presented in braille intensifies, further emphasizing Agole et al.'s findings (2021).

4.6.10 Correlation between the Land Size(grains) of Farmers with Disabilities and Their Agricultural Challenges

Examining the relationships between the land size (Grains) of Farmers with Disabilities and the agricultural issues they confront provides critical insights into the dynamics between land accessibility and the obstacles these farmers face.

Poor Building Designs (r=-0.138, p=0.030): The fact that there is a negative correlation between land size and poor building designs shows that because farmers with disabilities have more significant land holdings (grains), they appear to experience fewer issues with poor building designs. This result could be because larger property parcels have more financial resources or better infrastructure, lowering obstacles to accessible construction. However, while substantial, the correlation is somewhat modest, hinting that other factors may also play a role in influencing building designs.

Discrimination (r=-0.580, p=0.000): A sizeable negative correlation with land size implies that as the land size of farmers with disabilities increases, so does the amount of discrimination they suffer. This result could be because more prominent landowners are treated with more respect or power in the community, resulting in less discrimination. On the other hand, farmers with more excellent land holdings may have better access to resources and networks, giving them more possibilities to resist or avoid discriminatory behaviours.

Emotions of Inferiority (r=-0.500, p=0.000): According to the significant negative correlation, farmers with disabilities who own larger land plots had reduced feelings of inferiority. Owning more extensive land holdings may increase their self-esteem and community position, reducing feelings of inferiority.

Exceptional Training Deficit (r=-0.487, p=0.000): A strong negative correlation indicates that farmers with disabilities who own larger parcels of land are less likely to complain about a lack of special training. Farmers with more significant acreage may have better access to resources and training programmes or be able to afford such training independently.

Inadequate Sign Language Interpretation (r=-0.171, P=0.000): Although substantial, the negative correlation between land size and the absence of a sign language interpreter is

weak. This result implies that while farmers with bigger land sizes (Grain) may have slightly better access to sign language interpreters, the availability of such interpreters remains a persistent issue across all land sizes.

Inadequate Braille Documentation (r=-0.714, p=0.000): The substantial negative correlation implies a strong relationship between land size and the lack of braille documents. Farmers with disabilities experience fewer problems regarding braille document availability as their land size (Grains) grows. This result could be ascribed to larger landholders having the ability to translate documents into braille or being more linked to resources and networks that provide these services.

Finally, the negative correlations across the problems show that when farmers with disabilities and the land size of grains grow, they have fewer agricultural challenges. However, the degree of these relationships varies, with discrimination, feelings of inferiority, and a lack of braille material displaying particularly significant associations. Addressing these issues across all land sizes is critical to providing a welcoming and accessible agricultural environment for farmers with disabilities.

4.6.11 Correlation between the income on grains (grains) of Farmers with Disabilities and Their Agricultural Challenges

Discrimination (r=0.418, p=0.000): A moderately positive correlation exists between grain income and discrimination suffered by FWDs. This result means that when these farmers make more money from grains, they will face increasing discrimination. This discrimination could be due to envy, discrimination, or societal misconceptions that grow as these farmers' economic success grows. Alternatively, higher-income farmers may be more exposed to larger markets or social environments where they suffer higher degrees of discrimination.

Inferiority complex (r=0.258, P=0.000): Income on grains has a moderate positive connection with emotions of inferiority. This finding indicates that higher income from grain farming is associated with slightly heightened feelings of inferiority among farmers with disabilities. The underlying causes may be complicated; nonetheless, with more income and visibility, these farmers may confront additional societal pressures or negative attitudes, compounding their feelings of inferiority.

Inadequate availability of Braille documents (r=0.355, p=0.000): A moderately positive association between grain income and the lack of Braille documents is discovered in contrast to prior interpretations. This result shows that when farmers with disabilities' revenue from grain sales rises, so will their reported lack of braille papers. This unexpected finding could mean that higher-income farmers with disabilities are more aware of the need for braille agricultural information or deal with more complicated agricultural chores or concepts that necessitate accessible documentation. This finding emphasises the significance of making accessible information resources, like braille publications, available to all farmers with disabilities, regardless of income level.

The findings show that grain income is favourably connected with challenges such as discrimination, feelings of inferiority, a lack of specific training, and a lack of braille documents. These relationships highlight the complicated dynamics between income, disability, and agricultural issues. When establishing interventions and programmes to assist farmers with disabilities, these trends must be identified and considered.

4.6.12 Correlation between Land size of vegetables of Farmers with Disabilities and Their Agricultural Challenges

Investigating the relationship between the size of land used for vegetable cultivation by farmers with disabilities and their agricultural issues yields essential findings.

Poor Building Design (r=-0.236, p=0.025): The negative correlation implies that the challenges associated with poor building designs lessen as land area increases. According to Sanjaya and Prihtanti (2019), the amount of agricultural land can influence farming decisions, which may involve expenditures in better infrastructure and building designs as land size increases. However, it is also essential to examine Purkaysto et al. (2023) argument that farm size may not directly affect specific issues, signalling that other variables may be at work.

Discrimination (r=-0.432, p=0.000): The significant negative correlation between land size and prejudice shows that as land size increases, experiences of discrimination decrease. While the research does not directly address this issue, it can be extrapolated from the work of Aboh and Effiong (2021) and Sanjaya and Prihtanti (2019) that land size can indirectly influence societal attitudes and levels of prejudice.

Inferiority (r=-0.414, p=0.000): There is a significant negative relation between land size and emotions of inferiority. This result suggests that a more significant land area may be related to fewer sentiments of inferiority. Increased land size, as a proxy for success, may contribute to higher self-esteem among farmers with disabilities. This situation, however, requires more excellent investigation, given the complexities of the processes that contribute to feelings of inferiority.

Challenge of Special Training (r=-0.299, p=0.004): The negative correlation suggests that the reported deficit of special training decreases as the land size increases. Larger land size could substitute for more significant financial resources or access to networks and information, which might ease access to special training. This result affirms Sanjaya and Prihtanti's (2019) claim that land size can influence farming decisions, including access to resources and training.

Braille document scarcity (r=-0.359, p=0.001): There is a considerable inverse relationship between land size and the absence of braille documents. This result means that higher land size is associated with fewer challenges regarding braille document availability. Farmers on more extensive lands may have more resources to meet their demands, including having documents translated into braille.

While the precise correlations discovered in this study were not addressed in the relevant literature, we can deduce from the broader themes that land size can have varying effects on the challenges faced by farmers with disabilities. This condition implies that measures to assist these farmers should consider the complexities of land size and other socio-economic considerations.

4.6.13 Correlation between the Access to Training of Farmers with Disabilities and Their Agricultural Challenges

Poorly Designed Buildings (r=-0.169, p=0.005): Training may give farmers with disabilities the information and resources they need to improve building design to their advantage. Although there is no clear link in the extant research, one could reasonably deduce that as these farmers receive training, they may become more aware of their rights and the accommodations available, including structural or building improvements to support their jobs. They may also learn about potential funds or aid for making such changes, which will help them overcome this barrier.

Discrimination (r=-0.497, p=0.000): According to Agole et al. (2021), discrimination considerably limits young farmers with disabilities' access to agricultural programmes. The negative relationship between access to training and experiences of prejudice shows that better training can help reduce discrimination. This decline could be ascribed to one of two sources. For starters, training may assist farmers with disabilities in developing skills and competencies that oppose prejudiced stereotypes about their ability. Second, inclusive training programmes may promote social cohesion and mutual understanding among farmers with and without disabilities, reducing discriminating attitudes.

Inferiority (r=-552, p=0.000): The negative relationship between training access and feelings of inferiority might be interpreted in various ways. Training can improve farmers' skills and knowledge, giving them more confidence in their talents. It can help them feel equal to their other friends, lowering feelings of inferiority. Furthermore, being a part of a training programme can provide possibilities for social connection and support, which can help to alleviate feelings of inferiority.

Particular training limitation (r=-0.240, p=0.000): This inverse relationship means that improved availability of training immediately addresses the issue of a lack of special training. The more training farmers with a disability acquire, the less likely they are to face this particular difficulty. Training programmes could potentially incorporate content specifically intended to accommodate and meet the unique demands and concerns experienced by farmers with disabilities, boosting the training's effectiveness.

Inadequate Braille documentation (r=-0.319, p=0.000): The inverse relationship here shows that training programmes may include resources or methods for obtaining or translating content into braille. Farmers with disabilities may have more access to braille materials as their access to training improves.

In conclusion, the observed connections show that improving access to training could greatly alleviate the difficulties faced by farmers with disabilities. Future research should investigate these links and determine how specific training programme components can help mitigate these issues.

4.6.14 Correlation between the Distance travelled by Agricultural Extension Agents to Seek Farmers with Disabilities and Their Agricultural Challenges.

Discrimination (r=-0.247, p=0.011): The negative correlation implies that when extension agents go further, the discrimination experienced by farmers with disabilities diminishes. This data could be because extension agents travel significant distances to assist these farmers. Their dedication may eliminate prejudices or misconceptions maintained by those who discriminate against FWDs. Extension professionals may also assist these farmers in gaining access to extra resources and increasing their confidence, making them less likely to be subjected to discriminatory behaviours.

Inferiority (r=-0.383, p=0.000): The negative correlation implies that feelings of inferiority amongst farmers with disabilities decrease when extension agents travel greater distances to reach them. These results could be because the attention and resources provided by these agents might boost the self-esteem of these farmers. The extension agent's presence also signals recognition and inclusion, which may reduce feelings of inferiority. It is also possible that these agents provide knowledge and skills that empower the farmers, thereby decreasing feelings of inferiority.

Inadequate Braille Documentation (r=-0.227, p=0.039): The negative association could imply that the frequency of meeting a shortage of Braille documents lowers as extension agents move further. Extension professionals dedicated to reaching farmers with disabilities, regardless of distance, will likely be aware of their unique needs. As a result, they may ensure that relevant materials are carried in accessible formats, such as Braille, lowering the challenge of inaccessible information.

4.6. 15 Correlation between Access to Agricultural Extension Service and Farmers with Disabilities and Their Agricultural Challenges

Discrimination (r = 0.404, p = 0.000), Access to agricultural extension services and discrimination have a 0.406 positive correlation, indicating that the perception of discrimination improves as access to services improves. This finding defies logic, as one would anticipate increasing access to services to minimise discrimination. However, increased contact with agricultural extension agencies may expose farmers with disabilities to more discriminatory situations. This situation could also imply that

agricultural extension programmes are not inclusive enough or sensitive to the needs of farmers with disabilities.

Inferiority (r=0.513, p=0.000). Again, the positive connection of 0.513 between access to services and sentiments of inferiority is surprising. In theory, extension services should empower farmers rather than create a sense of inferiority. However, if the services supplied are not specialised or adaptable to the requirements of farmers with disabilities, it may reinforce feelings of inferiority. This issue could be due to service providers' insensitivity or lack of awareness of disability, or it could be due to the style of service delivery itself, which makes farmers with disabilities feel less capable or appreciated.

Special Training (r=0.213, p=0.000), access to agricultural extension services and the provision of specific training have a positive but very weak correlation. This result could imply that, while providing these services is partially related to specialised training, there is still a significant need to be filled. Agricultural extension services may be under-equipped to provide the necessary customised training for farmers with difficulties, emphasizing the need for capacity building in this area.

The absence of a Braille document (r=0.321, p=0.000), a positive association of 0.321 between access to extension services and the unavailability of Braille documents demonstrates that increased access to services does not always imply improved document accessibility. The increased frequency of interactions with agricultural extension services may expose farmers to additional instances in which a shortage of Braille documentation may occur. This issue could point to a severe gap in accessibility in present agricultural extension services, emphasizing the importance of developing accessible communication in these services.

While these correlations cannot be used to establish causality, they highlight the necessity for a more in-depth qualitative investigation of the experiences of farmers with disabilities when interacting with agricultural extension programmes. Additionally, capacity-building and inclusion training within these services may be required to ensure they are sensitive to the needs and challenges faced by farmers with disabilities. Furthermore, given the need for special training and accessible documents like those in Braille, extension services should consider cooperating with special education and accessibility experts to ensure their service delivery is as inclusive and accessible as possible.

4.6 CHAPTER SUMMARY

The chapter examines the socio-economic characteristics of farmers with disabilities in Ghana. Most farmers with disabilities in the study area are male, comprising 68.7% of the sample size. Most respondents had no formal educational background, with 43.9% having no education and 26.1% having junior high/middle school education. Most disabilities among farmers were caused by sickness, at 44%, while 34% were caused by disabilities at birth and 17% by injury or accidents. The study found that most farmers with disabilities were household heads, with 57% of the respondents being household heads. Most farmers surveyed had 3-5 dependents living in their households, and 71.3% were not members of any farmer-based organisation. The study also found that 71.7% of farmers with disabilities did not engage in non-farm activities, while 28.3% did. Most farmers surveyed had 1-19 years of experience, with 30% reporting access to extension agents and 92% using other sources for agricultural information without the Agric Extension Agents.

The chapter further discussed the socio-economic characteristics of Agricultural Extension Agents (AEAs) in Ghana and found that most AEAs were male, comprising 87% of the sample size. However, females made up the remaining 13%. Most officers were in the age range of 39-48 years, accounting for 53.3%. 30% of the officers were between the ages of 26 and 38, with the remainder between the ages of 49 and 59. Most of the officers had a first-degree qualification (36.7%), followed by post-graduate (26.7%) and diploma (28.3%). The majority had been in the extension service for 11-15 years, with 18.3% having 1-5 years and 18.3% having 6-10 years of service. The officers prioritised visiting Farmer with Disabilities (FWDs), with 53% saying they visit regularly. Communication with FWDs was reported to be robust by 72.4% of officers, but 28% reported that they were not good at communicating with FWDs. FWDs reported poor communication with AEAs, with 53.3% affirming it.

The chapter then discussed the mediation and examined ways to improve agricultural practices among farmers with disabilities in Ghana. The results showed that most AEAs strongly agreed (86.7%) that home and farm visits are a mediation factor that could help enhance agricultural practices among farmers living with disabilities in Ghana. Additionally, 74.6% of the AEAs strongly agreed that providing tools and equipment to facilitate farmers with disability training could help improve agricultural practices. In comparison, 72.4% agreed that farm input supply mediates to enhance agricultural

practices among farmers with disabilities. However, only 29.1% supported farmers' field schools, serving as a mediation factor in enhancing agricultural practices among farmers living with disabilities. The studies found that for farmers with disabilities to improve their farming output, they must adopt and use technologies, but the high illiteracy among farmers with disabilities and the inconsistency of support systems to assist such farmers pose challenges. Additionally, most of these farmers work subsistence, making the capital requirements for obtaining these technologies difficult.

The chapter identifies the barriers faced by farmers with disabilities (FWDs) in accessing agricultural extension services and assesses the socio-economic determinants and impact of extension contacts on farm income. The findings revealed several challenges faced by FWDs in accessing extension services, which were ranked based on their significance.

Farmers reported discrimination as the most significant barrier, scoring 5.58 out of 6, indicating the most significant difficulty level. Because of their marginalised status and the belief that disabilities impede productivity, FWDs faced workplace discrimination and were frequently ignored by extension officers. The feeling of inferiority and concerns about not being taken seriously in the presence of other farmers was ranked second, with a score of 5.39.

Other barriers included a lack of programming and planning for FWDs (score: 4.55), difficulties caused by building design and accessibility (score: 4.44), ineffective communication with extension services (score: 4.42), a lack of braille documents for providing agricultural information to the visually impaired (score: 4.11), insufficient equipment for training FWDs (score: 4.02), and a shortage of skilled agricultural employees to interpret sign language (score: 3.49).

These impediments to access to extension services impede FWDs' agricultural participation and success. Discrimination and challenges faced by people with disabilities are deeply rooted in societal norms and cultural attitudes toward people with disabilities. As a result, FWDs frequently have low self-esteem and may live in remote areas, making access to extension services difficult.

Finally, the chapter also looked into the relationship between numerous factors and the agricultural issues that farmers with impairments confront. Discrimination, feelings of inferiority, lack of training, and access to braille documents were among the challenges.

The type of disability and age played significant roles in determining the level of challenges experienced, with specific types of disabilities requiring more specialised training and older farmers facing more difficulty accessing braille documents.

Farmers' gender and household headship were positively correlated with these challenges, showing that certain groups confront these issues more frequently.

Notably, the number of household dependents was positively correlated with all challenges, meaning that farmers with more dependents may experience more significant challenges.

Larger land sizes for vegetable and grain production were related to fewer challenges, implying that scale may alleviate some issues.

Surprisingly, farmer-based organizations (FBOs) membership was associated with more significant issues.

While access to agricultural extension services is critical for farmers, it was also associated with increased reported problems, indicating potential areas for improvement in these services.

Finally, the distance travelled by agricultural extension agents to reach farmers with disabilities was inversely connected with the issues, implying that increasing interaction with extension services could help farmers with disabilities overcome some of their challenges.

CHAPTER FIVE

REGRESSION ANALYSIS RESULTS

5.0 Introduction

The chapter focuses on the regression analyses carried out in the study. The fractional outcome regression model was used to analyze the determinants of farmers with disabilities access to agricultural extension services per year, and the multiple linear regression model was used to analyze farmers' characteristics affecting their income.

5.1: Results of the Fractional outcome model of Farmers with Disabilities access to agricultural extension services per year

Extension services offer information and inputs that can significantly enhance the well-being of rural regions (Anang et al., 2020). It is commonly acknowledged that agricultural extension services may increase value, productivity, and food security (Danso-Abbeam et al., 2018) A fractional outcome regression model was performed to determine the determinants of farmers with disabilities access to agricultural extension services per year. The model estimates are based on the impact of various demographic and socio-economic characteristics on FWD access/contacts to agricultural extension services per year.

The goodness-of-fit test revealed significant test statistics ($P > 0.05$), suggesting that the fractional outcome regression model performed is appropriate for the analysis. From the analysed results, the model fitted well with the data, and the output was reported to be significant at a 0.000 significant level. Two hundred and sixty-six (206) FWD data sets from the study area were used to analyze the fractional outcome regression model. In this case, the dependent variable is access/contacts to agricultural extension services per year (number of extension visits made by the extension officer/s out of the expected number of visits per year). According to the estimated results in Table 5.1.1, Three variables, such as age, FBO membership, and years of farming experience, significantly affect the FWD's access to agricultural extension services per year.

Table 5.1.1 Factors that influence access to Extension of FWDs

Access/contacts to agricultural extension services per year						
	Coef.	Std. Err.	Z	P>z	[95% Conf. Interval]	
Age	0.26541**	0.119	2.23	0.026	0.03214	0.49867
Gender	0.285274	0.3402	0.84	0.402	-0.38159	0.9521381
Educational level	-0.13714	0.0981	-1.4	0.162	-0.3295	0.0552536
Household size	-0.2500481	0.1477	-1.69	0.091	-0.5396	0.0395204
FBO	0.6599***	0.2053	3.21	0.001	0.2573995	1.062448
Experience in farming	-0.283***	0.1063	-2.67	0.008	-0.4923	-0.075446
_cons	0.19049	0.6777	0.28	0.779	-1.137823	1.518802
Log pseudolikelihood	=	-112.07				
The number of obs.	=	206				
Wald chi2(6)	=	45.77				
Prob>chi2	=	0				
Pseudo	=	0.2012				

Sources: Field Data Significance level: 1%***, 5%**

5.1.1: Age of Farmers with disabilities

The analysis results showed that the “age distribution” of the FWDs was positively significant at a 0.026 level, with a coefficient of 0.2654. The result means that age of the farmers in the study area had a positive significant effect on their access/contacts to agricultural extension services, with other factors held constant.

This finding is consistent with previous research by Berry (2023), who found that older farmers have a competitive edge in capital accumulation, extension visits, and credit eligibility. The advantage of capital accumulation and loan eligibility can be explained by accumulated wealth over time and improved relationships with Agricultural Extension Agents (AEAs). Furthermore, ageing farmers' experience and knowledge boost their likelihood of seeking and utilising extension services.

Another study focused on the impact of age on access/contacts to agricultural extension services, finding that age was a significant factor affecting access, leading to higher crop yields for farmers who had access to extension services (Midamba et al., 2022).

Similarly, a study in Benin revealed age as a factor in access to advisory services, significantly impacting maize and cotton farmers' output (Bonou-Zin., 2022).

Furthermore, an Ethiopian study found that age significantly affected women farmers' participation in extension programmes (Haile, 2016).

In summary, the age of farmers is a significant indicator when developing strategies for farmers with disabilities to access agricultural extension services.

5.1.2: Farmer-Based Organization/ Farmer group membership of the FWDs

The second variable examined was the Farmer-Based Organization (FBO) of the FWDs. The analysis showed that the FBO of the FWDs was significant at a 0.001 level, with a coefficient of 0.6599. The result means that FBO membership positively affected the farmers' access/contacts to agricultural extension services, with other factors constant.

The results indicated that FWDs who were FBO members were more likely to have more contacts/access to extension services than those without membership. This outcome is consistent with research that has found that Farmers who are members of FBOs are more likely to benefit from the group's activities and have higher yield margins (Guntzburger et al., 2020). This assertion could be because FBOs provide a platform for farmers to share knowledge and resources and to advocate for their needs with the government and other stakeholders.

This finding is consistent with earlier empirical studies showing that FBO membership had a beneficial effect on farmers' inclination to adopt certain agricultural practices (Thinda et al., 2020; Esther et al., 2022).

FBOs provide appropriate collective actions for negotiations and a consistent supply of produce, which can contribute to improved access to agricultural extension services (Tortoe & Amo-Awua, 2014). Esther et al. (2022) investigated the impact of FBO interaction with research and extension service providers on technology adoption by FBO members in Ghana (Esther et al., 2022). According to the findings, there was more and more interaction between FBO members, extension service providers, and research institutions. This interaction resulted in a more significant contribution to technology adoption by FBO members, which can improve their access to agricultural extension services (Esther et al., 2022).

Furthermore, FBOs are essential in developing business capacity and commercial company organisation for farmers (Tortoe & Amo-Awua, 2014). They serve as a platform for collective action and coordination, which can lead to enhanced farmer access to resources and markets. However, administering FBOs can be expensive, and there is a need for ongoing contact between FBO members, extension service providers, and research institutions to maintain increased adoption of improved technologies and, as a result, improve FBO farm productivity (Esther et al., 2022; Tortoe & Amo-Awua, 2014).

FBOs are active in a variety of sectors, including health, in addition to agriculture. For decades, faith-based organisations (FBOs) have worked in the health sector and have received development assistance for health (DAH) (Haakenstad et al., 2015).

FBOs have been identified as critical healthcare providers in many Sub-Saharan African countries. Evidence suggests that FBO-managed health facilities lag behind other facilities providing family planning services (Ruark et al., 2019). Efforts are being made in Kenya to increase access to family planning services through the involvement of FBO-managed facilities, religious leaders, and community health volunteers (Ruark et al., 2019).

FBOs significantly impact farmers' access to agricultural extension services and technology uptake. Their participation in collective action, coordination, and engagement with research and extension service providers helps farmers access resources, markets, and information. However, administering FBOs can be expensive, and ongoing engagement between FBO members, extension service providers, and research institutions is critical for sustaining the adoption of modern technologies and increasing farm productivity. Furthermore, FBOs are involved in other sectors, such as health, providing services and solving health concerns.

5.1.3: Years of farming experience of FWDs

The third variable examined was the years of farming experience of the FWDs. It means the number of years a farmer has been farming negatively affects their access/contacts to agricultural extension services.

The results indicated that farmers with long-term farming experience do not stand a better chance of accessing extension services. This finding is consistent with previous studies by Gido et al. (2015) and Gomda (2021), who reported that years of farming experience did not influence FWDs' access/contacts to extension services but that new farmers

instead sought extension services. It may be because FWDs with more years of experience may have established better relationships with other agents besides Agricultural Extension Agents (AEA) and have more resources of their own to access those services. They may also better understand how to access and effectively utilize other services not offered by AEA. Additionally, FWDs with more years of experience may have a better credit history and more assets, making them more eligible for high-level services than the government AEA provides.

This finding is important because it suggests that FWDs with more years of experience are less likely to access government extension services, and therefore, they are more likely to benefit from other private agricultural services. This information could be used to target extension services to farmers with more years of experience to increase the effectiveness of these services. Furthermore, this information could also be used to identify why farmers with fewer years of experience are more likely to access extension services.

Overall, the findings of this study suggest that FWDs with long-term farming experience do not have much access/contacts to extension services, which is consistent with previous studies that have reported that years of farming experience did not positively influence farmers' access to government extension services.

5.2 Results of the Multiple linear regression model analysis of the FWDs' demographic and Socio-Economic characteristics that Affect Farm Income

The study examined how farmers' demographic and socio-economic characteristics affect farm income. To test the significant impacts between the farmer's characteristics and income, multiple linear regression model analysis was applied, and the results are shown in Table 5.2.2 below. The analysis was done on thirteen (12) independent variables. The dependent variable, Yi, was the annual farm income of the FWDs. It can be noted that four (4) independent variables were found to be significant at an alpha level of 0.05. These variables are non-farm activity, land size, proportion of produce sold, and proportion of farm inputs purchased. The model fit summary is presented in Table 5.2.1 below.

Table 5.2.1: Model Fit Summary Socio-economic factors that Affect income

Model	R	R Square	Adjusted R Square	Std. The error in the Estimate	Change Statistics				Durbin-Watson
					R Square Change	F Change	df1	Sig. F Change	
1	.725	.525	.500	1.050	.525	13.612	13	.000	1.151

The Durbin-Watson statistic is a test statistic used to detect autocorrelation in a regression model's residuals (errors). A Durbin-Watson value of 1.151 indicates that there is no autocorrelation present in the residuals. The Multicollinearity Test was performed, and the results presented in the table below. The multicollinearity test examines if there's a correlation among independent variables in a regression model, which is undesirable for a good model. To detect multicollinearity, the researcher assessed the Variance Inflation Factor (VIF), which indicates the extent to which independent variables are correlated with each other.

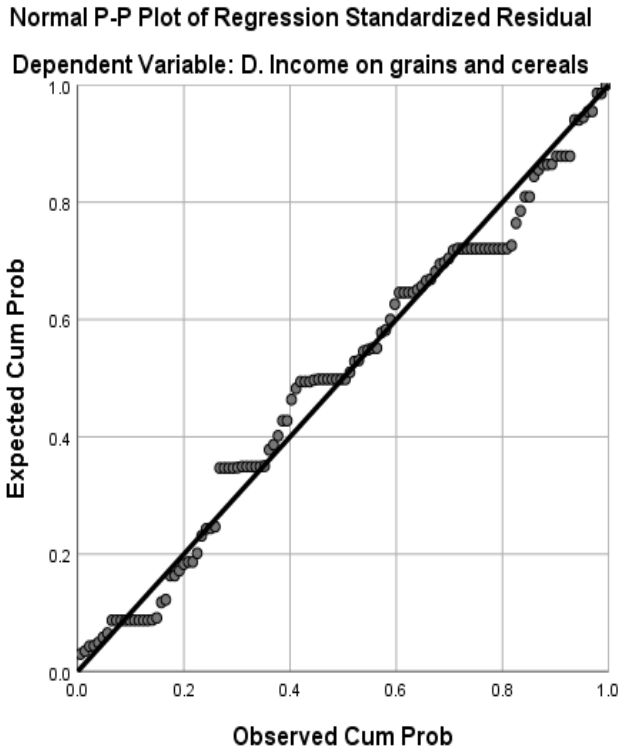
Table: Multicollinearity Test Results

		Collinearity Statistics		
No	**Variables**	**Tolerance**	**VIF<10**	**Description**
1.	Varieties of seed crops (X1)	.373	2.683	Absence of multicollinearity
2.	Pest and disease control (X2)	.510	1.959	Absence of multicollinearity
3.	Inputs and irrigation water(X3)	.618	1.619	Absence of multicollinearity
4.	Lack of Credit (X4)	.699	1.431	Absence of multicollinearity
5.	Inadequate Agriculture extension service (X5)	.543	1.841	Absence of multicollinearity
6.	Discrimination (X6)	.379	2.639	Absence of multicollinearity
7.	Land preparation (X7)	.405	2.468	Absence of multicollinearity
8.	Transporting produce (X8)	.385	2.597	Absence of multicollinearity
9.	Training needs (X9)	.580	1.725	Absence of multicollinearity

Source: Field data (2022)

The results in the table above, shows that there is s tolerance value of <1 among the independent variables. According to the rule of thumb, VIF less than 10 indicates that there is an absence of multicollinearity in the regression.

The Normality Test was also performed, and the results presented in the figure below. The normality test results using SPSS v. 27.0 can be seen in the Figure below.



Source: Field data (2022)

Figure: Pictorial View of Normality Test Results

From the Figure above, it can be seen that the plotting in the picture “Normality P-P Plot of Regression Standardized Residual” always approaches and follows the diagonal line. In view of this, as a basis for decision making in the normality test of probability plot technique, it can be concluded that the residual value is normally distributed. Hence, the fulfillment of the normality for the residual value in multiple regression analysis. The assumptions for autocorrelation (Durbin Watson statistic), multicollinearity (VIF), and the Normality (scatter plot) were full-filled so the semi-log, double logs and exponential models were not considered.

The adjusted R-squared value measures the goodness of fit of a regression model. It is calculated as the R-squared value adjusted for the number of predictor variables in the model. A value of 0.500 for the adjusted R-squared indicates that the model explains a moderate amount of the variance in the response variable (the incomes of farmers with disabilities in this case). It suggests that the predictor variables in the model may be pretty helpful in predicting the response variable.

The F change value measures the statistical significance of the model. A F change value significant at 0.000 means that the combined effect of the independent variables in the model is highly statistically significant. It means it is doubtful that the observed relationships between the predictor and response variables happened by chance.

The multiple linear regression analysis result is presented in Table 5.2.2 below. The significant variables include non-farm activities, land size, and the proportion of purchased inputs and outputs sold.

Table 5.2.2: Results of the Multiple Linear Regression Analysis of Demographic and Socio-economic characteristics that Affect income of FWDs.

Model	Unstandardized Coefficients		Standardized Coefficients	t-value	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	4.793	1.114		4.304	.000	2.594	6.993
AGE	.142	.138	.098	1.031	.304	-.130	.415
Gender	.032	.299	.007	.108	.914	-.557	.622
Education	-.067	.094	-.051	-.715	.476	-.254	.119
Type of Disability	.052	.057	.056	.903	.368	-.062	.165
Source of Disability	.054	.066	.052	.830	.408	-.075	.184
Number of Household dependents	.069	.133	.058	.519	.604	-.194	.333
FBO Membership	-.119	.182	-.037	-.651	.516	-.478	.241
Non-farm activity	-.616	.205	-.198	-3.002	.003	-1.022	-.211
Experience in Farming	.144	.126	.143	1.135	.258	-.106	.393
Cost of production	.128	.146	.086	.881	.379	-.159	.416
Land size	-.418	.109	-.369	-3.825	.000	-.633	-.202
Proportion Input purchased	-.328	.156	-.137	-2.103	.037	-.636	-.020
The proportion of Products Sold	.720	.173	.256	4.156	.000	.378	1.062

a. Dependent variable: Annual income from farm products sold

Source: Field Data, 2022

5.2.1 Land size as a factor that affects income

According to the regression analysis results, the regression coefficient for the land size of -0’418 is significant at the 1% level. This means that a unit increase in the land size results in a decrease of 41.8% in the annual farm income of the farmers, with other factors held constant. This could be because the farmers will not have enough inputs/resources to optimise production as land size increases. This result is inconsistent with other studies revealing that land size benefits income.

The findings are inconsistent with a survey undertaken by Yang and Xu (2019) in China, which found that land size has varying effects on household income. They discovered a strong link between land size and income using Hansen's threshold regression model. Similarly, Kadi and Arikan (2014) concluded in a Turkish study that more significant land areas led to higher profitability, which was determined using the stochastic frontier production function to estimate the input elasticity of production.

Karima et al. (2022) researched Indonesia and discovered land size's significant, favourable influence on coffee farmer revenue. According to the same study, land size considerably impacts rice output and income.

Finally, a study conducted in Mali by Coulibaly and Li (2020) found that land size significantly impacted farmers' yearly family income. In contrast, low-yield lands and young emigration increased the likelihood of farmers losing their fields to urbanisation. All the above are not consistent with the results of this study, which showed a negative association between land size and annual farm income of the FWD in the study area.

Overall, the findings of this regression show that more considerable land holdings not being associated with higher income levels of the FWD. It is crucial to highlight that land size may contribute to income disparity, and the specific impacts of land size on income may vary based on various factors, including the type of farming or agricultural activity and the regional environment.

5.2.2 The proportion of farm inputs purchased

The proportion of inputs purchased has a significant negative coefficient of -0.328 significant at 0.037 (5% level of significance), indicating that it is a statistically significant negative predictor of FWDs' incomes. The beta value of -.328 and t value of -2.103 suggest that a higher proportion of inputs purchased is negatively related to FWDs'

incomes. This finding suggests that farmers who buy more inputs may not make as much money because of the extra costs.

One study found that smallholder farmers in developing countries who purchased a higher proportion of inputs had lower profits due to the added cost (Saenger et al., 2013). Another study found that smallholder farmers in sub-Saharan Africa who purchased a higher proportion of inputs were less likely to adopt new technologies and had lower incomes than those who purchased a lower proportion of relevant inputs (Jayne et al., 2010).

In conclusion, this study found that land size and the proportion of farm inputs purchased negatively and significantly impact annual farm income. The study supports the literature that suggests that larger land sizes and a higher proportion of farm inputs purchased are negatively related to farm income. These findings can provide valuable insights for farmers and policymakers to improve the income of farmers with disabilities.

5.2.3 non-farm activity

According to the results of the regression analysis of the study, non-farm activities are a significant negative factor in determining annual farm income. Furthermore, the t-value of -3.002 and the beta value of -0.616 highlight the statistical significance and negative influence of non-farm activities on the annual farm income of the FWD in the study area. The negative beta value shows that when non-farm activities increase, farm revenue drops, possibly due to time and resource allocation away from farming methods. However, non-farm incomes may increase the total household income.

Numerous studies back up this claim. In their China-based study, Luo and Zhu (2006) discovered that non-farm activity plays an increasingly key role in rural household income and reduces rural income inequality by improving the income of poorer families more than that of more affluent households.

In Tanzania, Oni et al. (2009) discovered related results, with non-farm activities contributing more to household income than farming activities. In Nigeria, Israr et al. (2014) discovered that a significant fraction of the population was involved in non-farm activities, and non-farm income formed a significant portion of total annual household income. This means that nonfarm activity can be a significant source of income for rural households.

Dabkien (2020) also emphasised the significance of non-farm activity in Lithuania. The researcher discovered that off-farm activities significantly stabilised agricultural income. Many family farms were involved in off-farm activities, highlighting the appeal of part-time or lifestyle farming. It shows that non-farm activities can offer farmers a more consistent source of income than the annual income from farming.

In conclusion, the regression analysis and the literature agree that non-farm activity is a statistically significant predictor of income for impaired farmers. Nonfarm activities can help to reduce income disparity and provide a reliable source of income for rural people. The negative beta value, on the other hand, shows that when non-farm activities increase, farm revenue drops, possibly due to time and resource allocation away from farming methods.

5.2.4 The proportion of products sold

An analysis of the proportion of products sold as a factor that affects the annual farm income of farmers with disabilities (PWDs) found that it significantly impacts their annual farm income, with a significance value of 0.000 and a beta value of 0.256. It suggests a strong positive relationship exists between the proportion of products sold and the annual farm income of PWDs. The t-value of 4.156 further supports this finding, as it indicates that the relationship between the proportion of products sold and the income of PWDs is statistically significant. It means that FWDs who sell more farm products earn 25.6% more farm income, with other factors constant. The more income from such sales may be used to satisfy the family's other food and material needs. Some farmers may use some of their farm products for household consumption and therefore sell less of the farm products.

Some work has been done on PWDs and farmers in general, highlighting the economic challenges PWDs face in agriculture. For example, a study by Día et al. (2017) found that farmers with disabilities often face barriers in accessing markets, limiting their ability to sell products and generate income (Matungul et al., 2001). Another study by MacNaughton and Frey (2018) found that people with disabilities often have limited access to credit, making it difficult for them to expand their operations and increase their sales.

Deichmann et al. (2016) found that while market access and sales are essential factors that affect the income of PWDs, they also found that other factors, such as extension

services and the adoption of modern technologies and practices, play a crucial role in increasing PWDs' income.

Overall, these findings suggest that, while there is limited literature to support the study on the proportion of products explicitly sold, it is clear that PWDs face economic challenges in agriculture. Improving their access to markets, credit, and extension services and supporting the adoption of modern technologies and practices can help improve their income. It is also essential to address PWDs' barriers to accessing markets and credit, such as discrimination and a lack of accessibility.

The analysis suggests that non-farm activity, land size, the proportion of inputs purchased, and the proportion of products sold are all crucial determinants of FWDs' annual farm incomes. A combination of these factors and other unmeasured variables likely contribute to FWDs' incomes.

5.3 Model Framework for Agricultural Extension Practices

A model framework for agricultural extension practices among farmers with disabilities (FWDs) in Ghana can be built based on the full summary of the research. This framework aims to unify the study and synchronise the findings to provide a comprehensive roadmap to improving the agricultural practices of Farmers with disabilities in Ghana.

5.3.1 Demographic & Socio-Economic Profile Analysis

Gender, Education, Type of Disability, Household Structure, Farming Experience, Non-Farm Activities.

Objective: Understanding the distinct qualities of FWDs to contextualize extension services.

5.3.2 Challenges Analysis

Discrimination, Inferiority, Accessibility, Communication, Equipment.

Objective: Identifying and mitigating barriers that hinder FWDs from receiving extension services.

5.3.3 Integration of Agricultural Extension Agents (AEAs)

Gender Profile, Distance of Travel Experience, Communication Strategies.

Objective: To ensure that AEAs are well-equipped to support FWDs, regular visits are made, and strong communication is maintained.

5.3.4 Mediation & Improvement Strategies

Home & Farm Visits, Tools and Equipment Supply, Tailored Programs, Accessibility Improvements.

Objective: To provide support mechanisms that directly address FWDs' needs, connecting them with markets, providing specialized training, and enhancing access to inputs.

5.3.5 Income Determinants Analysis

Non-Farm Activities, Land Size, Output Sold, Inputs Purchased.

Objective: Understanding and improving the economic aspects that influence the income of people with disabilities.

5.3.6 Access/contacts/visits Determinants

Age of Farmers with disabilities, Farmer-Based Organization/ Farmer group membership of the FWDs and Years of farming experience of FWDs.

Objective: To determine the determinants of farmers with disabilities access to agricultural extension services per year

5.3.7 Community & Organizational Engagement:

Participation in Farmer-Based Organizations, Community Support, Anti-Discrimination Programs.

Objective: To improve the community support environment, involving Farmers with Disabilities in Municipal, District and Assemblies and addressing social challenges such as discrimination.

5.3.8 Environmental Management System

Component:

Practices: Sustainable farming techniques such as crop rotation, organic fertilizers, and natural pest control.

Resource Management: Efficient use of resources including water, energy, and raw materials.

Waste Reduction: Recycling, minimizing plastic use, and composting agricultural waste.

Environmental Impact Assessments: Regular evaluations and mitigation strategies.

Objective:

To promote sustainability, reduce environmental impact, and make agriculture more inclusive and manageable for FWDs. This approach aims to ensure safer and healthier farming methods, optimize resource use, minimize waste generation, and foster adaptability to environmental changes, ultimately enhancing the overall sustainability and productivity of farming activities for FWDs.

5.3.9 Monitoring, Evaluation, & Continuous Improvement:

Regular Assessment, Feedback Collection, and Adaptive Strategies.

Objective: To maintain continued efficacy, extension programmes must be constantly evaluated and adapted to meet the changing needs of FWDs.

5.3.10 Policy & Infrastructure Support:

Government Policies, Infrastructure Development, Inclusive Design.

Objective: To create a policy environment that promotes inclusive and accessible agriculture practices for people with disabilities.

5.3.11 Implementation & Usage

Policymakers, extension service providers, academics, and community leaders will use this framework to guide the developing, implementing, and evaluating agricultural extension strategies specifically suited for FWDs in Ghana. The interaction of these components shows the diverse nature of FWDs' difficulties and necessitates a thorough and coordinated strategy.

Using this strategy, stakeholders can ensure that FWDs' particular requirements, qualities, and potentials are addressed systematically, fostering agricultural success and social and economic empowerment. This paradigm thus helps the broader aims of inclusive development, sustainable agriculture, and social fairness in Ghana.

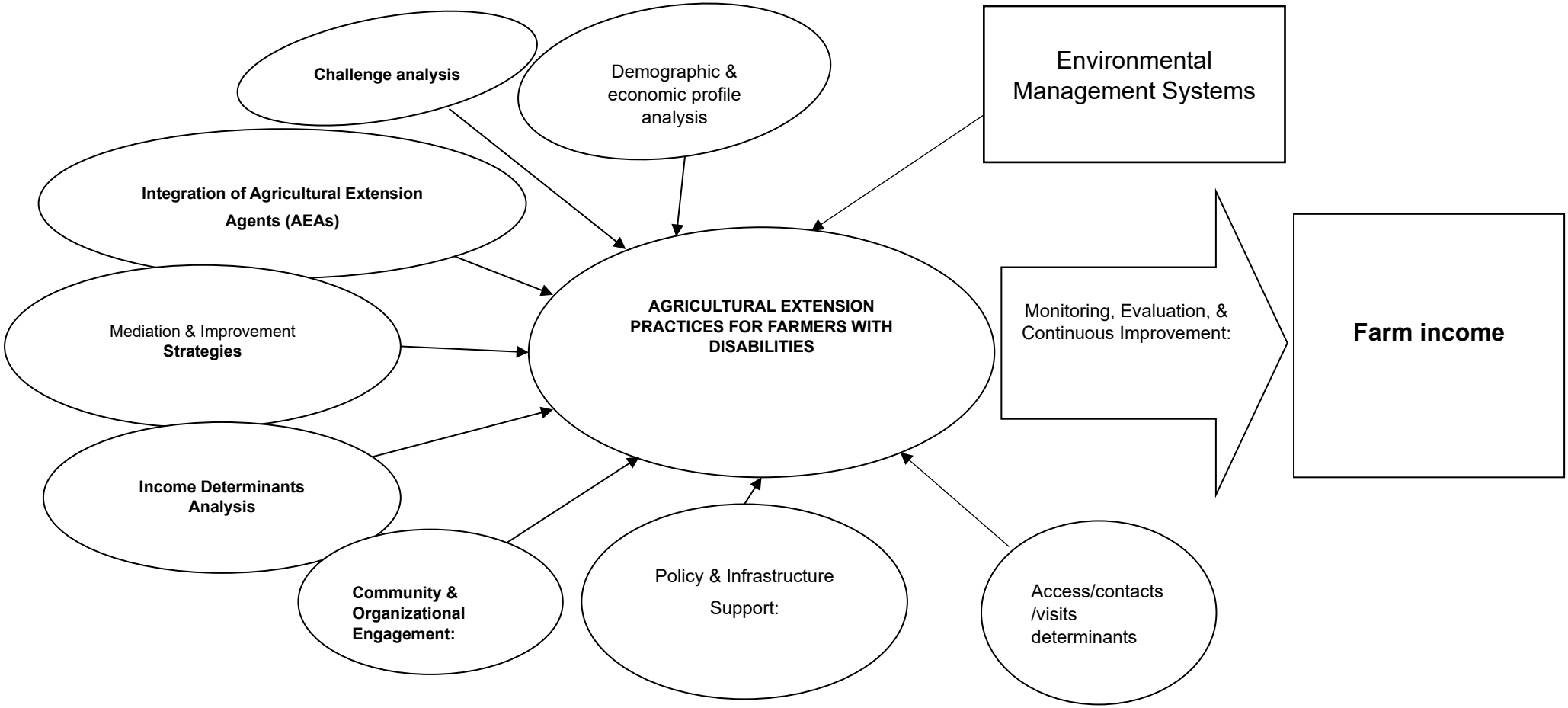


Figure 5.3.1: A model framework for Agricultural Extension Practices among farmers with disabilities

Source: Field Data, 2022

5.4 Chapter Summary

The chapter examined many elements of Farmers with Disabilities (FWDs), including their access/contacts to agricultural extension services, farm incomes, and the construction of a comprehensive framework for agricultural extension practices. The chapter began by describing the results of the fractional outcome model, which identified significant determinants influencing FWDs' yearly access/contacts to extension services. FWDs' age ($p=0.026$), participation in a Farmer-Based Organization (FBO) or farmer group ($p=0.001$), and farming experience ($p=0.008$) all had a significant impact on their access to extension services.

The chapter used multiple regression analysis to investigate the intricate relationship between FWDs' demography, socio-economic characteristics, and farm income. The research results revealed that several factors influenced FWDs' income. Non-farm activities ($p=0.003$), land size ($p=0.000$), the proportion of product sold ($p=0.000$), and the proportion of farm inputs purchased ($p=0.037$) were found to be significant predictors of FWD annual farm earnings. This chapter addressed the multifaceted nature of income determinants and the significance of comprehending the complex processes.

The chapter concluded by developing a comprehensive framework for agricultural extension practices that synthesised the study's significant findings. This framework was created to meet the issues and opportunities highlighted in the chapter's preceding sections. The framework aims to provide a holistic approach to improving agricultural extension practices customised to the unique conditions of FWDs by incorporating findings relating to FWDs' access to extension services and the factors impacting farm income. The paradigm stressed the critical importance of demographic, socio-economic characteristics, and contextual variables in influencing extension service efficacy and farm income.

In summary, the chapter traversed through a rigorous exploration of FWDs' access/contacts to extension services, farm income determinants, and formulating an encompassing framework for agricultural extension practices. The findings underscored the significance of factors such as age, membership in farmer groups, farming experience, non-farm activities, land size, and marketing strategies in shaping the agricultural landscape for FWDs. This chapter's multifaceted analysis contributes to a comprehensive understanding of the intricate interactions within agricultural extension

practices for FWDs, paving the way for informed policy interventions and strategic improvements.

CHAPTER SIX

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

6.1 Introduction

The focus of this study was to develop a framework for improving agricultural extension practices for farmers with disabilities in Ghana. This research aimed to develop a framework for agricultural extension practices among farmers with disabilities in the agricultural sector. The study is organised into six chapters. Chapter One introduces the study, outlining the objectives and problem statement. Chapter two provides background information on the theoretical framework, challenges in agricultural extension services, and the characteristics of farmers with disabilities. Chapter three presents the study's methodology, including the study area, data collection, and analysis methods. The results of the descriptive statistics and regression analyses are presented in chapters four and five, respectively. Finally, chapter six summarises the findings, provides conclusions and recommendations, and identifies areas for further research in farmers with disabilities. The chapter summarises the main findings and explains how the research objectives were achieved. The conclusion is drawn from the findings to identify recommendations and potential areas for future research in this field.

6.2 Summary of Findings

This study aimed to develop a framework for improving agricultural extension practices for farmers with disabilities in Ghana. The research was organised into six chapters, covering the introduction, literature review that explored the challenges in extension services, characteristics of farmers with disabilities, methodology, and results. The study used descriptive statistics and regression analysis to examine the challenges faced by farmers with disabilities and the impact of extension services on their income. The data for this study was collected between May and August of 2022 using a questionnaire. The collected data was recorded and analysed using statistical software such as SPSS, STATA, and Excel. These tools allowed the researchers to organise and analyse the data systematically and efficiently, enabling them to draw insights and conclusions from the collected data.

The first objective was to analyse the demography and socio-economic determinants of Extension contacts of farmers with disabilities in Ghana. The data on the socio-economic determinants of farmers with disabilities found that male farmers comprised the majority

of the study sample (68.7%), while female farmers comprised the remaining 31.3%. Most respondents (43.9%) had no formal education, and the least (0.5%) had a first degree from a tertiary institution. Physical disability was the most common disability among the farmers, comprising 52.5% of the sample. Speech and virtual/sight disabilities were reported by 13.2% and 12.4% of respondents, respectively. The study found that most farmers' disabilities were caused by sickness (44%), while a smaller percentage (5%) reported that their disability resulted from old age. Most of the farmers in the study were household heads (57%), and the majority (39.9%) had 3-5 dependents. However, (22.9%) had 6-7 dependents, and 18.8% had more than ten dependents. The results also showed that a large proportion (71.3%) of the farmers were not members of a farmer-based organisation, and the majority (71.7%) did not engage in any non-farm activities, even though only 28.3% had the opportunity to do so. Finally, the study found that farmers with 10-19 years of farming experience comprised 28.9% of the total, while those with 1-9 years of experience accounted for 26.4%.

The second objective of this study was to determine the challenges faced by farmers with disabilities in accessing agricultural extension services and the key associated factors. The main challenges identified, ranked in order of importance, were discrimination, feelings of inferiority, lack of programs specifically tailored for farmers with disabilities, poor building designs and accessibility, ineffective communication, lack of braille documents for educated visually impaired farmers, and a lack of training equipment suitable for use by farmers with disabilities. The fractional outcome model identified major determinants influencing FWDs' access to extension services were Age ($p=0.026$), participation in a Farmer-Based Organization/farmer groups ($p=0.001$), and farming experience ($p=0.008$) (were found to have a significant connection). These findings highlight the complex relationship between demographic variables and access to extension services. Using the Pearson coefficient of correlation, the following socio-economic factors influenced the challenges they are disability type, age, gender, land size, household headship, dependents, and FBO participation. Some are positively related, indicating more challenging locations. Some relationships were unexpected, such as FBO membership being linked to higher difficulties or AEA distance being inversely related to difficulties.

The third objective of this study was to assess the demographic and socio-economic determinants of farm income of FWD. A multiple regression analysis investigated the complicated relationships between demographics, socio-economic characteristics, and

farm income. Non-farm activities (p=0.003), land size (p=0.000), the proportion of output sold (p=0.000), and the proportion of farm inputs purchased (p=0.037) were revealed as significant predictors of FWD income.

The fourth was to examine agricultural extension mediations that could enhance agricultural practices among farmers living with disabilities. In response to the various mediations presented to them, the farmers' responses were largely positive, with most indicating that they "strongly agree," "agree," or are "neutral." For example, when asked about home and farm visits as a mediation factor to enhance agricultural practices, 86.7% of the farmers strongly agreed, 11.7% agreed, and only 1.7% were indifferent. Similarly, 74.6% of the farmers strongly agreed that providing tools and equipment could facilitate training for farmers with disabilities, while 22.0% agreed and 1.7% were indecisive. A high proportion (72.4%) of the farmers agreed that the supply of farm inputs could serve as a mediation to enhance agricultural practices among farmers with disabilities, and 60.3% linked farmers with disabilities to the market and other actors along the value chain. However, only 29.1% of the farmers supported farmers' field schools as a mediation factor in enhancing agricultural practices among farmers with disabilities, with 34.5% agreeing and 29.1% uncertain.

The fifth objective was synthesising the information from the first four objectives to create a comprehensive framework for Agricultural Extension practices. This framework would incorporate the insights gained from studying current Agricultural Extension methods, identifying the needs of farmers, and evaluating the effectiveness of these methods. The ultimate goal of this framework was to improve the delivery of Agricultural Extension services and increase their impact on farmers and the agricultural sector.

6.3 Conclusion

This research has endeavoured to understand the complex dynamics influencing agricultural extension practices among farmers with disabilities (FWDs) in Ghana, shedding light on an area that has long been neglected in academic research. Several key areas were discerned through a comprehensive investigation, leading to a holistic understanding that informs a more inclusive agricultural policy framework.

The preponderance of male farmers (68.7%) among FWDs and a high percentage lacking formal education reveals a marginalised group with specific needs. The types of disabilities, primarily caused by sickness, birth, or accidents, further complicate their

experience. These factors necessitate targeted interventions that address this demographic's unique needs and challenges.

The predominantly male (87%) profile of AEAs, with varied educational backgrounds and service years, underscores the need to diversify and enhance the competencies of AEAs. While their priority of regular visits and robust communication is commendable, the report from FWDs about poor communication emphasises the need for building stronger.

FWDs and AEAs agree on strategies to enhance agricultural practices, such as home visits and equipment supply. However, high illiteracy and lack of support systems among FWDs pose significant challenges. Addressing these requires a comprehensive approach integrating education, capacity building, and community engagement.

The barriers faced by FWDs, including discrimination, accessibility issues, and insufficient equipment, underline systemic inadequacies. This research necessitates policy interventions, awareness campaigns, and infrastructure improvement to ensure equality and inclusiveness.

The correlations between various factors like disability type, age, gender, land size and the challenges faced provide nuanced insights into the underlying socio-economic dynamics. Unexpected connections, such as FBO membership correlating with more problems, demand further exploration to unravel counterintuitive relationships. The conclusion aligns with earlier research by Lui and Lui (2023), who analyzed socio-economic determinants and their impact on winning Paralympic medals, further validating the intricate interplay of these factors in different contexts.

The fractional outcome model employed in the study has identified significant determinants like age, participation in FBOs, and farming experience, highlighting the complex interplay between demographic factors and accessibility. Additionally, the findings resonate with the work of Long et al. (2016), who utilized a fractional outcome model to identify significant determinants such as age, participation in FBOs, and farming experience.

Through multiple regression analysis, the complexity of income determinants has been unveiled. Factors such as non-farm activities, land size, and the proportion of farm inputs purchased provide avenues for targeted economic interventions. The conclusions also align with Bongole (2016), who through multiple regression analysis, unveiled the complexity of income determinants among rural households in Tanzania, identifying

factors such as non-farm activities, land size, and the proportion of farm inputs purchased as crucial for targeted economic interventions.

This study contributes to understanding the intricate and multifaceted landscape of agricultural extension practices among FWDs in Ghana. Identifying the critical areas of concern and improvement opportunities offers actionable insights for policymakers, practitioners, and researchers.

The framework proposed synthesises the diverse findings into a cohesive model, emphasising social inclusion, economic empowerment, and tailored interventions. However, ongoing research and iterative implementation will be vital to continually refine and adapt this framework to the ever-changing realities on the ground.

The challenges and opportunities in this research illuminate a path forward, setting the stage for a more inclusive and resilient agricultural system in Ghana that recognises and integrates the unique needs and contributions of farmers with disabilities. The lessons learned extend beyond the national context, offering valuable insights for similar endeavours globally.

6.4 Recommendations for further research and development

1. **Gender Dynamics:** The high percentage of male dominance in both FWDs and AEAs calls for an in-depth study on gender dynamics in agricultural extension practices in Ghana. This would include understanding male and female FWDs' needs, barriers, and opportunities.
2. **Communication Strategies**: Given the reported poor communication between AEAs and FWDs, a dedicated study on effective communication methods, tools, and strategies would be beneficial. This could encompass research on language, technology, and cultural factors that facilitate effective communication.
3. **Counterintuitive Findings**: Some findings, such as the correlation of FBO membership with more problems, need further investigation. Exploratory research could uncover the underlying mechanisms causing these unexpected results.
4. **Education and Literacy Programs**: With a high illiteracy rate among FWDs, research on targeted education and literacy programs, including adult education and vocational training tailored to FWDs, is essential.
5. **Disability-Specific Studies**: Disabilities caused by sickness, birth, or accidents among FWDs could be further studied to understand their specific impacts on

farming practices. This research could lead to disability-specific interventions and support systems.

6. **Technology and Tools Accessibility**: Investigate the potential of adaptive technologies and tools that cater to various disabilities, analysing their feasibility, effectiveness, and the required investments.
7. **Economic Models**: More comprehensive economic models that analyse the complex factors affecting FWDs' income, integrating variables like market access, value chain participation, and social capital, would enhance the understanding of the economic empowerment of FWDs.

Recommendations for Development

- **Policy Development:** Governmental bodies and stakeholders must work towards policies that support inclusivity, anti-discrimination, and equitable access to resources for FWDs. Any policy aimed at improving the FWD's access/contacts to extension services should be informed by the age of the farmers, FBO membership and years of farming experience. Similarly, policies to improve the annual farm incomes of the FWD should be informed by the non-farm activities, land size, the proportion of farm inputs purchased and the proportion of farm products sold.
- **Capacity Building for AEAs**: Implement training programs that equip AEAs with skills in disability awareness, communication, and gender-sensitive approaches.
- **Community Engagement Programs**: Develop community-based programs that foster a supportive environment, reduce stigma, and enhance collaboration between FWDs, AEAs, and the local community.
- **Investment in Adaptive Technologies**: Encourage public and private sectors to research and develop adaptive farming tools and technologies suitable for FWDs.
- **Monitoring and Evaluation Framework**: Implement a robust monitoring and evaluation system to continuously assess and refine interventions, using feedback from FWDs and AEAs.
- **International Collaboration**: Seek partnerships with international organisations and other countries to share knowledge, best practices, and resources in supporting FWDs in agriculture.
- **Sustainable Funding Mechanism**: Establish funding mechanisms, including grants, subsidies, or microfinance, specifically designed to support FWDs in their agricultural endeavours.

By focusing on these research and development avenues, stakeholders can build on the current understanding, fostering a more inclusive, effective, and resilient agricultural system that caters to FWDs' unique needs and leverages their potential and contributions. This multifaceted approach ensures that the agricultural extension practices among FWDs in Ghana are not merely an addendum but an integral part of the national agricultural development strategy.

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APPENDIX A

A Framework for Agricultural Extension Practices among Farmers with Disabilities in Ghana

Dear Farmer,

This questionnaire aims to solicit your views and experiences on Agricultural Extension Practices among farmers with disabilities in Ghana. This research is intended for solely academic purposes, in view of that please indicate your candid knowledge and responses for the questions. Confidentiality and anonymity of your responses are assured

NB: THIS MAY TAKE APPROXIMATELY 15 MINUTES TO COMPLETE

* Indicates required question

Socio-Economic Characteristics and determinants access to extension service by FWDs

1. Age range *

Mark only one oval.

- ◯ Below 25years
- ◯ 26-38 years
- ◯ 39-48 years
- ◯ 49-58 years
- ◯ 59-68 years
- ◯ 69-78 years
- ◯ above 79

2. Gender *

Mark only one oval.

- ◯ Female
- ◯ Male

3. Educational Level *

Mark only one oval.

- ◯ Post Graduate
- ◯ 1st Degree
- ◯ Training College
- ◯ Senior High School
- ◯ Junior High School/Middle School
- ◯ Drop-out
- ◯ No school

4. Type of Disability ?

Check all that apply.

- ☐ Speech Disability
- ☐ Physical Disability
- ☐ Autism Spectrum Disability
- ☐ Virtual/sight disability
- ☐ Skin/Albino
- ☐ Hearing/deaf disability
- ☐ Mental Disability

5. Indicate the source of your disability ?

Mark only one oval.

- ◯ At Birth
- ◯ Injury/Accidents
- ◯ Old age
- ◯ Sickness

6. Are you the head of household?

Mark only one oval.

- ◯ Yes
- ◯ No

7. IF YES, how many Dependents are in your household?

Mark only one oval.

- ◯ 1-2
- ◯ 3-5
- ◯ 6-7
- ◯ 8-9
- ◯ above 10

8. Do you belong to any farmer group?

Mark only one oval.

- ◯ Yes
- ◯ No

9. Are you employed in any non-farm activity?

Mark only one oval.

- ◯ Yes
- ◯ No

10. Number of years experience in farming ?

Mark only one oval.

- ◯ 9-1 years
- ◯ 10-19 years
- ◯ 20-29 years
- ◯ 30-39 years
- ◯ 40-44 years
- ◯ Above 45 years

CROP PRODUCTION ASSESSMENT

11. Are you into crop production

Mark only one oval.

- ◯ Yes
- ◯ No

12. If yes , do you cultivate Grains and Cereals

Mark only one oval.

- ◯ Yes
- ◯ No

GRAINS AND CEREALS ASSESSMENT

13. Total cost of production of grains and cereals

Mark only one oval.

- ◯ Below GHC 999
- ◯ GHC 1,000-1,900
- ◯ GHC 2,000-4,900
- ◯ GHC 5,000-9,900
- ◯ GHC 10,000-19,000
- ◯ Above GHC 20,000

14. Land size of grain or Cereals

Mark only one oval.

- ◯ 21 and above
- ◯ 15 -20 acres
- ◯ 10 -14 acres
- ◯ 5-9 acres
- ◯ 3- 4 acres
- ◯ 2 acres
- ◯ 1 acre
- ◯ 1/2 acre

15. Proportion of farm inputs purchased?

Mark only one oval.

- ◯ 1-50%
- ◯ More than 50%
- ◯ Non

16. Proportion of grains and cereals sold

Mark only one oval.

- 1-50%
- More than 50%
- Non

17. Income on grains and cereals

Mark only one oval.

- Below GHC 999
- GHC 1,000-1,900
- GHC 2,000-3,500
- GHC 3,600-4,900
- GHC 5,000-9,900
- GHC 10,000-19,900
- 20,000- 40,000
- above 41,000

ROOTS AND TUBERS ASSESSMENT

18. Do you cultivate Roots and Tuber ?

Mark only one oval.

- Yes
- No

19. Land size of Roots and tubers

Mark only one oval.

- ◯ Above 21 acres
- ◯ 15-20 acres
- ◯ 10 -14 acres
- ◯ 5-9 acres
- ◯ 3- 4 acres
- ◯ 2acres
- ◯ 1 acre
- ◯ 1/2 acre

20. Total cost of production of Roots and tubers

Mark only one oval.

- ◯ Below GHC 999
- ◯ GHC 1,000-1,900
- ◯ GHC 2,000-4,900
- ◯ GHC 5,000-9,900
- ◯ GHC 10,000-19,000
- ◯ GHC 20,000-40,000

21. Proportion of farm inputs purchased?

Mark only one oval.

- ◯ 1-50%
- ◯ More than 50%
- ◯ Non

22. Quantity of Roots and tuber sold?

Mark only one oval.

- 1-50%
- More than 50%
- Non

23. Income on Roots and tubers

Mark only one oval.

- Below GHC 999
- GHC 1,000-1,900
- GHC 2,000-4,900
- GHC 5,000-9,900
- GHC 10,000-19,900
- ABOVE 20,000

Vegetables Assessment

24. Do cultivate vegetable?

Mark only one oval.

- Yes
- No

25. Land size of Vegetables

Mark only one oval.

- ABOVE 21 ACRES
- 15-20 acres
- 10 -14 acres
- 5-9 acres
- 3- 4 acres
- 2acres
- 1 acre
- 1/2 acres

26. Total cost of production of Vegetable

Mark only one oval.

- Below GHC 999
- GHC 1,000-1,900
- GHC 2,000-4,900
- GHC 5,000-9,900
- GHC 10,000-19,000
- GHC 20,000-40,000
- above 40,000

27. Proportion of farm inputs purchased?

Mark only one oval.

- 1-50%
- More than 50%
- Non

28. Quantity of vegetables Sold ?

Mark only one oval.

- 1-50%
- More than 50%
- Non

29. Income on Vegetable

Mark only one oval.

- Below GHC 999
- GHC 1,000-1,900
- GHC 2,000-4,900
- GHC 5,000-9,900
- GHC 10,000-19,900
- 20,000- 40,000
- above 40,000

livestock Assessment

30. Do you rear livestock

Mark only one oval.

- Yes
- No

31. Livestock population

Mark only one oval.

- 1- 50
- 51-100
- 101-200
- 300-500
- 500-1,000
- 1001-5,000
- 5,000 and above

32. Total cost on livestock

Mark only one oval.

- Below GHC 999
- GHC 1,000-1,900
- GHC 2,000-4,900
- GHC 5,000-9,900
- GHC 10,000-19,900
- GHC 20,000-40,000
- ABOVE 40,000

33. Total income of livestock

Mark only one oval.

- Below GHC 999
- GHC 1,000-1,900
- GHC 2,000-4,900
- GHC 5,000-9,900
- GHC 10,000-19,900
- GHC 20,000-40,000
- ABOVE 40,000

Aquaculture Assessment

34. Are you engaged in Aquaculture?

Mark only one oval.

- ◯ Yes
- ◯ No

35. Proportion of Aquaculture sold?

Mark only one oval.

- ◯ 1-50%
- ◯ More than 50%
- ◯ Non

36. Proportion of farm input purchased?

Mark only one oval.

- ◯ 1-50%
- ◯ More than 50%
- ◯ Non

37. Total income of Aquaculture

Mark only one oval.

- ◯ Below GHC 999
- ◯ GHC 2,000-4,900
- ◯ GHC 5,000-9,900
- ◯ GHC 10,000-19,900
- ◯ ABOVE 20,000

38. Total cost for producing Aquaculture

Mark only one oval.

- Below GHC 999
- GHC 2,000-4,900
- GHC 5,000-9,900
- GHC 10,000-19,900
- ABOVE 20,000

39. Proportion FARM input purchased ?

Mark only one oval.

- 1-50%
- more than 50%
- Non

Sources of Agricultural information

Select which of the following sources is your most frequent and reliable source of agricultural information

40. Sources of Agricultural information

Check all that apply.

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Extension workers	☐	☐	☐	☐	☐
Community opnion leaders	☐	☐	☐	☐	☐
Radio	☐	☐	☐	☐	☐
TV	☐	☐	☐	☐	☐
Disability Association	☐	☐	☐	☐	☐
Leaflet	☐	☐	☐	☐	☐
Community Information center	☐	☐	☐	☐	☐
friends	☐	☐	☐	☐	☐

Access to Extension

41. Have you ever received any training from Agric officers?

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

42. Do you work with any AEA?

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

43. If yes, Source of Extension (AEA)?

Mark only one oval.

- ◯ Department of Agriculture
- ◯ Ghana Cocoa Board
- ◯ Private AEA

44. if yes, how often does he/she visit you?

Mark only one oval.

- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ Quarterly
- ◯ Yearly

45. Total number of visit by AEA last year. Indicate "0" if farmer has no access to extension *

_____

46. What is the Distance travelled by AEA to visit you?

Mark only one oval.

- ◯ less 5km
- ◯ 6-10km
- ◯ more than 11km

47. How best do you communicate with AEA?

Mark only one oval.

- ◯ Best
- ◯ Better
- ◯ Good
- ◯ Average
- ◯ Poor
- ◯ Very poor

48. Do you have access to extension services *

Mark only one oval.

- ◯ Yes
- ◯ No
- ◯ Maybe

Challenges of farmers with disabilities in accessing agricultural extension service

Select with the likest scale your challenge in accessing agricultural extension services.

49. Challenges in accessing Extension services

Check all that apply.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
lack of training equipment for training Farmers With Disabilities	☐	☐	☐	☐	☐
Ineffective communication	☐	☐	☐	☐	☐
Building designs and accessibility	☐	☐	☐	☐	☐
Discrimination	☐	☐	☐	☐	☐
inferiority	☐	☐	☐	☐	☐
Lack of special programs for FWDs	☐	☐	☐	☐	☐
Sign language interpreters	☐	☐	☐	☐	☐
Braille documents for educated virtually impaired	☐	☐	☐	☐	☐

Agricultural Meditations

50. Do you have ready and reliable market?

Mark only one oval.

- Yes
- No
- Maybe

51. Do you have access to credit?

Mark only one oval.

- Yes
- No

52. Do you practice Agricultural mechanization

Mark only one oval.

- Yes
- No
- Maybe

53. Do you keep farm records?

Mark only one oval.

- Yes
- No
- Somehow

CHALLENGES OF Farmers With Disabilities to Agriculture

indicate with the likest your challenge with Agriculture

54. Challenges Farmers With Disabilities

Check all that apply.

	Strongly agree	agree	Neutral	Disagree	Strongly Disagree
Knowledge in selecting appropriate varieties of seed crops	☐	☐	☐	☐	☐
lack of experience in pest and disease control	☐	☐	☐	☐	☐
lack of production inputs and irrigation water	☐	☐	☐	☐	☐
lack of Credit	☐	☐	☐	☐	☐
Inadequate Agriculture extension service	☐	☐	☐	☐	☐
Discrimination	☐	☐	☐	☐	☐
Land preparation	☐	☐	☐	☐	☐
Transporting heavy farm product and produce	☐	☐	☐	☐	☐
Training needs	☐	☐	☐	☐	☐

APPENDIX B

A Framework for Agricultural Extension Practices among Farmers with Disabilities in Ghana

Dear Officer,

This questionnaire aims to solicit your views and experiences on Agricultural Extension Practices among farmers with disabilities in Ghana. This research is intended for solely academic purposes, in view of that please indicate your candid knowledge and responses for the questions. Confidentiality and anonymity of your responses are assured and will be used only for writing my PhD thesis. Thank you.

NB: THIS MAY TAKE APPROXIMATELY 15 MINUTES TO COMPLETE

1. Gender

Mark only one oval.

- ◯ Female
- ◯ Male
- ◯ Prefer not to say

2. Actual age

_____

3. Age range

Mark only one oval.

- ◯ 17 or younger
- ◯ 18-20
- ◯ 21-29
- ◯ 30-39
- ◯ 40-49
- ◯ 50-59
- ◯ 60 or older

4. Educational Level

Mark only one oval.

- ◯ Post Graduate
- ◯ 1st Degree
- ◯ Training College
- ◯ Senior High School
- ◯ Junior High School
- ◯ Drop-out
- ◯ No school

5. How many years have you work as an Agricultural Extension Officer?

_____

6. How many times are you supposed to visit farmers per month?

_____

7. How often do you visit FWD farmer

Mark only one oval.

- daily
- weekly
- bi-weekly
- quarterly

8. How many extensions visit did you do last growing season (2021)

_____

9. Rate your performance on delivering extension service to FWDs

Mark only one oval.

- GOOD
- BETTER
- BEST
- POOR
- SATISFACTORY

10. Do you have any training on how to communicate with farmers with disabilities?

Mark only one oval.

- Yes
- No
- Maybe

11. Do you have any training material for educating farmers with disabilities?

Mark only one oval.

- Yes
- No
- Maybe

12. Which of the following approaches do you use in your extension delivery?

Mark only one oval.

- Participatory approaches
- Integrated approaches
- Farmer groups approach
- Income sources diversification promotion
- Promotion of productivity enhancing technologies
- Promotion of farm-level processing (value addition)
- Linkage to markets
- Promotion of savings mobilization
- Collaboration with other stakeholders
- Exit strategies

13. In the region(s) where you serve, what kind of physical disabilities do you see most among rural farmers, male and female?

Mark only one oval.

- Learning Disability
- Mental Disorder
- Hearing Impairment
- Speech Impairment
- Physical Disability
- others

14. What are the main agricultural activities of physically disabled people?

Check all that apply.

- [ ] livestock productionCrop
- [ ] cultivation Aquaculture
- [ ] Agro-forestry
- [ ] Agro-processing
- [ ] Marketing of Agricultural products
- [ ] Other: _____

Table

15. Answer as appropriately

Mark only one oval per row.

	Farm Size	Quantity of Product Produced	Income	Labour Cost	Unit Price	Produce Sold
Commodity						
Livestock Production						
Crop Production						
Aquaculture						
Agro-forestry						
Agro-processing						
Agro-Marketing						
Agro-transporter						
Challenges						

17. Which of the following activities do you engage with farmers with disabilities?

Check all that apply.

- [ ] Home and farm visits
- [ ] Farmers field school
- [ ] On-farm trail and field demostrations
- [ ] Distribution of Extension lecture
- [ ] Linking FWDs to Market and other actors along the value-chain
- [ ] Capacity building programmes
- [ ] Field days participation
- [ ] Dissemination of Agricultural technology through video film
- [ ] Suply of farm input i.e PFJ,PERD,RFERD

Taking account of the frequency and nature of disabilities among the farmers with disability in your region, what would you recommend non-governmental organizations, institutions and government agencies do to help disabled farmers to continue their agricultural activities? Please specify and explain your answers with regard to each of the following:

18. Provision of tools and equipment to facilitate disabled people's agricultural work

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly Disagree

19. Provision of special extension education programmes for farmers with disability and/or their nearest relatives

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly Disagree
- ◯ Other: _____

20. Provision of inputs, credit, loans, land, animals, etc. to farmers with disability, so that their agricultural activities can flourish

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly Disagree
- ◯ Other: _____

21. Formation of rural agricultural cooperatives, associations or groups of farmers with disability.

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly Disagree
- ◯ Other: _____

21. Formation of rural agricultural cooperatives, associations or groups of farmers with disability.

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Disagree
- ◯ Strongly Disagree
- ◯ Other: _____

22. Which of the following is a challenge for FWDs to access extension services

Mark only one oval.

- ◯ Lack of transportation facilities for extension agents
- ◯ Lack of appropriate extension materials
- ◯ High agricultural extension agents to farmer ratio
- ◯ Inadequate funds to implement practices
- ◯ Farmers' resistance to change
- ◯ Other: _____

APPENDIX C

PARTICIPANT INFORMATION SHEET

Ethics clearance reference number:

Research permission reference number:

Title: **A Framework for Agricultural Extension Practices among Farmers with Disabilities in Ghana**

Dear Prospective Participant

My name is Mark Arhin and I am researching with Dr. Clarietta Chagwiza and Professor M.A. Antwi, a professor in the Department of Agriculture and Animal Health at the University of South Africa. We are inviting you to participate in a study entitled **"**A Framework for Agricultural Extension Practices among Farmers with Disabilities in Ghana".

WHAT IS THE PURPOSE OF THE STUDY?

The study seeks to provide knowledge and unique insight into the main agricultural extension services that should be rolled out to the benefit of the farmers with disabilities.

WHY AM I BEING INVITED TO PARTICIPATE?

It will provide literature on farmers with disabilities and agricultural extension practices for Ghanaians and Africans, which will, in turn, ignite their desire to explore more in this area to enhance their understanding to enable them to suggest better ways of handling such services extended to the disabled.

WHAT IS THE NATURE OF MY PARTICIPATION IN THIS STUDY?

Questionnaires will be used for this study which involves providing answers to questions should you agree to participate in this research. Sections covered in the questionnaire include the socio-economic characteristics and challenges of farmers with disabilities. Both sections will take about 20 to 45 minutes to complete.

CAN I WITHDRAW FROM THIS STUDY EVEN AFTER HAVING AGREED TO PARTICIPATE?

Participating in this study is voluntary as you will not be subjected to pressure, force or coercion. Should you assent to participate in this study, you will be given the consent form and asked to sign it while this information sheet will be kept by you. Your identification number is not required for this study and you are free to withdraw at any time without giving a reason. However, it will not be possible to withdraw from the study once the questionnaires have been submitted.

WHAT ARE THE POTENTIAL BENEFITS OF TAKING PART IN THIS STUDY?

This study will increase awareness levels on farmers with disabilities which will provide sufficient information to plan and include farmers with disabilities in policy formation.

ARE THERE ANY NEGATIVE CONSEQUENCES FOR ME IF I PARTICIPATE IN THE RESEARCH PROJECT?

In light of the COVID-19 pandemic, enumerators will keep a 1.5m distance from you when asking you questions. You are expected to wear a mask as they will also have theirs on with their hand sanitizer which will be used at intervals during the discussion period. However, if you feel uncomfortable in answering a posed question, kindly inform the researcher.

WILL THE INFORMATION THAT I CONVEY TO THE RESEARCHER AND MY IDENTITY BE KEPT CONFIDENTIAL?

Your name will not be recorded anywhere and no one will be able to connect you to the answers you give. Your answers will be given a code number or a pseudonym and you will be referred to in this way in the data and any publications, or other research reporting methods such as conference proceedings.

Your answers may be reviewed by people responsible for making sure that research is done properly, including the transcriber, external coder, and members of the Research Ethics Review Committee. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

HOW WILL THE RESEARCHER(S) PROTECT THE SECURITY OF DATA?

Hard copies of your answers may be stored by the researcher for a period of five years in a locked cupboard/filing cabinet for future research or academic purposes; electronic information will be stored on a password-protected computer. Future use of the stored data will be subject to further Research Ethics Review and approval if applicable. After this study, the questionnaires will be shredded, and electronic copies will be permanently deleted from the hard drive of the computer after a period of 5 years.

WILL I RECEIVE PAYMENT OR ANY INCENTIVES FOR PARTICIPATING IN THIS STUDY?

There will not be any payment or incentives given to you should you decide to participate in this study. Your participation is voluntary.

HAS THE STUDY RECEIVED ETHICS APPROVAL

This study has received written approval from the Health Research Ethics Committee of the College of Agriculture and Environmental Sciences, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish.

HOW WILL I BE INFORMED OF THE FINDINGS/RESULTS OF THE RESEARCH?

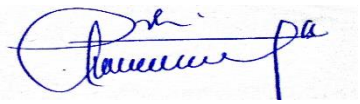
If you would like to be informed of the final research findings, please contact Mr. Mark Arhin on cell phone at +233244420299 and on email at arhinmark1@gmail.com

Should you require any further information or want to contact the researcher about any aspect of this study, please contact Mr. Mark Arhin's contact details.

Should you have concerns about how the research has been conducted, you may contact the research ethics chairperson of the CAES Health Research Ethics Committee, Prof M.A. Antwi on 011-670-9391 or antwima@unisa.ac.za if you have any ethical concerns.

Thank you for taking the time to read this information sheet and for participating in this study.

Thank you.

Signature: 

Name: Mark Arhin

APPENDIX D

CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits, and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications, and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the <insert specific data collection method>.

I have received a signed copy of the informed consent agreement.

Participant Name & Surname…… (please print)

Participant Signature……..Date……

Researcher's Name & Surname……(please print)

Researcher's signature……..Date……