UNIVERSITY OF CAPE COAST

ASSESSMENT OF COMPETENCIES OF AGRICULTURAL EXTENSION AGENTS AND SMALLHOLDER FARMERS FOR ADOPTION OF COMMERCIAL PINEAPPLE PRODUCTION TECHNOLOGIES IN THE CENTRAL REGION

ENOCH TEYE KWAO AMETEPEY

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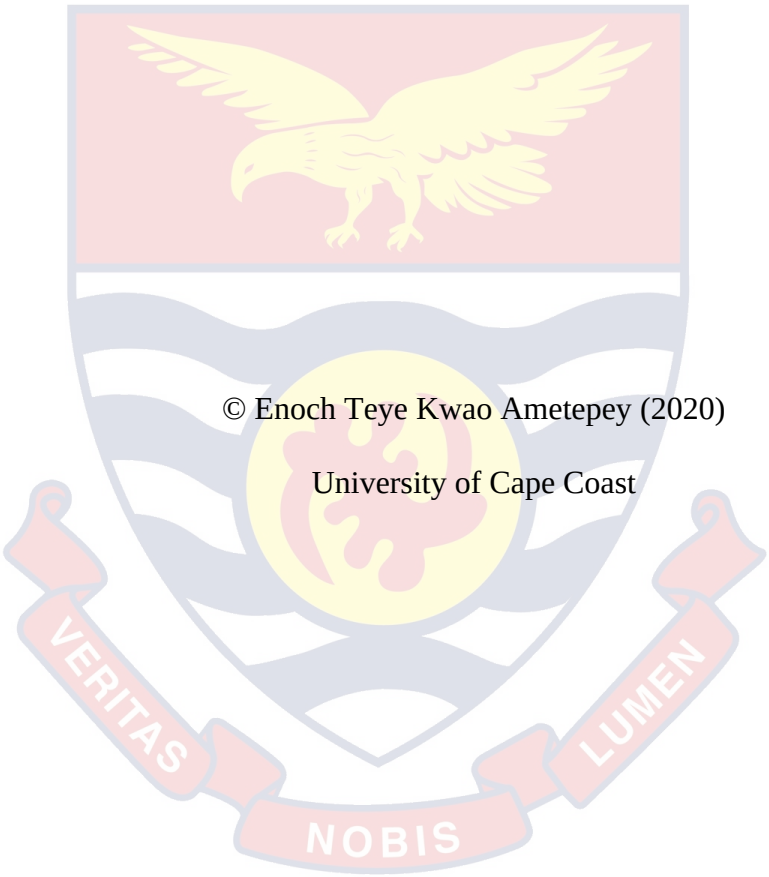

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ASSESSMENT OF COMPETENCIES OF AGRICULTURAL EXTENSION AGENTS AND SMALLHOLDER FARMERS FOR ADOPTION OF COMMERCIAL PINEAPPLE PRODUCTION TECHNOLOGIES IN THE CENTRAL REGION

BY

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A thesis submitted to the Department of Agricultural Economics and Extension of the School of Agriculture of the College of Agriculture and Natural Sciences, University of Cape Coast in partial fulfilments of the requirements for the award of Master of Philosophy Degree in Agricultural Extension.

SEPTEMBER 2020

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature: ..... Date: .....

Name: Enoch Teye Kwao Ametepey

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature:..... Date:.....

Name: Prof. Festus Annor-Frempong

ABSTRACT

The study investigated the competencies of smallholder farmers and agricultural extension agents for adoption of commercial pineapple production technologies in the Central Region of Ghana. The study used a descriptive survey design and multistage sampling procedure to select respondents. Content validated questionnaire and interview guide were used to collect data from 86 AEAs and 120 farmers. Frequencies, percentages, means and standard deviations were used to describe data whilst correlation coefficients and OLS regression were used to relate and predict variables in the study. The results revealed that farmers use commercial production technologies such as proper land selection, application of appropriate fertilizers, control diseases and plant double row along the beds. However, overall competencies of AEAs and smallholder farmers in commercial pineapple production was perceived to be moderate. Also, the system of farming practise, sex of farmers and number of acres of land cultivated influence the decision of farmers to adopt commercial pineapple technologies. It is recommended among others that there is the need for MoFA and other service providers to offer training on commercial pineapple production for AEAs so that farmers' adoption of commercialised pineapple production technologies will be enhanced.

KEY WORDS

Horticulture

Commercial production

Competencies

Production technologies

Pineapple production

Adoption

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DEDICATION

To my parents Mr. and Mrs. Eyum Kojo Ametepey and brothers (Abraham, David, Eric, Felix and Bismark).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AEA	Agricultural Extension Agent
GoG	Government of Ghana
HEII	Horticulture Export Industry Initiative
MoFA	Ministry of Food and Agriculture
NGOs	Non-governmental Organization
PERD	Planting for Export and Rural Development
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture.
OLS	Ordinary Least Square
ANTE	Agricultural Non-Traditional Export
EMQAP	Export Marketing and Quality Awareness Project.
UES	Unified Extension System
DAES	Department of Agricultural Extension Services
T&V	Training and Visit
ICT	Information Communication Technology
HPW	Fresh & Dry Fruits Company
FAO	Food and Agricultural Organization
FFSs	Farmer Field Schools
GIZ	German Agency for International Cooperation

CHAPTER ONE

INTRODUCTION

Overview

The chapter presents the general background to the study, statement of the problem, general and specific objectives, research questions, and justification of the study. Also, delimitations and limitations of the study are articulated to clearly define the scope of the inquiry and the potential setbacks. The chapter ends with definition of key terms.

Background to the Study

The agricultural sector remains the backbone of many developing countries in the world (IFAD, 2010). It provides food, employment, shelter, and income for households among other necessities of life (Umar & Phoa, 2012). A report by the World Bank in 2018 shows that the potential of the agricultural sector to reduce poverty, raise income levels of smallholder farmers and advance global food security cannot be overemphasised. To this end, in 2018, the World Bank committed USD 6.8 billion into world agriculture, with the aim to improving rural economic livelihoods (Arvis, Ojala, Wiederer, Shepherd, Raj, Dairabayeva, & Kiiski, 2018).

The agricultural sector has several sub-divisions but interconnected that work collectively in provision of employment, food, shelter, and income for households. These sectors include: crop production, livestock rearing, and forestry. Other sectors are fisheries and aquatic. Under the crop sector, there are further sub-divisions based on the economic importance and nature of the crops, which include the horticultural, thus cash and food crops. In recent times, the

horticulture sub-sector has received much attention in both the international and local levels due to the numerous potentials identified in the area.

In Ghana, the horticultural sub-sector plays a crucial role in the agricultural value food chain. Its significance spans through provision of income, employment, foreign exchange earnings, food security and serving as a source of survival for many households. What is more is that, some scholars have predicted that the horticultural sub-sector holds enormous potential for future diversification of Ghana's economy, as well as modernization of the agricultural system for socio-economic and sustainability purposes (Fuseini & Kemp, 2015)

The horticultural products in Ghana has been dominated by pineapple since the year 2000 and have been the biggest contributor to Agricultural Non Traditional Exports (ANTE). This ranged from 36 to 39 percent, and accounts for about 36 percent of the total value of export earnings. The total performance of the non - traditional agricultural (NTA) sub-sector to the overall export market in 2016 was 2,435,000 Mt valuing (USD) 371.14 million according to (Ministry of Food and Agriculture Report, 2016). This indicates that there are enviable opportunities available in the sector. Non - traditional crops such as pineapple is becoming increasingly important in Ghana due its potential in the local and export market. According to MoFA (2016), pineapple is the second most important and largely exported horticultural crop in Ghana. The report further pointed out that, pineapple contributes about 27,148 Mt in volume to crop export commodity (MoFA, 2016). Meanwhile, predominantly, smallholder farmers are the majority in the pineapple horticultural sector.

Considering the much enviable potentials in the horticultural sub-sector and the economic importance of fruits such as pineapple, the Government of Ghana (GoG) over the years has implemented programmes and policies (mostly in partnership with foreign donors) aimed at engineering development in this industry (Egyir, Mensah & Agyei-Sasu, 2012).

Currently, under the GoG's programme 'Planting for Export and Rural Development (PERD)', the government has rolled out innovative interventions to promote the production, export and value-addition of crops (including pineapple) in the entire nation. Other programmes such as the Horticulture Export Industry Initiative (HEII) and the Export Marketing and Quality Awareness Project (EMQAP) (sponsored by the World Bank and African Development Bank) were implemented by MoFA to boost productivity in the horticulture sub-sector. These interventions are primarily targeted at addressing the pressing production and marketing challenges that impede the growth of the sector.

To further increase the market prospects of pineapple, the Ekumfi Fruits and Juice Company Limited was established in the Central Region of Ghana under the current Government's flagship programme, 'One District One Factory' (1D1F). Now, there is the need for smallholder farmers (who dominate the industry) to engage in commercialization of pineapple production to feed the factory and other new market avenues the government has promoted. The necessity to highly commercialize production of pineapple in the Central Region cannot be underestimated. Again, the Central Region is known to be very proximate to Accra and Tema in the Greater Accra Region of Ghana, where most processing factories in Ghana exist, and also, the major ports for exporting

agricultural products. This further calls for the need for strategic investment into human and technological resources to sustain the production of pineapples to feed these available markets. This raises the question; what socio-technical and advisory services are required to sustainably commercialize pineapple production in Ghana?

Ejupu (2006) defined commercialization of agriculture as the process involved in a deliberate action on the part of the producers to use their land, labour, implements, advance technologies and inputs in such a way that profit is maximized from the crops produced or animals raised for the purpose of income generation. Besides, Seyoum, Lemma and Karippai (2011) also defined agricultural commercialization as a farming system through which households change their production goal from subsistence production system to a more market-oriented production based on consumers taste and preferences. Hence, commercialization of pineapple production requires the use of modern improved technologies with the potential to increase yield and output but at a reduced production cost to farmers.

According to Mahaliyanaarachchi and Bandara (2006), the role of agriculture extension in agricultural intensification is as crucial as the role it plays in subsistence agricultural farming system. In this regard, Agricultural Extension Agents (AEAs) will need to play a critical role in technology dissemination among smallholder pineapple farmers, if farmers are to increase productivity. In recent days, the efficiency in service delivery mostly require that (AEAs) be skilled in performing complex tasks in an efficient, cost-effective, and safe manner (Spencer & Spencer 2008). In the same way, Iwuchukwu, Amechi, and Udoye (2013) explained that, for agriculture to

become commercialized, sustainable and profit driven, it needs more interconnection, stronger voice and more than ever, skilled, optimistic and visionary farmers that are endowed with the potential and the necessary technologies to address key issues that affect the sector.

Joy (2010), clarified that for commercial pineapple production, farmers specifically require adherence to the following agronomic and technological usage. Land must be well cleared, 2-3 times ploughed, harrowed and ridged; the soil type should be fine with a pH of 5.0-6.0 (Hepton, 2003); and healthy disease free and graded (into sizes less than 500g, between 500-750g and more than 750g) planting materials ought to be used. Again, plants must be planted double with adequate spacing with planting density per hectare ranging from 53,300 – 63,758 suckers (Hepton, 2003). Likewise, plastic mulch to control weeds and conserve soil water is highly recommended. Crops require frequent irrigation, especially during dry seasons.

Furthermore, application of Ammonium Sulphate and other fertilizers are to be provided for crops at every growth stage. Additionally, herbicides such as Diuron (1.5kg/ha) and Bromacil (2.0kg/ha) are recommended to control weeds. This is because manual weed control is costly and difficult. Joy noted further that, Ethrel 10ppm (2.5ml/100 litres of water) + 2% urea + 0.04% sodium carbonate is to be used to induce flower at maturation state. Regrettably, most smallholder farmers lack the capacity in terms of technology and technical know-how to produce pineapple at the above standard (Joy, 2010).

Statement of the Problem

Commercialisation of pineapple production requires, smallholder farmers to adopt certain essential improved technologies to scale up large

quantity pineapple production and this would help meet the demand. For instance, in the case of Ekumfi Juice Factory Limited located in the Central Region as well as the local and export markets. Farmers, therefore, require advance competencies (knowledge, attitude and skills) as proposed by Durand, (1988) in the competency theory to produce at a commercialised level. Meanwhile, AEAs are mandated by Department of Agriculture under the auspices of Ministry of Food and Agriculture (MoFA) to facilitate technology transfer among farmers especially in the rural areas of Ghana, in an effort to promote agricultural development (Azumah, Donkoh & Awuni, 2018).

The AEAs also require certain competencies (knowledge, attitude and special skills) to transfer pineapple production technologies to address farmer's needs. The transformation of subsistence agriculture to a more commercialised system through agricultural extension, depends on the extent of competencies possessed by AEAs and smallholder farmers (Melek & Negatu, 2011). Olajide, et. al. (2012) pointed out that, increasing agricultural productivity and yield require adoption of relevant technologies and innovative scientific advisory by farmers at all levels. The key question then is; are extension agents competent enough to disseminate improved technologies required to commercialise pineapple production?

Unfortunately, there is inadequate documented evidence on the competencies AEAs and farmers possesses for commercialization of pineapple production in the Central region. Furthermore, existing literature on adoption theories has shown that socio-demographic characteristics of farmers' influence uptake of novel agricultural technologies and services. However, in the Central Region, such crucial knowledge about farmers who are into pineapple

production is missing. This could be due to little research conducted in the area. Considering the salient knowledge gap, and the recent attention pineapple production has gained in the nation, and its predicted socio-economic benefits and ever-desire to increase its production levels, it is imperative for a research that is aimed at identifying the competencies (knowledge, attitudes and skills) of AEAs and farmers to be conducted to provide scientific basis for organising tailor-based training programmes for them, if deficiencies are found. Hence, the study.

Purpose of the Study

The general objective of the study was to assess competencies of smallholder farmers and agricultural extension agents for adoption of commercial pineapple production technologies in the Central Region of Ghana.

Specific Objective

Specifically, the study sought to:

1. Describe the socio-demographic and work-related background characteristics of farmers and extension agents for commercial production of pineapple;
2. Identify the pineapple production technologies practised by farmers.
3. Determine the level of competencies (knowledge, skills and attitudes) of smallholder farmers for commercial pineapple production.
4. Examine the level knowledge, skills and attitudes of agricultural extension agent for commercial pineapple production.
5. Identify the constraints to commercialization of pineapple production in the Central region; and

6. Predict the factors that influence adoption of technologies for the commercial production of pineapples.

Research Questions

Considering the objectives of the inquiry, the following research questions are set to direct and guide the collection, analysis, and discussion of the data.

1. What socio-demographic and work-related background characteristics do farmers and extension agents possess for commercial production of pineapple?
2. What pineapple production technologies do farmers practise?
3. What competencies do smallholder farmers require for commercial pineapple production?
4. What are the needed competencies (knowledge, skills and attitudes) required by AEAs for commercial pineapple production?
5. What constraints exist against commercialization of pineapple production in the Central region?
6. Which socio-demographic and work-related background factors influence adoption of technologies for the commercial production of pineapples?

Significance of the Study

The establishment of the Ekumfi Juice and Factory Limited under the government flagship programme in the Central Region and demands for export will increase the demand for pineapple in the Central Region. The stakeholders such as farmers, MoFA, and other development agencies will have to scale up activities to ensure farmers adopt the necessary technologies to produce at

commercial level. The study has assessed the competencies of farmers and AEAs who supposed to be at the forefront for commercial production. The result of the study could be used to plan and improve the pineapple industry in the Central Region. Research has shown that staff training enhances workers' competencies and capability by improving the knowledge structures as well as the intellectual capacity of staffs (Davis & Yi, 2004). The outcome of the study has established the competencies of agricultural extension agents and factors that influence adoption of commercial technologies. The Department of Agriculture in the study districts can use the information to plan staff development oriented programmes for AEAs.

Besides, the recommendations made from the study will assist government and other stakeholder such as NGOs to improve the efficiency and effectiveness of AEAs in the pineapple producing districts. Future workshops and training for AEAs and farmers could be based on the findings of the study. Furthermore, the study result will serve as a reference point for academic purposes by adding to the body of knowledge (literature) available on pineapple production in the Central Region and Ghana at large. In addition, the documentation of the study has brought to light enough information on pineapple production in the districts under study. Finally, the result from the study will provide substantial information for RUFORUM, MasterCard and the CARP+ project on 'Development of a Sustainable Pineapple Value Chain in the Central Region' to make effective managerial decisions for agricultural development in the horticultural sub-sector in the Central Region of Ghana.

Delimitation

The study sought to emphasise the competencies of smallholder farmers and extension agents in pineapple producing districts in the central region. Extension services are offered by private and Non for profit organizations. The study however, did not include private extension agents. Furthermore, the study used questionnaires and interview guides instead of focus group discussion and other related data collection instrument to solicit information from respondents. The study also focused on competencies of smallholder farers and AEAs in pineapple production. Other competency areas in the pineapple value chain such as processing, packaging etc. were excluded.

Limitation

Pineapple production is a value chain oriented activity involving other actors such as input dealers, marketers, transporters and consumers contribute to the chain. However, resource constraints; time and funds did not allow the study all the actors. The study area is the Central Region of Ghana but only coastal and close districts/municipals were involved in the study. Inadequate resources, unavailability and willingness to participate in the study affected the data collection process and contributed due constraint of results. Agricultural extension agent availability as well as financial demands before filling posed as a challenge to the study. The outbreak of the global coronal virus pandemic has impeded data collection greatly. This has hindered the researcher from gathering data from all sample of farmers intended to be involved in the study.

Definition of Key Terms

Horticulture: It refers to the branch of plant agriculture that deals with the production of crops, mostly fruits, vegetables as well as ornamental plants for food and aesthetic purposes.

Commercialised technologies: This refers to new innovations with the potential to increase yield and enhance pineapple production. Specifically, these are selection of suitable land, ploughing, ridging, use of plastic mulch, selection of disease free planting materials, use of appropriate planting space etc.

Commercial pineapple production: Farming system through which pineapple producing households change production goal from subsistence production to a more market oriented production with the motive to generate revenue by adopting commercialised technologies. The production starts with application of commercialised technologies.

Smallholder Farmers: Farmers staying in farming communities with land size under cultivation less than 2 hectares.

Agricultural Extension Agents: They are change agents who link farmers to research in pineapple production by providing timely information and technology needed by farmers for decision making regarding their production. Specifically, AEAs are professionals that provide community-level extension services employed by the Department of Agriculture.

Knowledge: refers to the understanding an AEA or a farmer have regarding the process and technologies used in the commercial pineapple production.

Attitude: refers to the way of thinking as well as the perceived importance of pineapple production to extension agents and smallholder farmers.

Skills: it refers to physical abilities AEAs and farmers possess to actively perform pineapple production activities.

Competencies: refers to the ability (knowledge, skills and attitude) of AEAs and smallholder farmers to know and put into practise improved pineapple production technology**.**

Adoption: Refers to the acceptance, integration and use of improved technologies by smallholder farmers towards commercialization of pineapple production.

Rate of Adoption: it refers to the total number of pineapple production technologies used by smallholder pineapple farmers in the quest to commercialise pineapple production in the selected districts.

Socio-demographic characteristics: they refer to the characteristics of an individual or a population such as sex, age gender, ethnicity, educational level among others that explains why farmers and AEAs behave the way they do in society.

Work related Background characteristics: They are characteristics of AEAs related to their work that helps to understand AEAs competencies and training needs in pineapple production.

Organization of the Study

The study is organized into ten chapters. The first Chapter dealt with the introduction to the study. This covered the background of the study, statement of the problem, general objective, specific objective, research questions, and significance of the study, delimitation and limitation of the study as well as definition of key terms. Chapter Two focused on the review of literature relevant to the study. The theoretical, empirical reviews as well as the conceptual

framework for the study were included. The third Chapter contains the methodology detailing the research design, description of study area, population, sample size and sampling procedures and instrumentation were included. Chapter Three ends with data collection and analysis conducted based on specific objectives of the study. The Chapter Four presents the results and discussions according to the objectives of the study. The summary of the findings, conclusions, recommendations and areas for future research were included in the Fifth Chapter.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

This chapter consists of the theories used to understand competencies of extension agents and farmers and the decision of farmers to adopt commercial pineapple production. The competency and adoption of innovation theory, review of concepts are provided. The empirical evidence for the examination of competencies and adoption as well as the conceptual framework captured from review of literature are also presented.

Theoretical Frameworks

A theory according to Imenda (2014) is a set of interrelated concepts, definitions as well as propositions that explains an event or situation by specifying relationships that exists between variables under study. Theories are made up of principles and fundamental truth useful for explaining variables. The key variables that the study focused on were competencies and adoption. Therefore, the competency theory by Durand and Rogers' diffusion of innovation theory were used to underpin the study. These theories were used to understand how competence of AEAs and farmer's affect decisions to adopt improved technologies to commercialize pineapple production in the Central Region of Ghana.

Competency theory

The competency theory was propounded by Durand in (1988). The theory explains how competencies are developed at organizational level and individual levels. The theory states that the knowledge, attitude and skills are interdependent and reinforces one another as learning takes place all

simultaneously (Durand, 1988). The interplay of knowledge (what we know), attitude (our mental orientation to what we know) and skills (know-how) are described as competency. Each dimension is developed through a series of different learning activities otherwise known as competency building activities. Durand (1988) further explained the 'knowledge dimensions as a sequence of information assimilated and structured by individuals to understand the ''world'' and accumulated over a life's time. Knowledge is obtained through learning activities which are; formal training, use of existing knowledge based and learning by learning. Durand indicated that, skills are obtained from elements which encompass instructional companionship, use of existing skills and learning by doing. The skill dimension is contingent on the capacity of applying and using acquired knowledge in an action to achieve a specific purpose. Skill is the process where a person finds appropriate technique and information from facts prior to experiences to solve a problem. It could be intellectual or manipulative. The third dimension is also obtained through elements such as social companionship, self-identity and learning by sharing. Attitude is associated with social and effective aspects which relates to one's obligation. Durand perceived attitude as the degree of acceptance or rejection of the person, objective, event or a thing. The competency theory concludes that the three dimension are interrelated such that, without knowledge, there can be no substantial change. Skill alone is woefully inadequate to ensure change in society. In light of this, Durand (1988, p.33), ''indicated that unadulterated knowledge without relevant skill is sterile and again, knowledge without attitude could be counter- productive''. Hence, to examine the competencies of AEAs and smallholder pineapple farmers, this theory has enabled the researcher

to solicit information on their knowledge, attitudes and skills in some pineapple production area.

Diffusion of innovations theory

Roger' Innovation Diffusion Theory is one of the most popular theories that is widely used to underpin adoption studies. The theory was propounded by Everett Rogers. Everett Rogers is a professor of communication studies who popularized the theory in his book Diffusion of Innovations. He further argues that, diffusion is the process by which an innovation is communicated through specified channels over a period of time among people in a social system. The Diffusion of Innovations theory basically seeks to explain how and the reason behind the rate of spread of new ideas and technologies through a social system (Rogers, 2003). Rogers' theory explains an innovation or technology as an idea, process that is seen to be new or not familiar to a group of people living with a particular social system (Rogers, 2003). The theory explained that, every technology has two main components which include the hardware aspect, normally consisting of tools that embodies a technology as well as the software component mainly consisting of the information base for the tools (Rogers, 1983). Rogers again, pointed out that an innovation is an idea, a practices well as an object that one realises to be new. The theory further explains the channels of communication an innovation goes through to its users. The theory is hinged on certain assumptions. According to Rogers, there are four main factors that ensures adoption of improved technologies in agriculture. These are the communication channel through which the idea is communicated, the features of the technology, the characteristics (socio-demographic characteristics) of the farmers (adopters) as well as the social system where these farmers reside

(Rogers, 1983). The individual factors identified are educational qualification (years in school), age, marital status, household size, income, labour availability, farm size and other related characteristics. There are other institutional factors such as land ownership and access to extension services that play crucial role in the adoption decision by farmers. Tomas-Simin and Jankovic (2014) applied the diffusion of innovation theory to study organic agriculture. Tomas-Simin and Jankovic (2014) concluded that the diffusion of innovation theory can be used in the research of organic farming systems with respect to all the characteristics of the organic system. Likewise, Dearing (2010) applied the theory to study development innovations and focused on key concepts which included; intervention attributes, intervention clusters, demonstrating projects, societal sectors, reinforcing contextual condition, opinions leaders and intervention adaptation. Dearing (2010) further investigated the potential acceleration of the spread of evidence-based practices, programmes and policies in social work. Other several studies on adoption of innovation used this theory to understand individual's personal characteristics that influences adoption of improved technologies (Bekele and Drake, 2003; Zhang, et.al. 2015; Adesina & Baidu-Forson, 1995). Hence, for the purpose of this research, the study was delimited to the socio-demographic factors that influences farmers' decision to adopt new technologies within a social system. The theory allowed the researcher to assess the factors that influence smallholder pineapple farmers' decision to adopt commercial pineapple production technologies.

Concept of Competency

Davis, et. al (2005) defined competency as the cluster of skills, knowledge abilities as well as behaviour expected by people to succeed in assigned duties. Parry (1998) described competency as key to effective delivery of one's task in a profession, applying knowledge, attitude and skills. Similarly, Movahedi and Nagel (2012) considered competency to mean a dynamic group of qualities (knowledge, ability and skills) combined and coordinated in a way to enable an individual carry out task efficiently. Meanwhile Garavan and McGuire (2001), termed competency as the capabilities, capacities and the potentials of an individual, a group, team or work unit required for achievements of goals. Movahedi and Nagel (2012) suggested four areas needed for professionals in any field of endeavour. They include; technical (capabilities and motor skills inherent to a profession), methodological (ability to self-inform and assimilate fundamental learning and workplace techniques), Social (the ability to cooperate and communicate) and finally, the individual self-knowledge and responsibility development of personal interest and one's life plan. These key concepts of the competency theory; concept of knowledge, attitude and skill are further reviewed.

Concept of knowledge, attitude and skill

Winterton, LeDeist and Stringfellow (2006) viewed knowledge as a concrete manifestation of intelligence that is as a result of interaction between a person's capacity to acquire new ideas and situation (opportunity to learn), so is more socially-constructed than intelligence. Once more, knowledge comprises theory, concepts and implied knowledge obtained due to experience of executing certain assigned tasks. Fischer, Bruhn, Gräsel, Mandl, (2002)

further indicated that, knowledge is necessary for achieving content specific request and solving content-specific tasks. In contrast to general intellectual abilities, one can consider arbitrary knowledge as a demand specific competence

Attitude is denoted by Durand (1988) as the behaviour and 'will' of an individual, institution or an organization to achieve set goals and results. It explains how individuals perceive a task to be important or otherwise. It was further indicated that devoted individual or organization eager to thrive is more competent than a discouraged, passive one with exactly the same knowledge and skill.

According to Pear (1948) a skill is the blend of well-adjusted muscular performances. It was seen as being concerned with the quantity and quality of motor output. Typically, the term skill is used to denote the level of performance in the sense of correctness and speed in performing particular tasks assigned to a person. Durand (1988) looked at skills as the ability to act in a concrete way according to predefined objectives or processes skilled performance has long been a subject of psychological enquiry and it is of clear interest to every employer. Arguably other scholars on skill acquisition and performance, define skill as 'goal-directed, well-organised behaviour that is acquired through practice and performed with economy of effort' (Proctor & Dutta, 1995. p. 18). In a study, Bryan and Harter (1897) demonstrated that skill acquisition usually includes a sequence of phases accompanying with reaching plateaux of performance and that improvements continue well beyond achieving an adequate level. Skills in pineapple production in necessary to facilitate commercialization.

Commercial Production of Pineapple

According to Ejupu (2006) commercialization of agriculture is the process involved in a thoughtful action on the part of producers to use their land, labour, implements, advance technologies and inputs in such a way that profit is maximized from the crops produced or animals raised for the purpose of income generation. Nevertheless, Seyoum, Lemma and Karippai (2011) also explained agricultural commercialization as a farming system through which households change their production goal from subsistence production system to a more market oriented production based on consumers taste and preferences. Hence, commercialization of pineapple production requires the use of modern improved technologies with the potential to increase yield and output but at a reduced production cost of farmers. However, commercialization of pineapple production demands that smallholder farmers in the study area adopt certain commercial oriented improved pineapple production technologies to aid in the transformation and large scale production.

According to Mahaliyanaarachchi and Bandara (2006), the role of agriculture extension in commercialization of agriculture is similar to the role it plays in subsistence agricultural farming system. AEAs will need to play a critical role in technology dissemination among smallholder pineapple farmers to be able to commercialize productivity

Agriculture Extension Services in Ghana

Agricultural extension services play crucial roles in the nations where they are implemented. Extension ensures transfer of valuable information from researchers to farmers at all levels. Most especially, rural smallholder farmers' benefit from extension services to increase production and reduce risk

associated with their production according to Maunder (1978). In Ghana, history has revealed that, agricultural extension started at Aburi Botanical Gardens where certain school leavers were given training on improved crop technologies and then after went out to teach farmers in the Akwapim communities in the eastern region (MoFA, 1997). Soon after, several other organizations emerged within the Ministry of Food and Agriculture (MoFA) to carry out the extension services. As a result, the need to create a parallel extension department arose. This lead to creation of department of agricultural extension. Farmers are then given diverse technical advises from different extension agents with different technical skills and expertise.

Agricultural extension in Ghana has gone through many political shift from export commodity development approach prior to independence in 1957 to the promotion of food crop production. The Government shift in focus intended to modernize traditional farming practices, transfer resources and technology, and train personnel to address extension needs of peasant farmers. The Ministry–based general extension approach adopted in 1978 came under heavy criticism. The approach was viewed as a top-down and pro-urban, and was believed to pay more attention to progressive farmers, while totally neglecting poorer small farmers and women. The lack of coordination amongst various departments within the Ministry of Food and Agriculture (MoFA, 2001) and the poor management of the general extension approach coupled with the lack of well-trained extension workers and the poor quality of infrastructures, called for a transformation of the old system (Okorley, 2007).

The government of Ghana in its response to criticisms and external pressure from the World Bank, restructured the general agricultural extension

system formally practiced and adopted a new nationwide agricultural extension approach known as the Unified Extension System (UES) (World Bank,2015). This approach came together with the training and visit (T&V) extension management system approach. Under the UES-T&V approach, MOFA was reorganized and unified and extension was put under one department at the national level, the Department of Agricultural Extension Services (DAES). The lack of coordination and weak linkages resulting from the fact that the DAES and research institutions were under separate ministries was quickly noticed. An evaluation of the T&V approach indicated that in the pilot region were it was implemented; the T&V approach did not improve extension effectiveness. Amazingly, the approach was criticized as being rigid and non-responsive to the needs of the farmers nationally. It was then suggested that for extension to achieve greater improvement in the livelihoods of rural population in Ghana, the organization needed to focus broadly on farm production and income of farmer household livelihoods as well as the nutrition and the rural population according to (MoFA, 2001). These recommendations resulted in the decentralization of agricultural extension in Ghana.

Extension services were then organized and delivered in a variety of forms and the purpose of the decentralization introduced in Ghana in 1997 was to develop a demand driven extension system, with the ultimate goal of increasing farmers' productivity and income. Agricultural extension also links research with farmers by communicating agricultural innovations from point of innovation development to innovation users and then from farmers' problems to research station. As a result, the MoFA transferred power to the district level offices so that they could plan and implement their agricultural extension

activities and manage their resources within the framework of national policy (Okorley, 2007). Responsibilities, including service provision and administration were transferred to the agricultural unit of the District Assemblies (lowest level of government administration), while the regional and national level administration focused on policy planning, coordination, technical support, monitoring and evaluation (MoFA, 1997). The district level extension organization provides the best opportunity to effectively involve stakeholders to promote pluralism and it is now central to agriculture and rural development in Ghana.

Some few years ago, agricultural extension approaches in Ghana range from the top-down commodity-based approaches to more participatory approaches like the World Bank's Training and Visit (T&V), commodity participatory approaches, the farmer field schools (FFSs), the innovative ICT based approaches which provide advice to farmers on-line, and the promotion of mobile phones and community radio stations. These approaches have been promoted over the years by the various extension service providers, including government (MoFA, the main actors in extension), non-governmental organizations (NGOs), producer organizations and other farmer organizations.

Concept of Agricultural Extension

According to Demiryurek (2014), extension is understood differently by diverse experts depending on their background. Many people view extension as a policy tool used to enhance national food security, food safety as well as to produce enough export market. It is a tool for increasing farmer's income by endeavouring that rural farmers accept new technologies that will boost productivity. Meanwhile, Van den Ban and Hawkins, (1996) asserted that,

agricultural extension remains a service which usually assist farmers to solve their own identified problems.

According to Adam, Zakaria, and Abujaja (2014) looked at agricultural extension as an on-going process of getting useful information to farmers or rural people and assisting them to acquire the necessary knowledge, skills and attitudes to utilize effectively this information or technology to improve productivity and rural development. Conceptually agricultural extension is a communication and educational process of facilitating and managing a change process with a group of people. It provides a useful and crucial information to influence change in the competencies of rural people especially farmers to actively involve them in their development process. Agricultural extension is an aspect of adult education which changes from the usual classroom education setting in that it prepares its clientele to tackle the problems of today and helps them to live here and now. However, formal education on the other hand, prepares its learners for life after the school experience.

Agricultural Extension is mandated to spearhead the transfer of improved agricultural technologies to rural farmers to enable agricultural development. They ensure that clientele (farmers) have access to improved and tested technologies with notable benefits to increase yield and output. Agricultural extension further ensures that farmer's needs and concerns are well addressed by the appropriate institutions with the right kind of solution to solve farmer's problems (MoFA, 2003; USAID, 2002).

Again, besides the mandate stated above, agricultural extension also ensures that emerging challenges of farmers in the sector are confronted with the necessary solutions to enable the sector to develop. According to Amezah,

and Hesse (2002) there are three basic functions assigned to AEAs in Ghana in relation to delivering their mandate. They include; making regular and systematic visits to rural farms and to develop report with farmers to understand their challenges. Secondly, AEAs undertake educational activities in the form of meeting, campaigns, method demonstration, field days as well as training sessions with exhibitions. Finally, AEAs are with the mandate to provide advising services to farmers to solve their production problems.

History and origin of pineapple

Lobo, et al. (2017) reported that, pineapple originated from South America according to history, particularly in the regions of Brazil and Paraguay. It was noted that, Native America are known to consume this fruit. The countries with lowland in the tropics have this fruit widely distributed in the Caribbean and America before the arrival of Columbus (Collins, 1960). Lobo, et.al (2017) reported that, in 1493, pineapple fruits were found in an island known as Guadeloupe. The antiquity of this fruit even at the time of its discovery was evidenced at the distinctiveness of its characteristics such as the absence of seed. According to Collins (1960), the fruit was used for food, wine and medicine at the time of its discovery at Columbus. History noted it that, the pineapple fruit was a staple crop of South America Indian feast and rites related to tribal affirmations. Again, it was mentioned that, in the early 1960's the Spanish native introduced the pineapple to the Philippians in the 16th century. However, the fruit were made available to England in the year 1660 and began growing the crop in the early days of 1700s for the fruit and also as ornament for aesthetic purposes. China began growing pineapple in the 1594 and also in Africa, South Africa also began production of pineapple in the early days of 1655. In the year

1819, the 'Cayenne Lisse' variety popularly known as Smooth Cayenne from French Guyana (South America) was introduced into Europe and as a result was spread over the world in the 19th and 20th centuries as pointed out by Collins, (1951) with other varieties such as 'Queen' and 'Singapore Spanish'. As a result of the short shelf life of the fresh pineapple fruit, early commercial trade of the crop was limited to relatively short distance routes. While Puerto Rico, Florida, the Bahamas and Cuba supply the North America market, the Azores on the other hand send their produce to the European market.

Processing of the fruit started in the 19th century in South –East Asia, Australia in South Africa, Kenya and the Caribbean countries. However, due to the Second World War, the industries in the South – East were destroyed. As a result, Hawaii had gained prominence at the end of 1960 which was superseded by cote d'l vouir, Philippians and Thailand according to (Rohrback, et al., 2003). According to an unknown author, it was reported in the year 2003 that, after the Second World War, due to the invention of refrigerators, sea transport was developed to convey the fresh fruit thereby extending its self-life and proximity to the market was reduced.

Pineapple Production

Pineapple (*Ananas comosus)* is a tropical fruit known with unique qualities such as juiciness, vibrant tropical flavour and enormous health benefits to customers. Hemalatha and Anbuselvi (2013) indicated that pineapple is the third most important fruit crop grown in the world after banana and citrus. In recent days, the economic importance of Pineapple production is increasingly growing in most developing countries. Market instability and continuous changes in the world market prices of some traditional crops such as cocoa, yam

and maize among others have resulted to increasing pressure on these crops, but the case of pineapple is entirely different.

According to MoFA (2016), a report prepared by the ministry indicated that, the total yield obtained from pineapple production was 61.8 Mt/Ha. However, the potential of the crop as estimated by MoFA, is about 72 Mt/Ha. The lucrative nature of the commodity as well as the numerous opportunities of the fresh pineapple has incited both smallholder farmers and commercialised producers to engage in extensive production of the crop. In Ghana, the pineapple varieties normally cultivated are the smooth cayenne, sugar loaf and the MD2 for both the local and international market (Badu-Gyan, 2015). Among the top African countries that supply pineapple to the European Union market, Ghana was known to be one of the leaders in this industry alongside Costa Rica and Côte D'Ivoire (Achaw, 2010).

The industry as at its commencement was driven by supply from smallholder pineapple farmers who supply their produce to companies for the export (Onumah, 2007). Following the tremendous contribution of these companies to the national economy, government decided an intervention to expand the capacity of the industry and policy formulations to govern the operations in the industry seeing the enormous potentials the industry holds for the nation's agricultural development. Many small scale and commercial producers both locally and internationally around the time invested in the conducive policy atmosphere created by government to invest into the industry massively (Takane, 2004; Fold & Gough, 2008). A report from the World Bank (2016) indicated that, smallholder farmers lose 40 percent of their pineapple crops in Ghana. This is partly due to the gap discrepancies that exist in the

knowledge, skills and competencies of smallholder farmers in adopting improved pineapple production technologies noted to possess great potentials to increase yield and reduce loses. As a result, companies such as Blue-skies, Peelco and HPW sometimes do not get enough fresh pineapple for processing due to demand exceeding supply of fresh pineapple in the region. In addressing these challenges, the role of agricultural extension agents is very crucial

Propagation and Agronomic Practises

Pineapple (Ananas comosus) is usually propagated asexually from various parts of the plant (Megersa, 2017). The parts mostly used for the purpose of reproduction are crowns, slips and suckers. The crowns and slips are most common to farmers and are used by most smallholder farmers. Tissue culture is used for rapid increase of strain selections, but it is quite expensive to use this method for propagation of pineapple. Likewise, suckers from the lower axils of the leaves on the stem can be used to propagate pineapple. Pineapple requires effective land preparation (Megersa, 2017). The soil should be a fine tilth by 2-3 ploughing and harrowing followed by riding to loosen the soil. Mulching is done to reduce the frequency of weed growth and to conserve soil water. In addition, planting is done in trenches of 15-30cm deep at hilly and dry areas. Suckers must be selected from disease free and pest free healthy planting materials. It is imperative to grade suckers into sizes and categories such as less than 500g, 500-750 and those above 750g in weight. This avoids unnecessary competition among plants of different sizes (Reinhardt, et. al. 2018). Essentially, suckers must be weighed and cured in monocrotophos (0.15%), quinalphos (0.05%) and carbendazim (0.1%). Planting must be done in double rows at spacing of 70cm between rows and 30cm within plants. Usually, the

depth should be 7.5 to 10cm. It is essential to note that for commercial purposes, there must be up to 53,200 plants/ha on humid areas and 63400 plants/ha for mildly humid conditions (Reddy & Yang, 2015). These are planted in a doubled row. Importantly, weed control must be regular as well as pest and disease control and monitoring to ensure crops are not infested. Pineapple plants require certain amount of nutrients for root establishment, growth and fruiting. It is recommended to apply rate of 8:4:8g of N: P2O5: K2O per plant per year. Essentially, Nitrogen and potash of ammonium should be applied in 6 split doses at bimonthly interval (Reddy & Yang, 2015). However, during raining seasons, the application must be regulated. Phosphorus can be given to the crops during the time of planting. The first dose of fertilizer application could be provided within two (2) months of planting. Pineapples require light and frequent irrigation due to its smaller root system. The crops should be irrigated wherever necessary during the dry seasons of the year. Weed control must be given a critical attention. Meanwhile, it was noted that that hand weeding, especially is closely spread crops is difficult. Hence, it is recommended that, chemical weed control should be used in controlling weeds on the farm. Application of Diuron at 3kg/ha or Bromacil 2.5kg/ha or a combination of the two (2) at the ration Diuron (1.5kg/ha) and Bromacil (2.0kg/ha) in 600 litre of water is required to completely eradicate weeds. At maturation, a common agronomic practise is flower induction subsequent to fruiting. Ethrel 10ppm (2.5ml/100litre of water) + 2% urea + 0.04% sodium could be used to induce flower. The mixture of chemicals is sprayed into the heart of the plant 50ml per plant. Others also use calcium carbide to ensure flower induction. It is essential

to note that if it rains within 24-36 hours after application of the chemical, the treatment must be done again (Reddy & Yang, 2015; Megersa, 2017).

Empirical Literature Review

Factors influencing adoption of Pineapple Technologies

Loevinsohn, et. al. (2013) explained that, farmer's decision to adopt and use a specific technology is incumbent on the dynamics of interactions between technology characteristics and other external conditions relating to the technology. Akudugu, Guo, and Dadzie (2012) in a study to examine adoption of modern agricultural production technologies pointed out that, the factors that influence adoption of modern technologies include, farm size, expected benefits from technology adoption, access to timely credit and available extension services are the factors that significantly influence farmer's decision to adopt technologies among farm households in Bawku West District of Ghana. Akudugu et.al, (2012) found out that, farm size has a positive relationship with farmers' decision to adopt new agricultural technologies in the study area. The study reports findings that are in conformity with the finding of other research (Melesse, 2018, McNamara, et al., 1991; Abara & Singh, 1993). However, Ogada, Mwabu, and Muchai (2014) found out from a study to examine farm technology adoption in Kenya, that farm size negatively impact on farmers decision to adopt new agricultural technologies. These adoption studies imply that farmers with larger farm size are most likely to adopt new technologies than farmers with limited land space. Meaning there must be favourable policy environment to enable farmers' access to large space of land for cultivation. However, this could be challenging due to rapid population growth and other litigation constraints.

Again, Akudugu, et.al, (2012) noted that, farmers' level of education was found to have a positive relationship with their decision to adopt improved technologies. Meaning educated farmers have probability to use new technologies than non-educated farmers. Often, educated farmers have the ability to explore new ways of farming and as a result, sometimes convey new technologies to colleague farmers and relatives to adopt. Sex of farmers was found to also have a positive relationship with farmers' decision to adopt new technologies. The implication is that, male farmers are most likely to adopt new technologies than female colleagues (Akudugu, et al., 2012). The study attributed this finding to the fact that production decisions are mainly made by men which is the reason they have high probability to adopt than women. This finding on gender however, is inconsistent with the findings of Doss and Morris (2000) who found otherwise in their study.

Farmers' access to credit facility was found to be significant with decision to adopt new technologies. Lack of farm credit is a major constraint faced by most farmers in Africa, especially smallholder farmers. This is partly due to high collateral requirements by financial institutions before releasing funds to farmers. Meanwhile, when farmers are given the needed financial support, they will have the nerve to purchase and invest into new technologies to increase their production. This result conforms to the findings of MoFA (2010) study that indicated poverty and inadequate access to farmer credit has denied most farmers the ability to purchase new technologies. The findings are consistent with Kafle (2011) who asserted that, increase in financial support to farmers increases their probability to adopt new technologies. The study again agrees with Ogada, et. al (2014) and Djokoto, Owusu, Awunyo-Victor (2016)

who similarly noted that financial resource availability increases farmers' capacity for new technology uptake.

According to Chen (1999), the technology adoption process is to a large extent influenced by several factors. Mainly, the economic decision of farmers to accept a new farming technology is underpinned by certain four (4) crucial factors. These factors include: how known and competitive the new technology is among farmers, awareness of the existence of the new technology as a result of new market trends, the desire and motivation to explore the technology and finally the available resources to implement the decision of adopting the said technology.

Melesse (2018), in a review of factors that influence agricultural technology adoption in Ethiopia pointed out that, generally, the factors that influence adoption are classified into three (3) main categories. These are, factors related to the characteristics of producers (the farmer), factors related to the characteristics and relative performance of the new agricultural technology as well as the program and institutional factors associated with the particular technology. The study further asserted that, to a large extent farmer's educational level, experience in the farming activity, age, gender, level of wealth, farm size, plot characteristics, availability of labour, resource endowment, risk aversion production technology constitute the farmer characteristics that influence adoption of new technologies Melesse (2018).

However, regarding factors related to the characteristics and relative performance of the new agricultural technology, the study reported that, income generation, attributes of the new technology, the perception by individuals of the characteristics, complexity and performance of the technology, its

availability and that of complementary inputs, the relative profitability of its adoption compared to substitute technologies, the period of recovery of investment, local adoption patterns of the technology and the susceptibility of the technology to environmental hazards affect adoption of technologies. The study further mentioned that, institutional dynamics such as the availability of credit and quality technology data, product and input market accessibility, land tenure scheme and appropriate infrastructure availability and agricultural extension support contribute to adoption of new production technologies. Again, enabling policies and programs, market connections, access to institutional assistance and credit also play crucial role in farmer's decision to adopt new technologies (Shiferaw, Okello & Reddy, 2009).

Additionally, Ainembabazi and Mugisha, (2014) indicated from their finding in literature that, there are certain crucial areas that determines farmers' decision to adopt new agricultural technologies. The study indicated these areas: resource endowments which includes availability of land, farm labour, the existence of credit and markets outlets to dispose of produce from the farm; risk and uncertainty provisions; differences in soil, weather and land quality; and human capital such as education, farming experience and extension information access among others.

Socio – Demographic Characteristics of Farmers

Sex of respondents

Akudugu, et.al, (2012) in a study conducted at Bawku West District in the Upper East Region of Ghana to examine the factors that influence farm households' decision to adopt modern agricultural technologies reported that, 50 percent of the respondents were women while the other 50 percent were

males. Again, Djokoto, Owusu and Amwunyo-Vitor, (2016) in a study to identify factors that influence farmers' decision to adopt organic agriculture with an evidence from cocoa farming in Ghana reported that, 88percent of the respondents where male indicating the dominance rate of men in the agricultural sector as compared to women. Furthermore, a study by Morris, Tripp and Dankyi (1999) on the Ghana Grains Development Project reported 25 percent of the farmers who were the respondents as women while the males were 75 percentage.

Asante (2015), in a study conducted in the central region of Ghana indicated more than two thirds (61.8%) of the respondents (farmers) were males and 38.2 percent were women. Likewise, a study by MoFA (2011) reported more males than females as farmers. The study of Morris et.al, (1999) seems to agree with that of Asante (2015) which reported more males as farmers over the women in these study areas. Morris et.al, (1999) attributed the comparatively low fraction of women in farming to the fact that, in most developing countries such as Ghana, men enjoy independent access to farm lands over women. The finding of the above study is consistent with Melesse (2018) who conducted a research among rural women at Ethiopia. The study revealed that, majority of women groups in Ethiopia are disfavoured in society and as a result, they could not access valuable agricultural technologies as well as resources to aid their independent production. As a result of such inequalities in accessing farming resources, most women end up as labours in their husbands' fields or the farms of other male relatives in their communities.

More so, researchers have reported that, being a female household head negatively affects decision making regarding adoption of new agricultural

production technologies according to Melesse (2018). Consequently, some studies on adoption reported that, male household heads have more access to obtain and use innovations as compared to female household heads. However, Uzonna and Qijie (2013) in a study to examine the effect of extension programs on adoption of improved farm practices by farmers in Adana, southern Turkey reported majority of the farmers (72.5%) to be women. This finding disagree with other studies by Morris et.al, (1999) and Asante (2015)

Age of farmers

Age of farmers or household head in farming households is additional central factor that can affect the decision to adopt a new innovation by a farm household. Interestingly, a study by Blackburn (1994) pointed out that, at different ages, farmers access and use information regarding innovations differently. It was noted by Asrat, Belay and Hamito (2004)) that, the younger a farmer is, the more likely it is for him/her to willing and receptive to adoption of new technologies. Asante (2015) in a study conducted in the central region, reported 42 percent of the respondents in the study between the ages of 40-49, indicating an active workforce. The study however, revealed that, a few of the respondents constituting 13 percent fall within the age of 20-39. A study by Ahsanuzzaman (2015), on adoption and impact of agricultural technology in Bangladesh reported the average age of the respondents to be 40 years. Meanwhile, Akudugu, et.al, (2012) reported majority of their respondents (93%) between the ages of 18 and 60 years and are alleged to be key in influencing households' decision to adopt new technologies. The above findings show the balance and spread of the age groups in the agricultural farming sector. Some researchers believe that, the age of a farmer has influence on their ability

to adopt new agricultural technologies. Akudugu et.al, (2012) pointed out that, farmers whose age falls within the economic active group play a critical role in agricultural improvement and technology adoption.

Friedlander (2000), explained that, production efficiency of farmers is at the apex among farmers in the middle years but turn to decrease when extreme aging set in. Deducing from the above findings, it is very necessary for policy makers to encourage the youth into agriculture by providing them with the needed logistics and support to produce on their own. This will enhance productivity and adoption of technologies.

Educational level of farmers

FAO (2005), indicated that, education is a crucial tool needed for poverty reduction as well as elimination of hunger among farmers. Most research outcome has shown that, farmer's educational level plays a positive role in their decision to adopt new technologies. Education increases a farmer's access to quality information and positively affects their understanding of concepts and technologies. Generally, many researchers in social sciences believe that, education creates a favourable mental environment and the right attitude for farmers in decision making concerning adoption of new technologies (Caswell, et al, 2001). Ainembabazi and Mugisha (2014) in a study reported a positive significant relationship between farmer's educational level and their ability to adopt new technologies. Again, Feder et al. (1985) pointed out that, farmers' decision to accept new technologies is as a result of their level of education. Tjornhom, (1995) mentioned that, the ability of most farmers in both developed and under- developed countries to accept agricultural technologies is based on the number years these farmers had formal education.

Mahadi, et al. (2014), in on study conducted among sorghum farmers in Ethiopia reported that, one key observation was that, farm household heads who are educated have adopted new sorghum varieties more than farmers who are not educated. This finding is in line with many studies conducted in assessing factors that influence adoption of technologies. Research has shown that, farmers who have enough formal education have the ability to analyse the benefits as well as the challenges of a new technology and are able to make informed decision about adopting the technologies. Consequently, education gives farmers the opportunity to change their old fashion knowledge and skills that does not help in the development of agriculture. Education provides farmers with the ability to take practical decision regarding usage of new practices.

Melesse (2018) made a strong affirmation from his findings that, education has positive and significant relationship with the adoption of agricultural technology and improve farmers analytical and problem solving skills in carrying out their farming activities. It was further pointed out that, education also heightens a locative ability of farmers by assisting them to think more critically and use information sources efficiently. The study again asserted that, farmers with more education are likely to be aware of several sources of information, and more efficient in evaluating and interpreting information about new agricultural technologies than those with less education (Melesse, 2018).

Liao (2020) in a study to examine the effect of extension programs on adoption of improved farm practices by farmers in Adana, Southern Turkey, reported that, majority of the respondents (35 percent) had adult or non-formal education while 33.3% had primary form of education and 17.5percent of the respondents had no formal education. The study further indicated that, 10

percent of the respondents had secondary education while few (4.2%) had tertiary education. It was deduced from the study result that, most of the respondents had one form of education or the other which is quite encouraging although not much had higher level of education. This is expected to affect their decision to accept new agricultural practices to enhance productivity.

Farm size

A key factor that triggers farmer's decision to adopt a new technology has to do with the land size being cultivated (Mwangi & Kariuki, 2015). According to Bonabana-Wabbi (2002), certain agricultural technologies requires large land size for their adoption due their scale –dependent nature. Most studies conducted on adoption reported a positive relationship between adoption of technologies and land size (Ahmed, 2004; Gabre-Madhin & Haggblade, 2001; Mignouna et. al, 2011). Additionally, Baffoe-Asare, Danquah and Annor-Frempong (2013) in a study to determine the socio-economic factors influencing adoption of CODAPEC and Cocoa High-tech technologies among small holder farmers in Central Region of Ghana indicated that, cocoa farmers usually with large farm sizes are wealthy. As a result, there is more likelihood that they would readily adopt any improved technology because they have the capacity to afford.

Hence smallholder pineapple farmers with large farm size are most likely to adopt new technologies. Because, these farmers can afford portions of their land for testing new technologies. Unfortunately, farmers with small farm sizes do not have the luxury of land to attempt new technologies that demand large farm space, hence, the negative relationship between small farm size and technology adoption. However, farmers with small farm sizes turn to adopt

input related technologies that do not require large farm sizes (Mwangi & Kariulai, 2015). Again, some studies reported that, farmers with small land sizes adopt land saving technologies that have the potential to increase yield and output. (Harper et.al, 1990 and Yaron, Dinar & Voet, 1992). Meanwhile, other studies by Ridgley and Brush (1992); Mwangi and Kariuki, (2015) reported a neutral relationship between land size and technology adoption. As a result, Bonabana-Wabbi (2002) explained that, technology adoption can best be measured based on the proportion and overall land area which is suitable for a new technology.

Years of experience

Experience in farming exposes farmers to diverse competencies in terms of knowledge and skills of farming practices. These competencies are gained by smallholder farmers basically through their constant practise of farming or through trainings they have received on farming. According to one study by Lapple (2010) farmers with much farming experiences have enough knowledge and skills in making relevant decisions. Farming experience therefore increases adoption of improved technologies. But this is not always the case. Again, Genius et.al (2006) noted a significant negative relationship between competencies of farmers and their years of experience. The study noted that, the longer the farming experience gained by a farmer, the higher their competencies and ability to take considerable decisions to enhance production.

Contacts with extension agents

Farmers' contact with AEAs gives them the opportunity to express their need and challenges to be addressed by these experts. Access to extension agents on regular basis will certainly address the knowledge gap in pineapple

production among smallholder farmers. But due to the inadequacy of AEAs in most districts in the country, contacts of AEAs is almost not in existence in some communities. A study by Iwuchukwa, et.al (2013) reported that over 77 percent of farmers do not have contact with extension agents in the year 2011 while just (22.50 percent) of the respondents had contact with AEAs. The study noted that in most developing countries, extension agents to farmer ratio is an issue of concern and must be addressed if farmers can fully produce to maximise their potentials.

Trainings attended

Training provides both farmers and extension agents the opportunity to build capacity and acquire new skills to increase their ability of effectiveness. A study by Baffoe-Asare, Danquah and Annor-Frempong (2013) on the socioeconomic factors influencing adoption of CODAPEC and Cocoa High-tech technologies among small holder farmers in Central Region of Ghana pointed out the significance of training of farmers to adoption of improved technologies. The study noted among others that, training farmers provides understanding to functioning of new technology as well as technical implications associated with a technology. Again, training fuels farmers' comprehension of the challenges expected to be encountered from the application of the new technology. Effective and targeted training increases the level of proficiency of farmers which unwavering leads to adoption of improved technologies. Invariably, education is said to be intimately linked to training which positively influence farmers to adopt improved technologies.

Socio-Demographic and Work-related Background Characteristics of AEAs.

Alibaygi and Zarafshani (2008) assessed the competence of Iranian extension agents and found that 34percent of the respondents were over 40 years of age, 40.10 percent were between 30 and 39 years of age whiles 25.9 percent were between 20 and 29 years old. Age is known as a key component that predicts a AEAs competencies due to accumulated experience gained in the course of delivering their services. It has significant implications of the competence and confidence of AEAs. A study by Alotaibia, Yodera, Brennana and Kassemc (2019) to examine the competence of extension agents' regarding organic agriculture in Saudi Arabia pointed out that, extension agents generally expressed moderate interest regarding the training topic in the area organic agriculture. Again, a study indicated that the age of an agricultural extension agent is a significant element that influences the extension agents' decision to attend training program to increase capacity and raise their knowledge in general (Yadav, et. al., 2013).

Again, the study revealed that, 89 percent of the respondents had qualification in agricultural. Interestingly, out of the 90 respondents, 46 percent had a high school diploma 52.5 percent had some college training, and 1.5 percent of the respondents had educational levels below that of a high school diploma. Meanwhile, (45%) of the respondents were operating from rural villages and (55%) were operating from urban areas in Iraq (Saleh, 2017).

Work experience

Akpotosu, et. al. (2017) examined the determinants of agricultural extension agents' internet competencies in Eastern Region of Ghana and

reported that over 66 percent of AEAs had work experience extending from 1-20 years. The mean years of work experience of the AEAs was 15.1 years with standard deviation of 10.6 years. The results illustrated that AEAs had relatively varied experiences in extension. Generally, it is anticipated that the more the years of experience of an AEA, the lesser the training needs. Driskill and Brenton (2005) argued that, experience is the job-relevant knowledge gained over time. Hence, AEAs with long years of working experience are expected to have highly competent in areas of pineapple production.

Responsibility assigned to AEAs

Alotaibia, Yodera, Brennana and Kassemc (2019) examined the training needs of extension agents' regarding organic agriculture in Saudi Arabia and revealed that, there were significant differences among agricultural extension agents, in relation to responsibility in providing information related to organic agriculture. Extension agents with responsibility for information related to organic agriculture had a higher level of interest in training in organic agriculture (mean=4.08), compared to extension agents with no responsibility related to organic agriculture (mean=3.34). Deducing from the result of the study, AEAs assigned special responsibilities are more likely to undertake training in these areas to build their competencies than those not assigned special duties. Majority of the extension agents 75 percent recounted no current extension responsibility specifically in organic agriculture programming while 65.3 percent of them point out that they have no previous experience with organic farming. Akpotosu, et. al. (2017) examined the determinants of agricultural extension agents' internet competencies in the Eastern Region of Ghana. The result of their study indicated that majority (72.4%) of the AEAs

are directly responsible for extension delivery while a few of the rest of the participants are assigned with such duties as supervision (15.2%) and report writing (5.1%). This implies that majority of AEAs are involved in extension duties. Extension Agents assigned to oversee pineapple farmers are most likely to attend on the job training to build their capacity and competencies to serve their clientele better.

Area of specialization

According to Alotaibia, et.al. (2019), the Games-Howell post hoc test indicated that, agricultural extension agents who specialized in agricultural engineering (mean=4.20) had a significantly higher mean, compared with agents specializing in agricultural extension, economics, and general agriculture (mean=3.00), this is same with extension agents specializing in areas such as horticulture and postharvest (mean=3.11). Akpotosu, et. al. (2017) reported that over 50 percent of AEAs specialized in general agriculture. Meanwhile, the study noted other specialised areas such as animal science, crop science, horticulture, agricultural engineering and post-harvest that extension agent could specialise during their degree trainings. Haleem and Khan (2018), found that, the field of specialization of extension agents is not significant to the training needs of agricultural extension agents on organic agriculture. This study was interested in exploring the relationship that exist between area of specialization of an AEA and their competencies. This will be phenomenal in decision making for future policies.

Constraints in Commercial Pineapple Production

Although pineapple is the third largest export commodity in Ghana, cultivation of pineapple often comes with certain constraints that pose

challenges to farmers and other actors in the pineapple value chain. A study by Obeng (1994) to classify and rank pineapple production constraints reported several constraints that affect pineapple production at all levels of cultivation. The study reported that, inadequate credit, high cost of production, expensive labour cost, issues of land acquisition, low output process, problems with soil fertility as well as disease are key constraints that affect pineapple production.

However, Boateng (2002) pointed out that, poor organization and procurement of production inputs such as chemicals (fungicide, pesticides and fertilizer), planting materials etc. constitute the major constraints smallholder farmers experience in pineapple production. Again, another study mentioned bushfires, theft cases, and difficulty in acquiring planting materials as well as accessibility to disease free planting materials to be great challenges smallholder pineapple producers face in many developing countries.

Meanwhile, Abbey (2005) acknowledged that, a major reason why smallholder pineapple farmers face challenges is inability to organize themselves into pineapple cooperatives which is a minimum requirement to assessing and using credit as well as managing export, inputs for production and transportation of produce to the market. These have affected the overall tonnage produced by smallholder farmers thereby denying the vase opportunities in the sector.

Again, Yeboah (2000) examined the profitability of Ghana's pineapple export and reported that, pineapple production is a very lucrative business mostly for those into the export of the fresh pineapple. However, the study further stated that, lack of crop insurance programs as well as market options availability is a challenge for smallholder farmers. Interestingly, the study

suggested that, exporters could group themselves into cooperatives to present a more unified front to importers and explore issuance options available in the agricultural sector. He also indicated that, government should incorporate pineapple financing into the other business financing programs developed in the country.

Mba (2019), in a survey on pineapple quality problems and postharvest losses in Benin identified several constraints in pineapple production. Among the constraints identified by the study are; problem with land acquisition, production/distribution of planting materials, financial constraints, climatic constraints, poor water management and irrigation problems, seeds/planting materials unavailable, high cost of farm inputs, lack of technical know-how, labour inefficient, pest, weed and diseases problems, poor fertilization, poor in field sanitation, poorly trained labour, lack of infrastructure and lack of operating capital. Mba, (2019) explained that these were major constraints identified with smallholder pineapple producers in Benin. Addressing these challenges will definitely lead to higher yield thereby increasing overall yield of the farmers. For the purposes of this study, the researcher classified the pineapple production constraints into inputs, management marketing, and government policy related constraints

Conceptual Framework

The conceptual framework is designed to demonstrate the relationship between key variables used in the study. AEAs and smallholder farmers require certain competencies in order to scale up pineapple production in the Central region. These competencies are classified into three dimensions which are knowledge: obtained through training and learning, attitude; behaviour/

perceived importance, and skills; ability to put acquired knowledge in pineapple production (Durand, 1988). According to Durand, (1988), these three aspects of competencies are interdependent.

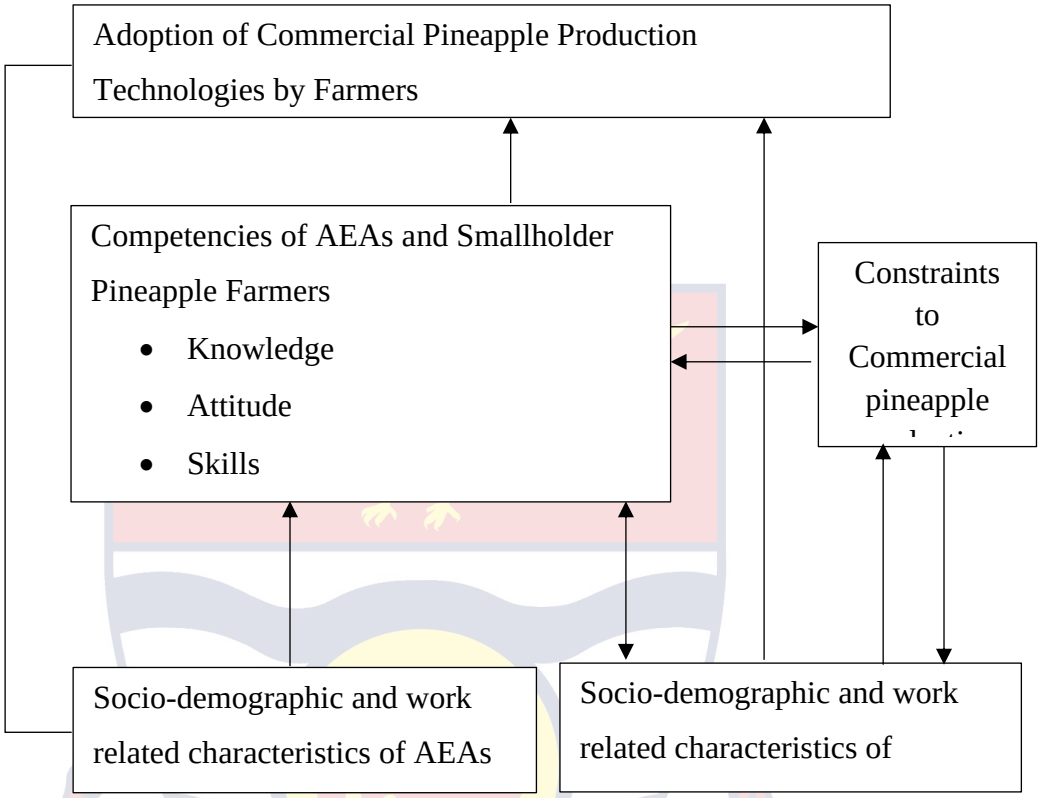

Figure 1: Conceptual framework
Source: Author's Construct (2020)

To scale up pineapple production, there is the need to understand the competencies of AEAs to adequate train farmers to also build their competencies. Farmers possess certain sociodemographic characteristics that determines their decision to adopt commercialised pineapple production that must be understood (Rogers, 1983). The socio-demographic characteristics also determines their level of competencies. To ensure adoption of commercial pineapple production in the central region, there are certain perceived constraints which are classified into input, managerial, market oriented and market oriented and government policy related constraints. These constraints

must be assessed and addressed to pave way for farmers to holistically adopt commercial pineapple production. Hence, the Roger's diffusion of innovation theory aided the researcher in explaining the socio-demographic factors that influence smallholder farmers to adopt commercial technologies. The competency theory on the other hand assisted in assessing the competencies possessed by AEAs and smallholder farmers in pineapple production.

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

This chapter describes the methods and procedures that were used to collect and analyse data for the study. The chapter covers the research design, description of the study area, study population, sample size, sampling procedure, instrumentation, validity of the instruments, pre-testing and testing for reliability and procedures for data processing and analysis.

Research Design

The study is a descriptive survey that centred on a particular population with distinctive characteristics (Asika, 2008). Furthermore, the design compared and contrasted objectives, opinions, perceptions, attitudes and other characteristics of the population (Bennette, 1979). The study is a descriptive survey because, it allowed the investigator to collect data of interest from a specific sample (Nwankwo, 2010). Again, using a descriptive design requires a researcher to describe variables from a sample drawn for the study and generalise the result. The descriptive survey was used because it is flexible, easy to use and inexpensive (Sukamolson, 2007). The study falls within the requirements of the above literature hence, deemed descriptive survey appropriate.

Profile of Study Area

The study was conducted in the Central region of Ghana. The Region has 21 administrative districts. It is located in the South –Western centre of Ghana and shares boundary with the Ashanti Region in the North, Eastern

Region to the North-East, Greater Accra Region to the South-East and on the West by the Western Region. It is bounded to the South by the Gulf of Guinea.

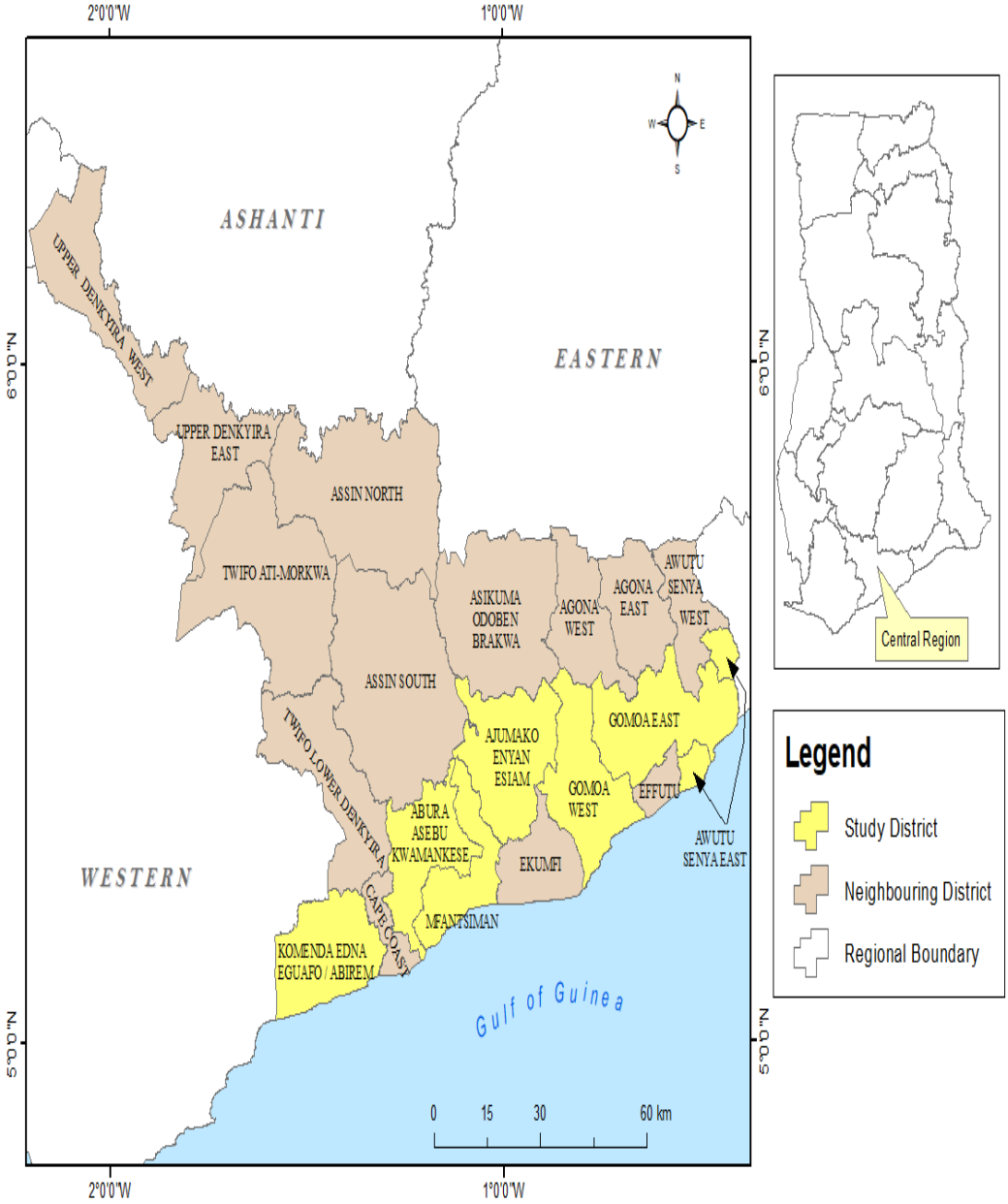

Figure 2: Map of the study areas in National and Reginal Context.
Source: Department of Geography and Regional Planning, UCC (2020).

The coastline is about 150km, and it is the longest coastline in the entire country. The main language of communication among citizens is Fante. However, most of the citizens understands the English language. This could be attributed to the numerous schools situated in the region which has resulted into

most citizens interacting with students at all levels. The region experiences bi-modal rainfall pattern allowing crop farmers to produce in the major (May-June) and the minor (September - October) farming seasons. There is severe dryness between Decembers – February. The variability in climate and vegetation which is influenced more by rainfall than temperature with double maxima rainfall. The annual rainfall in coastal locations ranges between 750mm and 1,000mm while in the hinterlands between 1200mm and 1500mm are measured per annum. The topography and climatic conditions make pineapple cultivation very easy in the region. The relative humidity hovers between 50 – 85 percent.

The national population and housing census report in 2010, specifies that the Central Region had a population of 2,201,863 citizens. Which is approximately 8.9 percent of the national population (GSS, 2012). Agriculture and its related activities employ over half of the citizens of working age in the region and provides livelihoods opportunities for households. Out of the 9830km^2 total land area, approximately 7864km^2 of the total land area indicating about 786,400 ha can be used for agricultural purposes. Unfortunately, 393,200 ha of the agricultural land is not cultivated. Most farmers in the region are smallholder producers with average land size of 0.5 hectares (MoFA, 2010). That notwithstanding, there are some large farm holdings in the Region. Especially, those practising out-grower methods; where their inputs are supplied by organizations for cultivation. In terms of land ownership, most of the indigenous citizens own the lands used to cultivate agricultural produce. Ownership inheritance from ancestors, distribution by family heads and through chieftaincy orders. Agro inputs shops are located where farmers could easily purchase agricultural inputs materials. Additionally, pineapple farmers have

averagely good market access and roads on which they cart produce to customers. It is worth noting that, roads leading to the major market areas in the region are averagely good according to (Badu-Gyan, 2015). Agricultural extension services provided by the Department of Agriculture are carried out on all crops in the districts. The extension officers are given operational areas to work. They visit farms to provide advice and technologies to boost production of crops the study. However, there are other NGO's such as GIZ, HPW etc. that provide extension services to smallholder farmers to promote pineapple production in the central region. Literature from Badu-Gyan (2015), indicated Awutu Senya East district, Gomoa East district, Gomoa West, Ajumako Enyan Essiam, Ekumfi district, Nfantsiman Municipality district, and Komenda Edina Eguafo Abrem and Abura Asebu Kwamankese as pineapple growing districts in the Central region. Hence these districts were as indicated in the map above were contacted for the study.

Study Population

Vanderstoep and Johnston (2009) described a study population as the universe of people to which a study would make generalization. The population therefore consists of all the elements under investigation. It determines the number of people to be involved in a study. The population for the present study in particular is therefore agricultural extension agents of the Department of Agriculture of the metropolitan, municipal and Districts Assemblies in the Central region and the respective smallholder pineapple farmers (farmers who cultivate land size less than 2 hectares (World Bank, 2011).

Sample Size and Sampling Procedures

A sample is a group of relatively smaller number of people carefully chosen for a particular study from a well-defined population (MacCallum, Widaman, Preacher & Hong, 2001). Tronchin (2006) had suggested that, to ensure precision of inferences from a study based on the population, there is a need for representativeness of the population. Therefore, a well-represented sample enables a researcher to generalize the findings to an entire population from which they are selected. Cohen, Manion and Morrison (2007) argued that, a good sample size does not necessarily depend on how huge or less the sample but rather the purpose and the kind of population under study. However, the larger the sample size the more reliable and representative the information obtained from the sample. Best and Kahn (1998) had earlier indicated that, a sample size depends predominantly on either the nature of population, the kind of data to gather as well as resources available for the study. Furthermore, Franenkel and Wallen (2000) suggested that for a descriptive research, the sample should minimally contain 100 respondents for a correlational (relationship) analysis while for casual comparative study, a minimum of 30 will suffice. A minimum of 50 respondents are required to explore relationship between variables in a relational study. The above information assisted the researcher in selecting the sample set of respondents from agricultural extension agents and smallholder pineapple farmers that constitute the population of the study. A multistage sampling procedure and census were therefore adopted to select smallholder farmers and AEAs respectively. According to Sarantakos (1998) a multistage sampling technique allows a sample to be drawn from an

already selected sample one after the other. However, only the last sample of subjects is studied.

Purposive selection of pineapple growing districts and municipals in the Central region was done. According to Badu-Gyan (2015) Awutu Senya East district, Gomoa East district, Gomoa West, Ajumako Enyan Esian, Ekumfi district, Mfantsiman Municipality district, and Komenda Edina Eguafo Abrem and Abura Asebu Kwamankese are well-known pineapple growing districts in the Region.

Sampling Procedure for AEAs

The list of all AEAs from the eight (8) districts; namely; Awutu Senya East district, Gomoa East district, Gomoa West, Ajumako Enyan Esian, Ekumfi district, Mfantsiman Municipality district, and Komenda Edina Eguafo Abrem and Abura Asebu Kwamankese was obtained from the MIS Officers in each district. All AEAs in the purposely selected districts were included in the study because, the number of those present and actively functioning were about 97 which is relatively a small population but the sample size deemed adequate for a descriptive survey. Out of a total of 97 AEAs list compiled, 86 responded to the research instrument. The number of AEAs based on district is presented in Table 1.

Table 1: List of AEAs in the Districts

District	Number of AEAs
Ekumfi	15
Ajumako Enyan Esian	12
Awutu Senya East	13
Gomoa East	12
Gomoa West	11
Mfantseman Municipality	8
Komenda Edina Eguafo Abrem	15
Abura Asebu Kwamankese	11
Total	97

Source: Field Survey, Ametepey (2020)

Sampling Procedure for Smallholder Farmers

The first stage is the purposely selection of the eight pineapple producing districts Awutu Senya East district, Gomoa East district, Gomoa West, Ajumako Enyan Esian, Ekumfi district, Mfantsiman Municipality district, and Komenda Edina Eguafo Abrem and Abura Asebu Kwamankese in the Central Region. At the second stage, 50 percent of the eight purposively selected districts was selected representing 4 districts using simple random technique. The four districts 50 percent were randomly selected. The research instrument answered by the AEAs in the four selected districts were selected from the other four districts. At the next stage, the list of smallholder farmers including (names, contacts and location) in those districts were compiled to constitute the population of farmers since there was no database on smallholder pineapple farmers in the various districts. This was used as the sampling frame for the study since, the researcher could not obtain the list from the Department of Agriculture. A total of 194 smallholder farmers cultivating less than 2ha of pineapple was compiled to constitute the population. According to Krejcie and Morgan (1970) in determining a representative sample size, for a population of 190, it requires a sample of 127 respondents.

Selection Procedure for Individual Farmers

To ensure representativeness 127 smallholder farmers were randomly selected from the list of farmers from the four districts to constitute the sample to be interviewed. To do this, an online system for generating random numbers was used. There are several systems used in generating random numbers. However, this study adopted the system on this site 'https://andrew.hedges.name /experiments/random. The total population was inputted into the online system

and random numbers were generated from 1 to 120 out of the total population. This random numbers were coped and used to select farmers from the sampling frame created. These farmers were located with the assistance of the AEAs in those districts, where the interviews were conducted. Best and Kahn (1998) explained the unbiased nature of simple random sample, by indicating that it guarantees every individual in the population has equal opportunity of being selected.

Data Collection Instrument

Two different set of similar research instruction questionnaires were used; interview schedule for Farmers (Appendix A) and questionnaires for AEAs (Appendix B) to collect data for the study based on the objectives of the study. The questionnaire for AEAs consists of two main parts. Part I obtained information on the socio-demographic and work related characteristics of AEAs such as age, sex, level of education, years of working experience, professional grade, major area of specialization, basic language of communication, the number of trainings attended and major job responsibility of AEAs. The second part consists of items that measured competence (knowledge, attitude and skills in pineapple production). The perceived level of knowledge was measured using a 5 point Likert scale ranging from 1=Very Low Knowledge to 5 =Very High Knowledge. The attitude (i.e. perceived importance) was also measured along a 5-typed Likert scale ranging from 1 =Very Lowly Importance to 5 =Very Highly Importance. The perceived skill items were measured from Likert type scale of 1 =Very Low Skilled to 5 =Very Highly Skilled.

The questionnaire (structured interview schedule) for Farmers consists of 5 parts based on the specific objectives of the study. Part 1 solicited data on

the socio-demographic attributes of smallholder farmers. Items included are type of farming, age, sex, educational level, farming experience, years of cultivating pineapple, size and composition of household, membership of organization, acreage of land cultivated, number of fruits harvested per acre, income, costs of fruit, sources of credit, land ownership, contacts with AEAs, numbers of trainings attended, trainings received and the varieties of pineapple cultivated. The part II of the interview schedule consists of a list of improved pineapple production technologies adopted by farmers. The level of adoption was measured using 1=Yes and 2=No. Part III of the interview schedule solicited information on sources of information of farmers on pineapple production. The Part IV measured competence of farmers (knowledge, attitude and skills in pineapple production). The perceived level of knowledge was measured using a 5 point Likert scale ranging from 1=Very Low Knowledge to 5 =Very High Knowledge. The attitude (i.e. perceived importance) was also measured along a 5-typed Likert scale ranging from 1 =Very Lowly Importance to 5 =Very Highly Importance. The perceived skill items were measured from Likert type scale of 1 =Very Low Skilled to 5 =Very Highly Skilled). The Part V consisted items that solicited information on the constraints faced by farmers in pineapple production.

Table 2: Interpretation of Likert Type Scale for Competencies in pineapple production of AEAs and Smallholder Farmers

Rating	Interval	Competency
1	1.00-1.44	Very low
2	1.45-2.44	Low
3	2.45-3.44	Moderate
4	3.45-4.44	High
5	4.45-5.00	Very High

Source: Field Survey, Ametepey (2020)

Validity of Instruments

Content validity of the instrument was ensured by correcting errors identified in the instrument by re-casting items to bring clarity to the respondents. The variables measuring various constructs were either added or removed to ensure they measure clearly what they were supposed to measure. The Supervisor and other Senior Lecturers in the Department of Agricultural Economics and Extension at the University of Cape Coast ensured the content validity of the instruments. Questions were rephrased and formatting were suggested to ensure conformity with standards of social research.

Pre-testing Instruments

The instruments were pre-tested to reduce discrepancies, ambiguities and deficiencies of the items and also to check the internal consistency of the Likert items on the instrument (Alumode, 2011). The data collection instruments were pre-tested between 10th to 14 November, 2019. Ten questionnaires were given to agricultural extension agents in the Cape Coast Municipality to respond to them. Twenty (20) smallholder farmers from

Daboase in the Wassa East district in the Western region were interviewed using the interview schedule for farmers before 10th to 14th November 2019.

The parts of the instruments that contains items that used Likert type scales to measure perceptions were entered into Statistical Package for Social Sciences (SPSS) version 25.0 for analysis to generate Cronbach's Alpha coefficients. The alpha coefficients ranged from 0.97, 0.97 and 0.99 respectively for knowledge, attitude and skills for AEAs. The Cronbach's Alpha estimates for farmers were respectively 0.87, 0.94 and 0.87 for knowledge, attitude and skills.

Table 3: Reliability Coefficient of subscales of Research Instrument

Variable	AEAs		Farmers	
	Number of Items	Cronbach's. Alpha Coefficients	Number of Items	Cronbach's. Alpha Coefficients
Knowledge	22	0.97	21	0.87
Attitude	22	0.97	21	0.94
Skills	22	0.99	21	0.87

Source: Field Survey, Ametepey (2020)

According to George and Mallery (2003) for a descriptive study, the greater the Cronbach's Alpha coefficient the higher the internal consistency of the items on the scale. The coefficients greater than 0.9 = Excellent, >0 .8 = Good, >0 .7 =Acceptable, >0 0.6 = Questionable, > 0.5 = Poor, and a coefficient less than 0.5 = Unacceptable. The result of the Cronbach's Alpha estimates from the scales ranged from 0.87 to 0.99. This indicates clearly that the items on the scales are considered to be reliable.

Data Collection and Field Work

The pineapple growing districts according to literature were purposively selected. The researcher contacted the district Directors and MIS officers of the Department of Agricultural Extension in the eight districts for monthly technical review meetings days. This enabled the researcher scheduled to meet with the AEAs to administer the instruments. Feedback including specific date, time and venues for meeting at each district was communicated. At each scheduled meeting, the researcher explained the purpose of the study and sought the consent of AEAs. The instruments were then administered to all AEAs and were given time to complete. Some AEAs who were not present at the monthly technical review meetings were subsequently contacted. Times was scheduled for interviews via the mobile phone. A total of 86 AEAs responded to the instrument. After the first phase of data collection which involved the AEAs, the second phase which involved smallholder farmers commenced few weeks afterwards. The researcher and research assistant with the support of AEAs in the randomly selected pineapple growing districts visited the selected farmers in the homes and some on their farmers where consents were sought and the interviews were conducted. Prior to the data collection, three research assistants were trained to collect part of farmers' data. The training process was such that the researcher accompanied by assistants interviewed farmers whilst the assistants looked on. After that, each research assistant was asked to interview a farmer whilst the others look on. Areas of difficulty in the instrument were discussed among the team. The researcher and research assistant took time to explain each item on the instrument to the best understanding of the farmers. This was to ensure the questions were understood properly. Using the

determined sample size from the four districts, a total of 120 smallholder pineapple farmers were interviewed in the four selected districts. The data was collected between 4th January and 30th March, 2020.

Data Processing and Analysis

The data obtained for the study was organised and cleaned by asking the enumerators to clarify the writings of the open ended questions on the instruments. The open ended answers were categorised into items. The classified coded items were entered into Statistical Package for Social Science Sceneries software (SPSS, version 25) to generate descriptive statistics. To describe the socio-demographic and work related characteristics of AEAs and smallholder pineapple farmers in the Central region, descriptive statistics such as frequency, percentages and means were used to describe the farming system, sex, education, AEAs operational area, area of specialization of AEAs, channels of communication used by AEAs, visits by AEAs to farmers, AEAs staff position, job responsibility, membership of organization, type of organization of farmers, farmers sources of credit, land ownership and market availability. Furthermore, the following variables were computed using frequencies, percentages, mean and standard deviations: age, working experience, trainings attended, total fruits per acre and acreage of land cultivated. Again, correlation coefficients (Pearson, Point Biserail and Spearman rho) were used to estimate factors that influence adoption technologies and commercial pineapple production by farmers. Table 4 presents the analytical frame work used for data analysis.

Table 4: The Codes, Sign and Explanatory variables used in analysing objectives

Objective	Explanatory Variables	Scale of Measurement	Coding	Statistics used
Description of socio-demographic and work related characteristics of AEAs and Farmers	Farming Systems	Nominal	1= Organic 2= Conventional	Frequency / Percentage
	Sex of Respondents	Nominal	1= Male 0= Female	Frequency / Percentage
	Age	Scale	Number	Frequency / Percentage/ Mean/ SD
	Education	Ordinal	Educational level	Frequency / Percentage
	Operational Area of AEA	Nominal	1= Rural 2= Urban	Frequency / Percentage
	Communication Channels	Nominal	1= Always 2= Sometimes 3= Often 4= Never	Frequency / Percentage
	Number of Visits by AEAs	Scale	Number of times	Frequency / Percentage/Mean/SD
	Staff Position	Ordinal	1= Frontline 2=District Officer 3= MIS 4= Director 5=Other	Frequency / Percentage
	Job Responsibility	Ordinal	Roles and responsibilities	Frequency / Percentage
	Membership of Organization	Nominal	1= Yes 0= No	Frequency / Percentage
	Type of farmer Organization	Nominal	1= Farmer group 2= Religious group 3= Cooperative Society 4= Political group	Frequency / Percentage

Table 4 Cont'd.

	Position	Nominal	1= Leadership 2= Ordinary member	Frequency / Percentage
	Source of Credit	Nominal	1= Self financing 2= Family/Friends 3= Bank loan 4=Farmer group 5= NGOs	Frequency / Percentage
	Land ownership	Nominal	1= Owner of land 2= Family land 3= Rented 4= Shared 5=Traders 6= Others	Frequency / Percentage
	Acre of land Cultivated	Scale	Number of acres	Frequency / Percentage/Mean/SD
	Income	Scale	Amount	Frequency / Percentage/Mean/SD
	Contact with AEA	Nominal	1=Yes 2= No	Frequency / Percentage
	No. of Contacts	Ordinal	Numbers	Frequency / Percentage/Mean/SD
	Trainings attended	Scale	Number	Frequency / Percentage/Mean/SD
Examining the pineapple production technologies practised by farmers towards commercialization of pineapple production	List of pineapple technologies	Nominal	1= Yes 2= No	Frequency / Percentage
Determining the level of competencies (Knowledge, skills and attitudes) of smallholder	List of competency areas in pineapple production presented to farmers.	Scale	Knowledge: 1=very low knowledge 2=Low knowledge 3= Moderate knowledge 4=High	Mean/ Standard Deviation.

Table 4 Cont'd.

farmers for commercial pineapple production			knowledge 5=Very High. Attitude: 1= Not very important, 2=Not Important, 3= moderately important 4= Highly important 5=Very highly Important. Skill: 1=Very low skill 2= Lowly skilled 3=Moderate Skills 4=Highly Skilled 5= Vey highly skilled.	
Determining the level knowledge, skills and attitudes of agricultural extension agent for commercial pineapple production	List of competency areas in pineapple production presented to AEAs.	Scale	Knowledge: 1=very low knowledge 2=Low knowledge 3= Moderate knowledge 4=High knowledge 5=Very High. Attitude: 1= Not very important 2=Not Important 3= moderately important 4= Highly important 5=Very highly Important. Skill: 1=Very low skill 2= Lowly skilled 3=Moderate Skills 4=Highly Skilled	Mean/ Standard Deviation.

Table 4 Cont'd.

			5= Vey highly skilled.	
Examining the constraints to commercialization of pineapple production in the Central region.	Input Constraints Management Constraints Market Constraints Government Constraints	Nominal	1= Yes 2= No	Frequency/ Percentage

Table 5: The Codes, Sign and Explanatory variables used in the Regression Analysis

Objective	Explanatory variables	Code	Sign	Explanation (Assumptions)
Predicting the factors that influence adoption of technologies for the commercial production of pineapples	Type of Farming system	1= Organic 2= Conventional	+/-	Farming system determines the competencies of pineapple farmers
	Sex	1= Male 0= Female	+/-	High probability of males to have high competencies in pineapple production
	Age	Number of years	+	Older farmers are likely to have more competencies than younger farmers.
	Education	Educational level	+	Higher education increases the probability of high competencies in pineapple production.
	Household head	1=Yes 0 = No	+	Framers who are household heads are more likely to have more competencies in pineapple production.
	Membership of organization	1=Yes 0=No	+	Farmers who are part of farmers organizations are likely to have more competencies
	Farm size	Number of acres	+	Higher farm size increases the probability of high competencies in pineapple production.
	Title of land	1= Owner of land 2= Family land 3= Rented 4= Shared	+	Ownership of farm land increases the probability for adoption and competencies in pineapple production.

Table 5 Cont'd.

		5=Traders 6= Others		
	Contact with AEA	1= Yes 2= No	+	Contacts with AEAs increases adoption and competencies of farmers in pineapple production
	Number of times AEAs visit	Number of times	+	Higher number of visit of farmers increases the probability of adoption and competencies of farmers.
	Training Attended	1=Yes 2=No	+	Higher number of training increases technology adoption and competencies of farmers.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents data and discuses results on socio-demographic and work related background characteristics of farmers and extension agents, the type of technologies practised by smallholder farmers, the competencies possessed by smallholder farmers and AEAs as well as the constraints that hinder commercialization of pineapple production in the central region. Again, the factors that predict rate of adoption was also included.

Socio-Demographic and Work Related Background Characteristics of Respondents

Operational areas of AEAs

Figure 3 presents result on the operational area of AEAs in the eight selected districts where the study was conducted. The results revealed that majority (93%) of AEAs operate in rural communities while a few (7%) operate in urban area. The Food and Agriculture Organization (FAO) indicated that about 70 percent of rural dwellers depend directly or indirectly on agriculture survival.

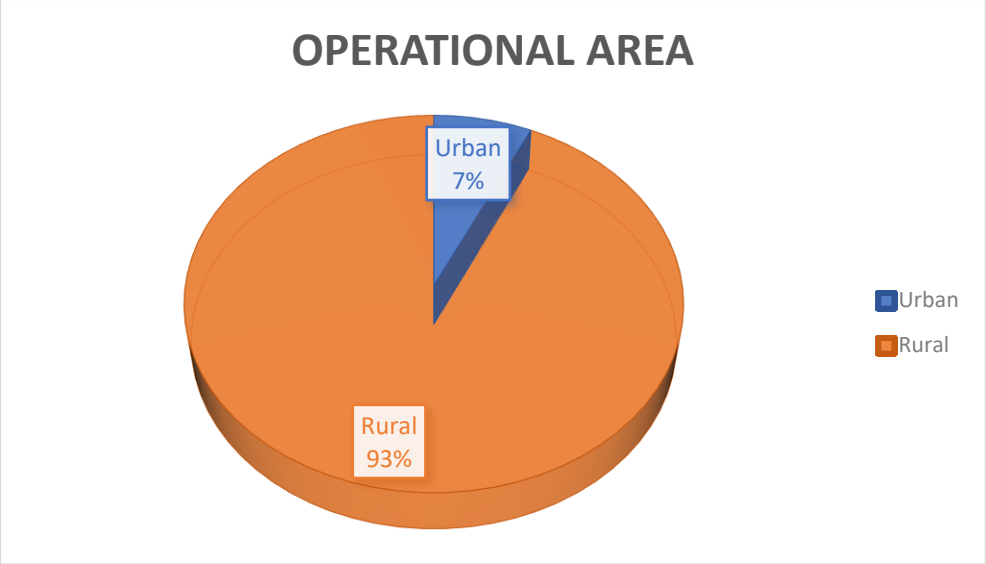

Figure 3: Operational area of AEAs
Source: Field Survey, Ametepey (2020)

Majority of AEAs working in the rural areas indicated the fairness in the distribution of AEAs to where their services are needed since majority of farmers in Ghana are found in the rural areas (FAO, 2009).

Sex of AEAs and farmers

In the agricultural sector, sex plays a crucial role in policy formulation and decision making. The result from Figure 4 indicated that there were more male AEAs (79.1%) and farmers (80%) respondents compared to females (20.1%) for AEAs and (20%) for farmers. The high number of male to female farmers is not surprising because of the complex nature of pineapple production which makes it more labour intensive and difficult. MoFA (2010), confirmed the high number of male AEAs than females AEAs. Again, for every 5 males there was one female AEAs in Ghana. This is not surprising since it conforms to the findings of Akpotosu, et. al. (2017) in a study to examine the determinants of agricultural extension agents' internet competencies in the Eastern Region of Ghana.

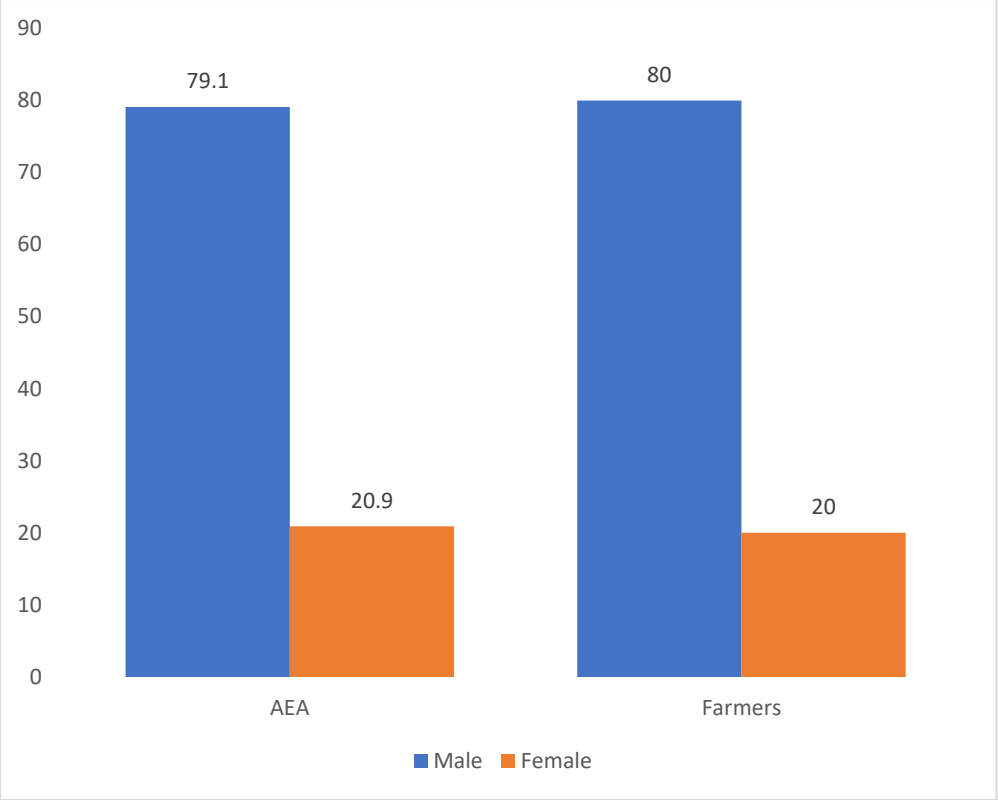

Figure 4: Sex distribution of AEAs and Farmers
Source: Field Survey, Ametepey (2020)

The result is also consistent with Olorunfemi, et. al. (2019) who reported that majority (72.3%) of the respondents were males in a study on extension service in Kwara State, Nigeria. Meanwhile, a more closely related study conducted in Nigeria by Akinbile and Otitolaye (2008) revealed that there are more male (73.5%) extension agents than female (26.5%) which suggest that, the nature of the extension work making it unbearable for women due to their domestic responsibilities.

Age distribution of AEAs and farmers

Table 6 presents information of the age distribution of AEAs and farmers. The result revealed that whilst 64 percent of AEAs were 40 years below, 40 percent of farmers belong to same category. This indicates that Less than one-fifth of AEAs will be going on retirement between now and the next 9

years. Only 11.6 percent farmers were beyond the retiring age of 60 years. The mean ages of 39 years and 45 years of AEAs and farmers respectively indicated that the respondents are youthful.

Table 6: Frequency Distribution on Age of AEAs and Farmers

Age	Age of AEAs		Age of Farmers	
	Frequency.	Percent	Frequency.	Percent
20-30	22	25.6	17	14.2
31-40	33	38.4	31	25.8
41-50	15	17.4	35	29.2
51-60	16	18.6	23	19.2
61-70	-	-	13	10.8
71-80	-	-	1	0.8
Total	86	100.0	120	100.0

Source: Field Survey, Ametepey (2020). AEAs Mean= 39, SD=10. Farmers Mean=44.78, SD=12.39. Range= 35

The result is consistent with the findings of Olorunfemi, Adebayo, Letsoalo and Modirwa (2019) who examined the evidence in competency needs of extension agents on value added fish production from Kwara State, Nigeria. Also, Idrisa and Ogunbameru (2008) established that normally, extension staff between ages 25 to 45 years are found to be most active and full of energy hence, appropriate for extension service delivery.

Educational Level of AEAs and Farmer

Figure 5 presents the level of education of AEAs and farmers. More than half (66.3%) of AEAs have had up to diploma to postgraduate/ master's degree, while the rest (33.7%) are certificate holders from the agricultural training colleges in Ghana. Meanwhile 10 of the 120 farmers (8.3%) had no formal education. Majority (88.3%) had up to senior high or middle school level of

education. Interestingly, three of the farmers had formal tertiary education. Education is a crucial tool needed to identify information to reduce poverty and eliminate hunger among farmers. Educated farmers are most likely to explore and acquire relevant information to try an innovation (FAO, 2005).

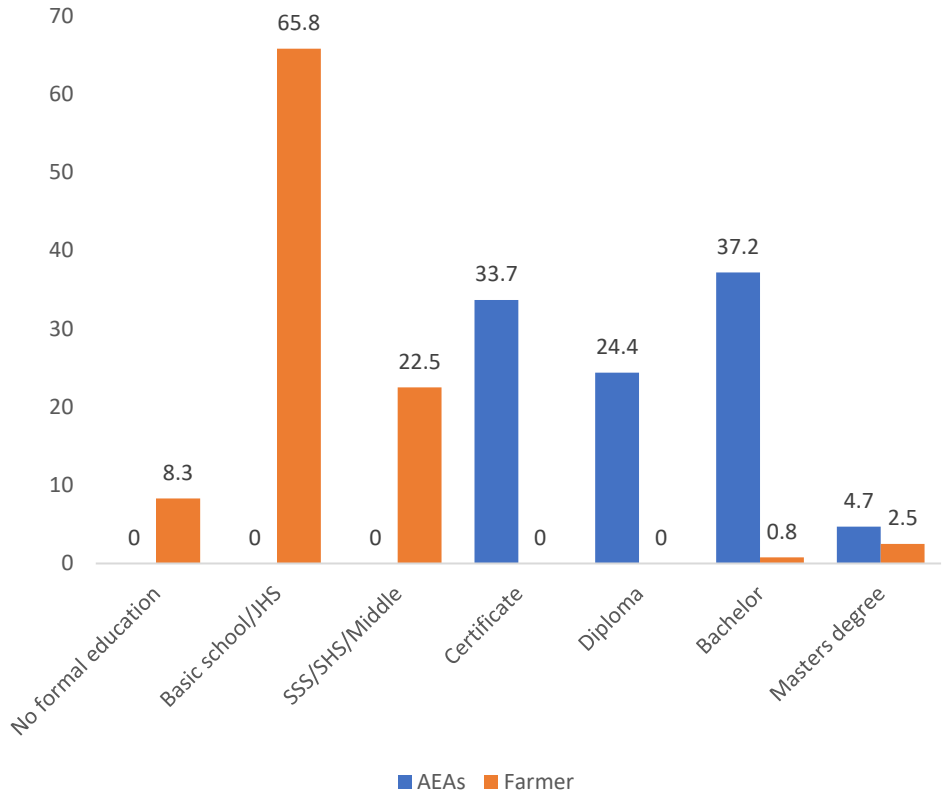

Figure 5: Educational level of AEAs and farmers
Source: Field Survey, Ametepey (2020)

Education increases access to quality information, positively affects understanding of concepts and technologies and creates a favourable mental environment and the right attitude for farmers in decision making concerning adoption of new technologies (Caswell, et. al., 2001). Education also provides farmers with the capacity to learn how to search for information, apply fertilizers timely, study calendar for farming activities and ensure records are kept.

Area of Professional Specialization of AEAs in the Study Area

Specialization in specific aspects of agriculture enabled AEAs to gain competencies in pineapple production to assist farmers scale up production. Figure 6 indicates that, 54 percent of AEAs have specialised in general agriculture, 16percent specialised in agriculture extension and 12 percent had specialization in crop science and postharvest technology.

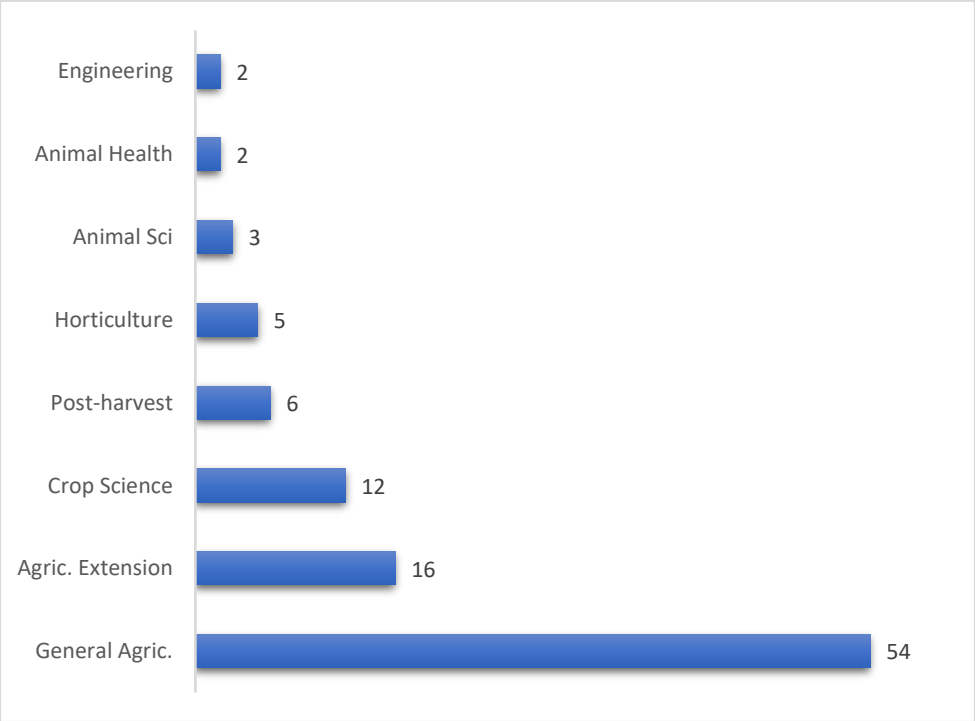

Figure 6: Area of professional specialization of AEAs
Source: Field Survey, Ametepey (2020)

Furthermore, a few others had specialization in horticulture, animal science, animal health and agricultural engineering. AEAs specialization is contingent on their educational qualification and the kind of tertiary institution that trained them.

Channels of Communication used by AEAs

The major means AEAs communicate with farmers is through demonstration method of which 67 percent often and always used to reach

farmers. The findings is similar to Ekerete and Ekanem (2017) and Iwuchukwu and Udoye (2014) who found demonstration to be mostly used by AEAs in reaching farmers in Akwa Ibom State, Nigeria. Demonstration methods was mostly used because, adults learn best when they can see and identify with the learning process (Dirkx, 1998). Adults prefer practical oriented studies to theoretically inclined learning situations. More than two-thirds (65.1%) of AEAs had never used drama to carry out activities to ensure adoption for change in attitude of farmers.

Surprisingly, more than half (52.3%) had never used radio as a means of communication although it is the best medium for mass communication to farmers. In the study area, there are several radio stations that are easily accessed by famers. However, due to high cost of charges and lack of fund, AEAs are unable to use these ration waves to reach farmers.

Table 7: Frequency Distribution of Communication Channels used by AEAs

Variable	Always (Once a week)		Often (Once every month)		Sometimes (Once every three month)		Never (0)	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Demonstration	36	41.9	13	15.1	35	40.7	2	2.3
Drama	2	2.3	6	7	22	25.6	53	65.1
Radio	6	7.0	6	7	29	33.7	45	52.3
Social Media	6	7.0	5	5.8	32	37.2	41	47.7
Text Message	7	8.1	11	12.8	39	45.3	29	33.7

Source: Field Survey, Ametepey (2020).

Ekerete and Ekanem (2017) cited poor access to radio frequencies, fund to sponsor time as factors preventing use of radio in Nigeria. In the case of the selected districts in the study area, AEAs have actually not thought of using radio to reach famers and also lack training on use of radio. Interestingly more than half (52.3%) of AEAs take social media such as WhatsApp, Facebook to always, sometimes or often communicate to farmers in the study area. Therefore, it will be appropriate to train AEAs and farmers to use social media in extension delivery since is less expensive and more reliable and could be access with limited cost.

Text message has been a cheap medium of communicating to farmers since the insurgence of mobile phone usage had made it easy to receive information with minimal cost. It is encouraging that AEAs (66.3%) sometimes, often or always use text messaging to reach farmers. A budget for use of mobile phone as part of line of resources for extension when provided will ensure that AEAs use text messages to communicate with farmers.

Languages used by AEAS to Communicate with Farmers

Figure 7 presents result on languages used by AEAs in engaging disseminating information and technologies to farmers. The majority (69.8%) spoke the native language Fante/Akan local languages with farmers. Fuaku (2011) admonished agricultural extension agents to use language that the clientele would appreciate and understand. Agbamu (2006) further established that a good AEA is the one that endeavour to communicate in clear terms using the kind of language the receivers understand.

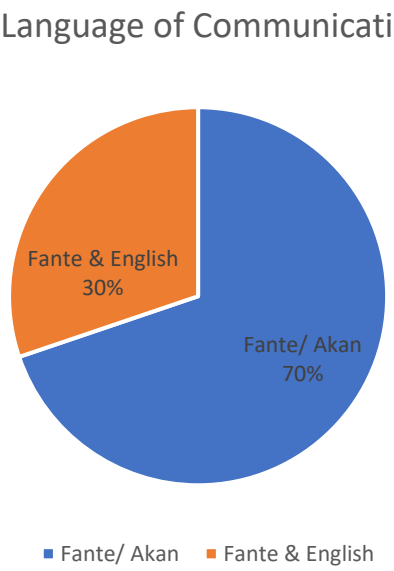

Figure 7: Language of communication used by AEAs
Source: Field Survey, Ametepey (2020)

Number of Trainings Attended by AEAs on Pineapple Production

Malik and Yadav (2018) established that, the ability of AEAs to guide farmers increase awareness about a particular agricultural technology and ensure sustainable use of innovations depends on training and experience of the extension agents. Training builds the capacity of individual to work effectively and efficiently (Kamara, Leonard & Haines, 2017). Table 8 shows the result of the number of trainings attended by AEAs on pineapple production in the previous years. Close to two-third (59.3%) of AEAs had not attended any capacity building training for the past two years on pineapple production. About 30.2 percent had attended once to twice trainings on pineapple production. However, 10.9 percent representing one tenth had up to 6 training session on pineapple production. This implies that a lot has to be done to ensure AEAs are fully equipped to transfer the necessary knowledge and skills to farmers in the study area.

Table 8: Frequency Distribution of Number of Trainings Attended by AEAs

Variable	Frequency	Percentage (%)
0	51	59.3
1	15	17.4
2	11	12.8
3	3	3.8
4	4	4.7
5	1	1.2
6	1	1.2
Total	86	100.0

Source: Field Survey, Ametepey (2020)

AEAs Visit to Farmers

AEAs visit farmers to advise and provide knowledge and skills. Table 9 presents the result on the number of visits extension agents made to respective farmers within a year. The study results revealed that, 57 percent of the AEAs visited farmers 30 times within the entire year. Again, more than a third 32.5 percent visited farmers between 31 to 150 times within a year. A few 3.5 percent visited between 150 to 180 times within the period.

Table 9: Number of Visit to farmers

Number of Visit	Frequency	Percentage (%)
1-30	49	57
31-60	18	20.9
121-150	10	11.6
150-180	3	3.5
Total	80	93.0

Source: Field Survey, Ametepey (2020)

Job Responsibility Assigned to AEAs

The result from figure 8 revealed that majority (91.9%) of AEAs directly work with farmers only. However, key activities such as report writing (66.3%) and training of farmers (65.1%) are job responsibility of AEAs. Interestingly, some AEAs also do supervision (31.4%) and collaborate with institutions for research (15.1%). The results of the findings mirrors Akpotosu (2015) and Mabe and Oladele (2012) who concluded that the main job responsibility of extension staff is to work directly with farmers.

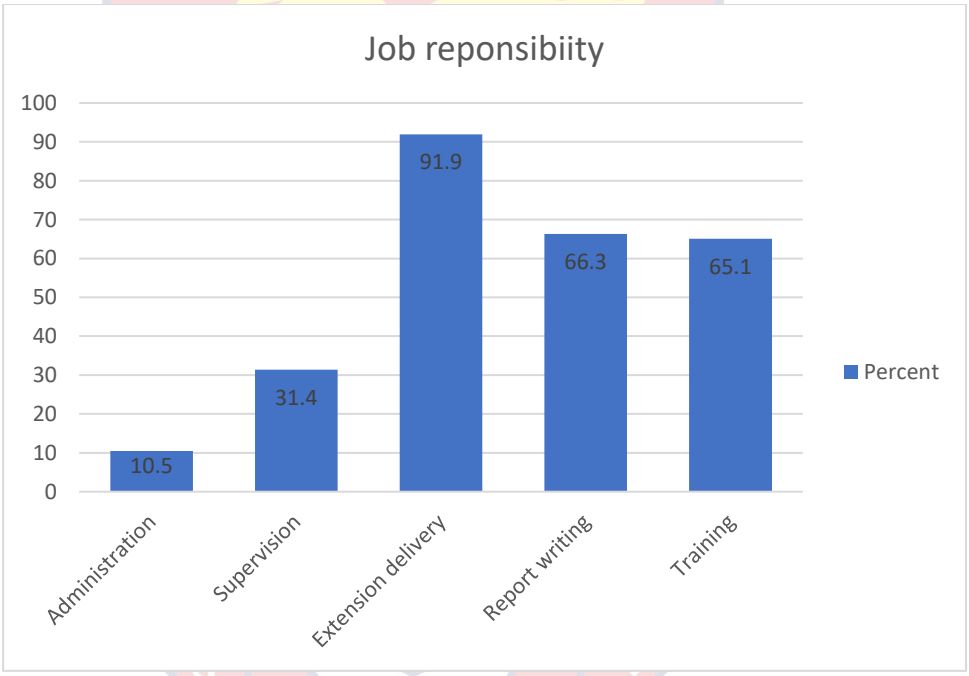

Figure 8: Job responsibility assigned to AEAs
Source: Field Survey, Ametepey (2020)

System of Farming Practised by Farmers

Agricultural farming systems are the underlying factor that determines the input and approach that a farmer must employ in production. Results from Table 10 shows that, majority nearly two-thirds (68.3%) of farmers practise the organic system of farming while 30.8 percent engage in conventional pineapple production. Out of the 120 smallholder pineapple farmers interviewed, only one

(1) practise both organic and conventional system of farming. The few farmers (30.8%) practise conventional farming due to high cost involved in conventional production especially purchasing inputs such as fertilizers, plastic mulch, chemicals among other relevant materials.

Table 10: System of Farming Practised by Farmers

Farming System	Frequency.	Percent
Organic	82	68.3
Conventional	37	30.8
Organic & Conventional	1	0.8
Total	120	100

Source: Field Survey, Ametepey (2020)

Years of Experience in Pineapple Production

The research solicited different data on years of farming experience and years of pineapple production experience. This was to ascertain the actual period of pineapple production independent of general years of farming experience. The result form the Table11 indicated that a little over half (50.8%) of the farmers cultivated pineapple since the past 10 years. The result further revealed that, almost half of the farmers (48.3%) cultivated pineapple for more than ten (10) years, as was revealed by the overall average Mean= 13.3 and SD=10.4. It is however, evident that most farmers in the selected districts have considerable experience in pineapple production and are expected to have high competencies in pineapple production.

Table 11: Years of Experience in Pineapple production

Experience in Years	Frequency.	Percent
Less than a year	1	0.8
1-10	61	50.8
11-20	34	28.3
21-30	18	15.0
31-40	6	5.0
Total	**120**	**100.0**

Source: Field Survey, Ametepey (2020) Mean=13.3, SD= 10.4

Frequency Distribution of the Position of Farmer in Household

The position a farmer holds in a household affects their decisions to adopt or not to adopt modern commercialised pineapple production technologies. The result from figure 9 revealed that, whilst more than half (77.5%) of farmers were heads of the household, (22.5%) were not the heads of their household. Farmers who are household heads, when provide with the right training and information, they will be able to make decisions to adopt commercial technologies to enhance their pineapple production.

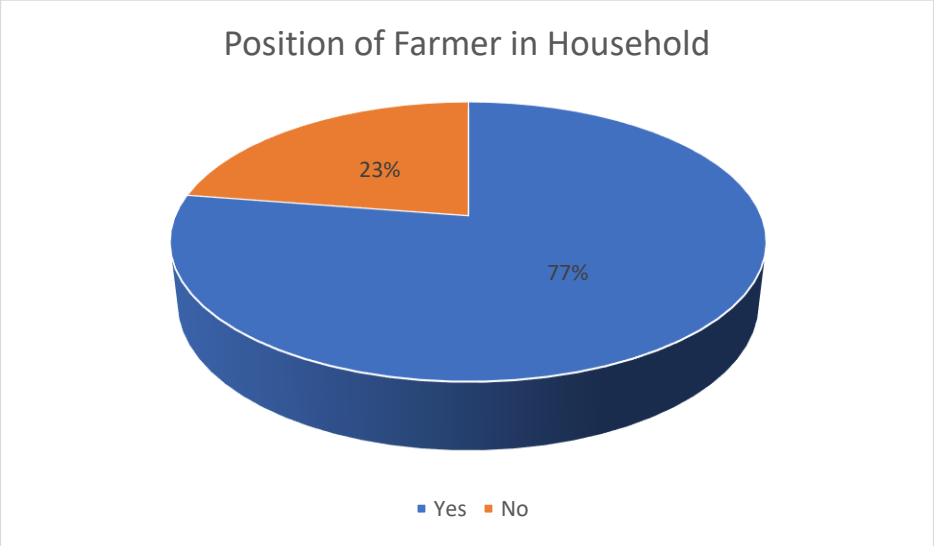

Figure 9: Position of Farmers in the Household

Source: Field Survey, Ametepey (2020).

Farmer's Membership, Type and Position in Social Organizations

Table 12 revealed majority (74.2%) of farmers belong to some social organizations while more than one-fifth (25.8%) do not belong to any social organization. Specifically, nearly 60 percent belong to farmer groups, a few (6.7%) belong to religious groups, 5.8 percent belong to cooperative society and 2.2 percent belong to political organization. However, about one-fourth (25.8%) do not belong to any social organization. The result mirrors a similar study by Iwuchukwu, et. al. (2013) who reported majority (73.8%) of farmers as members of religious groups, 25 percent belonging to farmers group, 20 percent belong to cooperative organisations and finally 8.8 percent belong to political organizations. The commitment of farmers to their social organizations play significant role in building and enhancing their competencies in decision making to adopt commercialise pineapple production technologies.

Table 12: Membership, Type and Position of Farmers in Social Organizations.

Organization	Frequency	Percent
Membership		
Yes	89	74.2
No	31	25.8
Type		
Farmer group	71	59.2
Religious group	8	6.7
Cooperative society	7	5.8
Political	3	2.5
No organization	31	25.8
Position		
Leadership	28	23.3
Ordinary member	61	50.8
Total	**120**	**100.0**

Source: Field Survey, Ametepey (2020).

Therefore, farmers' involvement in social organizations especially farmers' groups and cooperatives, could facilitate and enhance diffusion of information. It again makes it easy for farmers to access government interventions credit, loans, subsidies and other inputs (Iwuchukwu, et. al., 2013). Furthermore, AEAs can effectively work with farmers' groups to achieve maximum result considering inadequate resources which makes visitation to individual farmers' quite challenging. While one- fifth (23.3%) of farmers assumed leadership positions in the social organizations, more than half (50.8%) are ordinary members.

Number of Acres of Land Cultivated by Farmers

The farm size of a farmer plays crucial role in the decision to adoption improved technologies and produce commercially. Farmers with bigger land size have the ability to take risk by practicing new technologies on farms without necessarily affecting and interruption regular production. Bonabana-Wabbi (2002) indicated that commercial production requires large land size for adoption due to the scale - dependent nature although majority (67.5%) of farmers cultivate between 1 to 10 acres of pineapple. A quarter (25%) produces pineapple on less than 1 acre of land size. Few (7.5%) farmers cultivate more than 10 acres.

Table 13: Number of Acres of Land Cultivated by Farmers

Response	Frequency	Percent
Less than 1	30	25
1-10	81	67.5
11-20	6	5.0
21-30	1	0.8
31-40	1	0.8
41-50	1	0.8
Total	120	100

Source: Field Survey,Ametepey (2020).

Source of Credit for Farmers

Accessibility to credit is essential in any agricultural endeavour. Farmers require credit to purchase inputs, prepare lands, pay labours and maintain farms. Table 14 presents results on sources of credit for farmers. Among the 120 farmers interviewed, nearly three fourths 77.5 percent are self-financed, 11.7 percent obtained credit from banks, 8.3 percent and a few 2.5 percent receive credit from friends/family. The results contradict the findings of Ijioma and Osondu (2015) who pointed out that, the leading sources of credit accessible to farmers in the study area were co-operative societies 43.33 percent followed by friends or relatives 30 percent. Similarly, Akinnagbe and Uchechukwa (2014) asserted that, majority of the respondents received credit from friends and relations 89.3 percent and cooperative society 78.6 percent.

Table 14: Source of Credit for Farmers

Source of Credit for Farmers	Frequency.	Percent
Self-financing	93	77.5
Family/friends	3	2.5
Bank loan	14	11.7
Farmer group/ cooperatives	10	8.3
Total	120	100.0

Source: Field Survey,Ametepey (2020).

However, it could be realised that the main sources of credit for the smallholder pineapple farmers are personal fund. This is because self-financing does not attract credit interest and as such, there is no need for collateral before accessing the fund. Meanwhile, not many of the farmers access credit from the banks due to high collateral requirements. Again, inadequate financial institutions and absence of systems that are farmer friendly have resulted in famers falling on their personal savings for production. It must be noted

however that, to ensure commercialisation of pineapple production, farmers must be supported with credit by government and other stakeholder.

Farmers Accessibility of Funds

MoFA (2010) indicated that poverty and inadequate access to farmer credit have denied most farmers the ability to purchase and invest into commercial technologies. The assertion by MoFA was supported by Kafle (2011) who emphasised that, increase in financial support to farmers increases their probability to adopt new technologies. The results from Table 15 portrays that more than half 62.5 percent of farmers always have access to credit to produce pineapple while two-third 34.2 percent sometimes have access to credit for pineapple production. Meanwhile, a few 3.3 percent pointed out that they do not have access to credit from any sources. From the study accessibility of funds is high because, the main source of credit for farmers was personal savings. It is quite easy for a farmer to self-finance production, knowing the production will bring returns. However, there must be financing to enable farmers' have access to credit always so they could scale up production.

Table 15: Farmers Accessibility of Funds

Response	Frequency.	Percent
Always	75	62.5
Sometimes	41	34.2
Never	4	3.3
Total	120	100.0

Source: Field Survey, Ametepey (2020).

Type of Land Ownership

The results as presented in Table 16 demonstrations the type of land ownership used by smallholder farmers in the study area. The results revealed that more than half 52.5 percent of farmers have rented the lands for pineapple

cultivation. Out of the 120 farmers, a little less than quarter 24.2 percent cultivate pineapple on family lands while 22.5 percent cultivate pineapple on their own land. Meanwhile one (1) out of the 120 farmers interviewed uses a shared land to cultivate pineapple.

Table 16: Type of Land Ownership

Title of Land	Frequency	Percent
Own land	27	22.5
Family Land	29	24.2
Rented	63	52.5
Shared	1	0.8
Total	**120**	**100.0**

Source: Field Survey,Ametepey (2020).

Farmers Contact with AEAs

Figure 10 presents results on the number of farmers who have had contact with AEAs within the 2019 farming seasons. The results showed that majority 74.2 percent had contact with AEAs in the 2019 farming season to discuss issues regarding pineapple production. Meanwhile, a little above quarter 25.8 percent lamented that they have not had contact with AEAs within the 2019 farming season. As a result, they depended on their indigenous knowledge and support from friends to produce the pineapple.

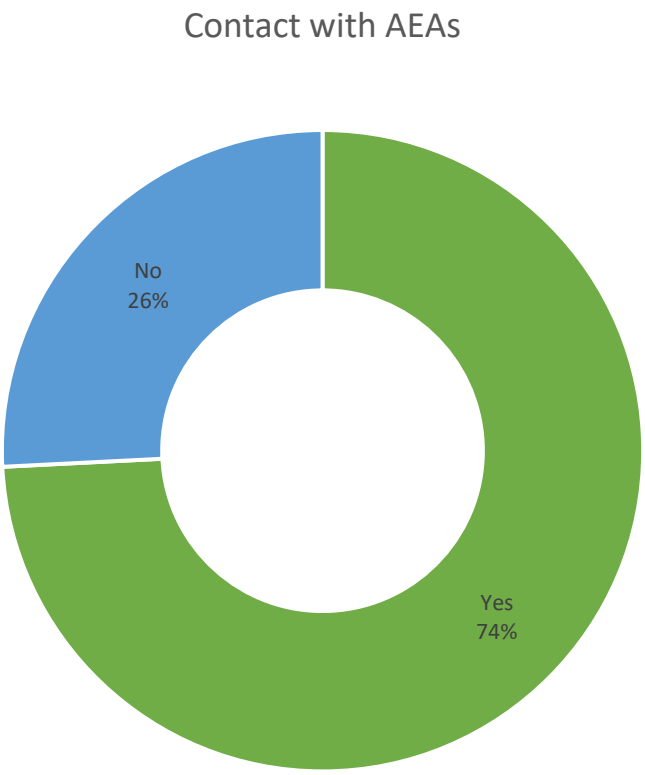

Figure 10: Farmers contact with AEAs.
Source: Field Survey,Ametepey (2020).

Number of Visits Received by Farmers from AEAs

Table 17 presents results on the number of times AEAs had visited farmers with the 2019 farming season. Among the 120 farmers interviewed, more than half 60 percent had received 4 visits in the year 2019, 11.7 percent had received 5 to 9 visits within the year, 6.7 percent had received between 10 to 14 visits while 2 out of 120 farmers 1.7 percent had received between 15 to 19 visits in the year 2019. The result is inconsistent with the findings of Iwuchukwa, et.al. (2013) who found that, 77.5 percent of respondents did not have contact with extension agents in 2011 while 22.5 percent had contact with extension agents. Smallholder farmers require the support of AEAs to adopt

commercialised pineapple technologies. The more farmers have access to AEAs and interact, the more farmers' issues are addressed.

Table 17: Number of Visits Received by Farmers from AEAs

Visits received by Farmers from AEAs	Frequency	Percent
No visit	24	20
1-4	72	60
5-9	14	11.7
10-14	8	6.7
15-19	2	1.7
Total	120	100.0

Source: Field Survey, Ametepey (2020). ** Mean=3.4, SD= 3.2

Trainings Attended by Farmers

Training fuels farmers' comprehension of the challenges expected to be encountered from the application of the new technology. Baffoe-Asare, Danquah and Annor-Frempong (2013), pointed out the significance of training of farmers to adoption of improved technologies. The study noted that, training provides farmers with understanding to functioning of new technology as well as technical implications associated with a technology. The results in Table 18 showed that more than half 62.5 percent of farmers had attended training on pineapple production since 2018, two- fifth 37.5 percent did not attend any training on pineapple production since the year 2018. The study further revealed that a little less than half 41.7 percent had received 5 trainings whilst about quarter 20.8 percent had attended training more than 10 times. It is evident that, most farmers had received some level of training on pineapple production. This means that the farmers have considerable knowledge, attitude and skills in

pineapple production. Hence, when support by AEAs can switch to commercialization easily.

Table 18: Trainings Attended by Farmers

Training Attended	Frequency	Percent
Yes	75	62.5
No	45	37.5
Total	120	100
No. of Trainings		
No training	45	37.5
1-5	50	41.7
6-10	18	15.0
11-15	6	5
16-20	1	0.8
Total	120	100.0

Source: Field Survey,Ametepey (2020).

Market Availability for Pineapple

Figure 11 presents results on the perception of farmers regarding market availability for pineapple sales in the study area. The results pointed out that among the 120 farmers interviewed, majority 90 percent indicated there is easy access to ready market to sell pineapple while one-tenth 10 percent pointed out that they do not have readily available market to sell pineapple fruits. The Central Region is privileged with the current government flagship program on the 'One District One Factor Project' which provided the opportunity for installation of the pineapple juice factory. Again, the Region is nearer to Accra and Tema, where the major ports of export are situated. These have provided farmers with enough market avenues to sell fruits. Other individuals and agencies with certification for export also go to purchase the fresh fruits for export and for processing into fresh juice and other products.

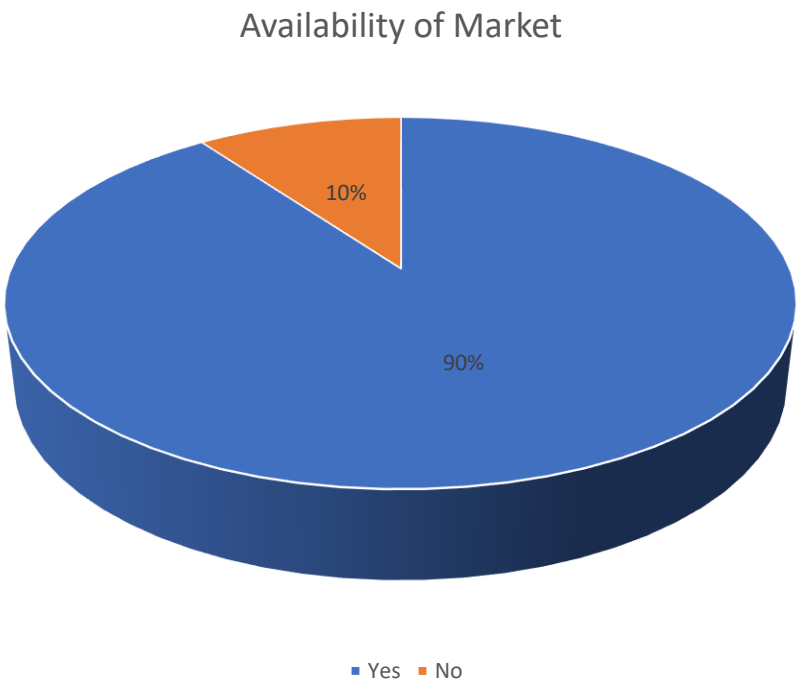

Figure 11: Market availability in the study area
Source: Field Survey, Ametepey (2020)

Household Size of Farmers and Number Engaged in Farming

Table 19 presents results on the number of people in the households of farmers and those engaged in farming. The results revealed that, more than half 56.7 percent of the household heads had 6 to 10 people in their household who are their responsibility while more than quarter 33.3 percent had about five people in their households. However, less than thirty percent 28.3 percent engaged 3 members of the households in farming while a few 17.5 percent engaged 6 people working on their farm. Half 50 percent of the farmers do not engage any member in their household on the farm.

Table 19: Household Size and the Number Engaged in Farming

Number of household size	Frequency	Percent	Number that work on farm	Frequency	Percent
1-5	40	33.3	None	60	50
6-10	68	56.7	1-3	34	28.3
11-15	10	8.3	4-6	21	17.5
16-20	2	1.7	7-9	4	3.3
-	-	-	10-12	1	0.8
Total	120	100.0	Total	120	100.0

Source: Field Survey,Ametepey (2020).

Technologies used by Farmers towards Commercialization of Pineapple Production

Table 20 presents results on the various pineapple production technologies used by smallholder farmers in the study area. The results showed that the highest number of farmers 87.5 percent select suitable land (slightly acidic with pH. of 5.5 -6.0) to grow the pineapple whilst a little more than one-fifth 21.7 percent apply MAP fertilizer responsible for promoting root growth one week after planting the pineapple. More than 80 percent use disease free planting materials 84.2 percent and sort pineapple planting materials before planting 83.3 percent. It was revealing to note that, more than two-thirds 67.5 percent are able to follow the inter spacing of 30-40cm and plant in a double row along the beds. Again, more than half of the farmers 56.7 percent control insects on the farm with a little over half 50.8 percent using fungicides on the pineapple farms to control fungi infections whilst less than half 41.7 percent use integrated pest management method (s) in controlling pest on the farm.

Table 20: Use of commercial pineapple production technologies

Commercial pineapple production technologies	Use	
	Frequency.	Percent
Selection of suitable land (slightly acidic with pH. of 5.5 -6.0) to grow my pineapple	105	87.5
Use of disease free planting materials	101	84.2
Sorting of the planting materials into sizes before planting	100	83.3
Planting at 30-40cm in a double row along the beds.	81	67.5
Control of insects on my farm.	68	56.7
Use of Ethephon or ethylene gas to induce flowering	67	55.8
Control fungus on my pineapple farm	61	50.8
Harrowing of farm before planting	55	45.8
Preparation of ridges for planting	55	45.8
Ploughing of my land before planting	54	45
Using rubber mulch to conserve water and control weeds.	54	45
Use integrated pest management method (s) to control pest on my farm	50	41.7
Control of weeds on the farm using weedicides	48	40
Using calcium carbide to induce flowering	48	40
Application of 2kg Sulphate of Potash every four weeks/acre	28	23.3
Application of 6kg NPK(15-15-15) fertilizer every 4 weeks/acre	27	22.5
Application of urea fertilizer every 4 weeks/acre	27	22.5
Application of 2kg of Magnesium Sulphate fertilizer every 4 weeks period	27	22.5
Application of 2kg MAP fertilizer within one week of planting	26	21.7

Source: Field Survey,Ametepey (2020).

It is fascinating to note that, 40 percent or more but not 50 percent of the farmers' harrow farms before planting 45.8 percent, prepare ridges 45.8 percent, plough the land before harrowing 45 percent, adopt the usage of plastic mulch to control weeds and conserve water 45 percent and 40 percent control weeds on the farm using weedicides. Meanwhile, more than one-fifth of the farmers apply 2kg of sulphate of potash every week per acre 23. percent, 6kg per acre of NPK to boost growth every 4 weeks 22.5 percent, 4kg and 2kg of urea 2.5 percent and magnesium sulphate fertilizer 22.5 percent every week for growth and development. However, during maturity of the pineapple crops, more than half 55.8 percent use ethephon or ethylene gas to induce flowering whilst less than half 40 percent use calcium carbide to induce flowering.

Commercialisation of pineapple production demands collective usage of these technologies. AEAs have the responsibility to ensure farmers are well-informed with these technologies. The precise competence in the usage of these technologies have the potential to increase pineapple production in the study area. It can be noted that though majority of the technologies are in use by farmers, some are adopted or in use more than others. It is imperative that AEAs equip farmers with the right knowledge, attitude and skills to effectively apply these commercial technologies producing pineapple in the region. This would not only increase productivity, but may as well reduce cost of production thereby increase income levels of smallholder farmers engaged in pineapple production.

Rate of Adoption of Commercial Pineapple Technologies

Table 21 presents the report on the rate of adoption of commercial pineapple technologies. The study revealed that, out of the nineteen commercial

technologies presented to farmers, 5 representing 20.8 percent had adopted 1 to 5 of the improved pineapple production technologies. Impressively, more than half 50.8 percent had adopted 6 to 10 technologies. However, about one-third 28.4 percent adopted more than ten commercial technologies. The mean number of technologies adopted is (M=9.01 and SD=4.52). This implies that averagely, smallholder pineapple farmers have adopted about half of the nineteen commercial pineapple production technologies presented in the study. The low adoption of technologies could be attributed to cost and other production constraints, such as lack of technical know-how and adequate support from relevant institutions.

Table 21: Rate of Adoption of Commercial Pineapple Technologies

Number Adopted	Frequency.	Percent
1-5	25	20.8
6-10	61	50.8
11-15	17	14.2
16-20	17	14.2
Total	120	100.0

Source: Field Survey, Ametepey (2020) ** Mean=9.01, SD=4.52

Competencies of Smallholder Farmers and Agricultural Extension Agents for Commercial Pineapple Production

Competencies of Smallholder Farmers in Pineapple Production

Table 22 presents results on the overall competencies of smallholder farmers in pineapple production. The results revealed that, farmers demonstrate moderate competencies (composite mean = 3.4, SD=0.7) in pineapple production. It is revealing that, while the farmers have high attitude (composite mean =4.1, SD=0.7), they again demonstrated moderate knowledge (composite mean = 3.0, SD=0.8) and Skill (composite mean = 3.4, SD= 0.7).The results

specifically demonstrate that farmers have high competency in selection of suitable land to grow pineapple (mean=3.9, SD=0.9), production of the local sugarloaf pineapple variety (mean=3.9, SD= 1.2), preparation of land for pineapple production (mean=3.9, SD=1.8), selecting disease free planting material (mean=3.8, SD=1.0), pineapple crop maintenance and establishment (mean= 3.7, SD= 0.9), flower induction method(s) (mean= 3.7, SD=1.1), using of appropriate planting space for planting (mean= 3.7, SD=1.0), organic pineapple farming system (mean= 3.7, SD=1.3), postharvest handling practices (mean= 3.6, SD= 1.0), harvesting for the local market (mean=3.6, SD=1.0), harvesting for the export market (mean=3.5, SD=1.1) and proper weed control measures (mean=3.5, SD=1.2).

Table 22: Competencies of smallholder farmers in commercialising pineapple production

Competency Areas in Pineapple production	Knowledge		Attitude		Skills		Competency	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Selection of suitable land to grow pineapple	3.8	1.1	4.2	0.7	3.7	0.9	3.9	0.9
Production of Sugarloaf variety	3.7	1.4	4.4	0.9	3.6	1.2	3.9	1.2
Land preparation for pineapple production	3.9	3.6	4.2	0.8	3.5	1.0	3.9	1.8
Selection of disease free planting material	3.5	1.2	4.3	0.8	3.4	1.1	3.8	1.0
Pineapple crop maintenance and establishment	3.5	1.1	4.3	0.8	3.5	0.9	3.7	0.9
Methods of flower induction	3.4	1.3	4.4	0.9	3.4	1.1	3.7	1.1
Use of appropriate planting space for planting	3.5	1.2	4.3	0.7	3.3	1.0	3.7	1.0
Organic pineapple farming system	3.5	1.6	4.2	1.0	3.3	1.2	3.7	1.3
Postharvest handling practices	3.3	1.1	4.2	0.9	3.4	1.1	3.6	1.0
Harvesting for the local market	3.2	1.2	4.3	0.8	3.3	1.0	3.6	1.0
Harvesting for the export market	3.1	1.2	4.2	1.1	3.2	1.2	3.5	1.1
Proper weed control measures	3.1	1.4	4.3	0.9	3.0	1.2	3.5	1.2
Water conservation in the farm	2.9	1.3	4.1	0.9	3.0	1.0	3.3	1.1
Managing soil erosion on the farm	2.8	1.5	4.1	1.1	3.0	1.2	3.3	1.3
Use of plastic mulch and its benefits	2.8	1.5	4.1	0.9	3.0	1.2	3.3	1.2
How to prepare ridges for planting	2.8	1.6	4.0	1.0	2.9	1.3	3.3	1.3
Integrated pest management in the pineapple farm.	2.5	1.5	4.0	1.2	2.7	1.3	3.1	1.3
Periods of fertilizer application	2.0	1.5	4.0	1.3	2.5	1.3	2.8	1.4
Conventional pineapple system	2.0	1.6	3.9	1.3	2.6	1.4	2.8	1.4
Production of MD2 variety	1.6	1.8	3.9	1.5	2.2	1.5	2.6	1.6
Production of smooth cayenne variety	1.5	1.5	3.9	1.4	2.2	1.5	2.5	1.5
Composite	**3.0**	**0.8**	**4.1**	**0.7**	**3.0**	**0.6**	**3.4**	**0.7**

Source: Field Survey, Ametepey (2020). N=120

**Means were calculated from a scale of 1 – 1.44 = Very Low, 1.45 – 2.44 = Low, 2.45 – 3.44 = Moderate, 3.45 – 4.44 = High, 4.45 – 5.00 = Very High

However, out of the twenty-one competencies presented to farmers, a number of response demonstrated by the result displayed a moderate to low competency in preparation of ridges (mean= 3.3, SD= 1.3), integrated pest management (mean= 3.1, SD= 1.3), periods of fertilizer application (mean= 2.8, 1.4), conventional pineapple production (mean=2.8, SD= 1.4), production of MD2 variety (mean= 2.6, AD= 1.6) and production of smooth cayenne variety (mean= 2.5, SD= 1.5). It could be ascertained from the results that; farmers require training in the identified competency areas as shown in the table to enable commercialization of pineapple production in the central region.

Competencies Possessed by AEAs for Commercial Pineapple Production

Agricultural extension agents are mandated to spearhead dissemination of technologies and knowledge transfer among farmers to boost agricultural production in Ghana. To scale up commercial pineapple production in the Central Region, it is necessary to understand the competencies possessed by AEAs to ensure they effectively deliver the task assigned them. Maddy, Niemann, Lindquist and Bateman (2002) states that agricultural extension agents need to possess essential competencies to be able to discharge their duties diligently. AEAs are expected to demonstrate that they have basic competency in their disciplines by way of showing understanding of the new technologies being promoted (Ayansina & Adeogun 2017). Table 23 presents results on competencies possessed by AEAs for commercialising pineapple production. The results showed that AEAs have moderate competency in pineapple production (composite mean= 3.2, SD= 0.8). While they have high attitude (composite mean= 4.1, SD= 0.7), they have moderate knowledge (composite mean= 3.0, SD= 0.8) and skills (composite mean=3.0, SD= 0.6) as well in

pineapple production. Precisely, AEAs demonstrated high competency in land preparation for pineapple production (mean = 3.5, SD= 0.9) and using of appropriate planting space for planting (mean= 3.5, SD = 1.1).

Out of the 22 competency areas presented in the study, AEAs were perceived to have moderate competency less than (mean= 3.4) but greater than (mean= 2.5) in 20 competency areas. Specifically, the areas include; selection of disease free planting materials, selection of suitable land, preparation of ridges, water conservation, use of plastic mulch with its accompanying benefits, pineapple crop establishment and management, integrated pest management, periods of fertilizer application among others. Ayansina and Adeogun (2017) noted that the success of an extension outfit dependent greatly on their competencies in the identified areas and ability to demonstrate and disseminate them to their clients. Again, Robertson and Callinan (2002) pointed out that, the efficiency of AEAs depend on their capability to attain and efficiently use the existing knowledge and competencies to achieve a desired goal among the target audience. To ensure farmers are equipped with the necessary competency in pineapple production, AEAs should be provided with training in these identified competency areas to build their acumen and capacity to be able to train farmers.

Table 23: Competencies of AEAs in Pineapple Production

Competency Areas in Pineapple production	Knowledge		Attitude		Skills		Competency	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Land preparation for pineapple production	3.6	0.8	3.7	0.9	3.2	1.0	3.5	0.9
Use of appropriate planting space for planting	3.5	1.1	3.7	1.0	3.2	1.1	3.5	1.1
Selection of disease free planting material	3.4	0.9	3.8	1.0	3.1	1.0	3.4	1.0
Selection of suitable land to grow pineapple	3.5	0.8	3.5	1.1	3.1	1.0	3.4	1.0
How to prepare ridges for planting	3.3	0.9	3.7	0.9	3.0	1.0	3.3	0.9
Managing soil erosion on the farm	3.4	0.9	3.5	1.1	3.1	1.1	3.3	1.0
Use of plastic mulch and its benefits	3.4	1.2	3.5	1.1	3.0	1.0	3.3	1.0
Pineapple crop maintenance and establishment	3.3	1.1	3.6	1.0	3.0	1.0	3.3	1.1
Periods of fertilizer application	3.3	1.0	3.5	1.0	3.0	1.1	3.3	1.0
Proper weed control measures	3.2	1.2	3.5	1.3	3.1	1.1	3.3	1.2
Water conservation in the farm	3.3	0.9	3.4	1.0	3.1	1.1	3.3	1.0
Integrated pest management in the pineapple farm.	3.2	1.1	3.4	1.1	3.1	1.0	3.2	1.0
Postharvest handling practices	3.1	1.1	3.5	1.2	3.1	1.1	3.2	1.1
Conventional pineapple system	3.0	1.1	3.5	1.0	3.1	.9	3.2	1.0
Harvesting for the local market	3.1	1.3	3.3	1.2	3.0	1.2	3.1	1.2
Methods of flower induction	3.2	1.1	3.4	1.1	2.8	1.2	3.1	1.1
Production of Sugarloaf variety	3.0	1.1	3.4	1.0	2.9	1.1	3.1	1.0
Organic pineapple farming system	2.9	1.3	3.5	1.2	2.8	1.1	3.1	1.2
Production of smooth cayenne variety	2.8	1.2	3.1	1.3	2.8	1.0	2.9	1.1
Linking pineapple farmers to market avenues and other value chain actors	2.7	1.3	3.2	1.1	2.8	1.1	2.9	1.2
Harvesting for the export market	2.6	1.2	3.3	1.3	2.7	1.0	2.9	1.2
Production of MD2 variety	2.9	1.1	3.0	1.1	2.5	.09	2.8	1.0
Composite	**3.0**	**0.8**	**4.1**	**0.7**	**3.0**	**0.6**	**3.2**	**0.8**

Source: Field Survey, Ametepey (2020)

** Means were calculated from a scale of 1 – 1.44 = Very Low, 1.45 – 2.44 = Low, 2.45 – 3.44 = Moderate, 3.45 – 4.44 = High, 4.45 – 5.00 = Very High

Constraints to commercialization of Pineapple Production in Selected Districts in the Central Region

Constraints Faced by Smallholder Farmers in Pineapple Production

Cultivation of pineapple often comes with certain constraints that pose challenges to farmers and other actors in the pineapple value chain. This constraint can sometimes be attributed to inadequate visit of extension agents who could assist smallholder farmers in addressing these challenges. The study classified the challenges into input constraint, management constraint, market constraints and government policy constraints. The results on perceived constraints by smallholder pineapple farmers in the Central Region of Ghana are presented in Table 24 to 26.

Perceived Inputs Constraints to Commercial Pineapple Production

Close to two-thirds 59.2 percent of farmers perceived lack of irrigation facility as a major input constraint. More than half perceived land acquisition challenges 55 percent and high cost of human labour 52.5 percent as inputs constraints. Meanwhile, a little less than half 46.7 percent perceived access to credit facility as a constraint whilst 30 percent pointed out availability of planting material and production information as constraints. These were the major perceived input constraints to affects commercialisation of pineapple production in the study area. More so, most farmers indicated that, land acquisition is a constraint due to the high cost of land prices. In an interaction with the farmers, some explained that due to rapid population growth in the communities, most arable lands are being competed for real estate development. High cost of labour is a constraint in that, cost of employing a labourer is quite high and not easily accessible. Most of the youth within the working age group

are in school while others migrated to the cities for greener pastures. Furthermore, more than a third, 46.7 percent of the farmers indicated access to credit facility as a constraint because, most farmers do not have collaterals to meet the demands of financial institutions for credit. This results mirrors the findings by Abbey (2005) who posited that, inability to organize farmers into pineapple cooperatives which is a minimum requirement to assessing credit is a reason why they cannot access credit easily. Meanwhile, about a third 30 percent noted lack of pineapple planting materials as an input constraint because, apart from obtaining suckers and plantlets from friends which may be unhealthy. Farmers may have to travel to Eastern Region or Greater Accra Region to access planting materials and this practise is accompanied with high cost of transport. The findings agree with Baruwa (2013) who found shortage of high quality planting materials was ranked as the first constraint faced by pineapple farmers in Osun State, Nigeria. The study further identified high fruit perishability, low sales price, lack of access to credit and plant diseases as constraints. Again, Baruwa (2013) explained that, high quality planting materials enable dense planting. There is a need for a collaborative effort by the Ministry of Food and Agriculture to help address these input constraints to commercialise pineapple production in the Central Region.

Table 24: Perceived Inputs Constraints to Commercial Pineapple Production.

Inputs Constraints	Frequency.	Percent
Lack of Irrigation facilities	71	59.2
Difficulty in Land acquisition	66	55
High Cost of labour	63	52.5
Inadequate Credit facilities	56	46.7
Unavailability of production information	36	30
Availability of planting materials	36	30
Distance in accessing planting materials	31	25.8
Information on agronomic practise	26	21.7

Source: Field Survey, Ametepey (2020).

Perceived Management Constraints in Pineapple Production

The results on perceived management constraints to commercial pineapple production are presented in the Table 25. The results indicated that, majority 57.5 percent perceived pest control and disease control in the pineapple farm as key management constraints. However, among the remaining perceived management constraints, less than half 45.8 percent indicated weed control as a constraint due to the frequency and cost involved. A little over 40 percent also mentioned unavailability of labour 40.8 percent as a constraint whilst less than 40 percent noted water management 35.8 percent pineapple plant management 26.7 percent and visit by extension agents 22.5 percent as constraints to commercial production. More than half 57.5 percent noted pest control as a major management constraint, due to infestation of pineapple farms by destructive pest that feed on the crop and eventually destroys the pineapple. Pest infestations leaves traces of diseases on the pineapple. Labour availability was again selected as a constraint by farmers. The respondents indicated that, coupled with the high cost of labour, the labour force is sometimes not readily

available to be hired. The respondents further noted weed control 45.8 percent as a constraint in pineapple production. Weeds turn to grow very fast and compete with for nutrient, space and water on the farm. It was revealed that weed control constitute a greater percentage of production cost. Hence to commercialise pineapple production, farmers must be assisted to use the plastic mulch control weed and conserve water.

Table 25: Perceived Management Constraints to Commercial Pineapple Production

Management related constraints	Frequency.	Percent
Pests control in the pineapple farms	69	57.5
Disease control in the pineapple farms	69	57.5
Difficulty in weed control	55	45.8
Labour availability	49	40.8
Soil water management	43	35.8
Pineapple plant management	32	26.7
Visit by extension Agents	27	22.5

Source: Field Survey, Ametepey (2020).

Perceived Market Related Constraints

In Table 26 the results of market constraints encountered by smallholder pineapple farmers in the Central Region is presented. It was revealed that, almost half 49.2 percent stated seasonal price fluctuations, poor road network to their farms 40 percent, market availability 35 percent, and distance to market 34.2 percent as management constraint. A little over quarter 26.7 percent mentioned availability of market information as a constraint whilst less than one-fifth 18.3 percent indicated post-harvest handling as key perceived constraints to commercial pineapple production. The findings mirror Kayitesi (2011) who discovered that as part of constraints faced by pineapple farmers in Ngoma District of Rwanda, inadequate planting materials, unhealthy planting

materials and poor farming practices, inadequate access to credits, high transport costs and poor road network from the farms to the main highways and lack of adequate market information are the constraints faced by smallholder pineapple farmers. The high rate of perishability of pineapple makes post-harvest handling very delicate. Less than quarter 18.3 percent complained that post-harvest handling is a constraint. The results imitate that of the findings of Amao, Adebisi-Adelani, Olajide-Taiwo, Adeoye, Bamimore, Olabode (2011) that perishability of pineapple is a major post-harvest constraint to commercial pineapple production. There is therefore the need for innovative ways of handling pineapple after harvesting to prolong its shelf-life and quality.

Table 26: Market Constraints to Commercial Pineapple Production

Perceived Market Constraints	Frequency	Percent
Seasonal price fluctuations	59	49.2
Poor road networks to farm	48	40
Available pineapple market	42	35
Distance from farm to the market	41	34.2
Inadequate on market information	32	26.7
Post-harvest handling issues	22	18.3

Source: Field Survey, Ametepey (2020).

Policy Related Constraints to Pineapple Production

It was revealed that most farmers perceived unfavourable policy environments for pineapple production 30.8 percent as a constraint whilst more than quarter 27.5 percent indicated inadequate government subsidies on pineapple production as a hindrance to commercialising pineapple production. Government fertilizer subsidy programmes are expected to enable farmers to access fertilizer at cheaper cost to boost production. Unfortunately, farmers in the study area do not benefit from these subsidies. To ensure commercialisation

of pineapple production in the study area, stakeholders must work hand in hand to address these constraints. Policies must be put in place with the necessary support systems and resources to tackle these issues. Farmers must adopt innovative was of farming to help curb some of these constraints.

Factors Influencing the Adoption of Technologies for Commercial Production of Pineapples.

Relationship between Background Characteristics of farmers and Adoption of Pineapple Technologies.

The relationship between socio-demographic background characteristics of farmers and adoption of pineapple technologies was computed using Pearson product-moment correlation. According to Rhaffor and Jamian (2019), correlation analysis is mostly used to check relationship and examine the degree of strength of such relationships between the variables under study. The result in Table 27 indicated that out of the eleven socio-demographic variables used in the correlation analysis, four of the variables which are education ($r= 0.08$, $p<0.42$), membership of social organization ($r= -0.12$, $p< 0.21$), type of land ownership ($r= 0.14$, $p< 0.13$), and trainings attended ($r=0.15$, $p<0.87$) did not significantly relate to rate of adoption of commercial pineapple technologies.

According to Davis (1971) the strengths of a correlation analysis depends on the coefficient. The rate of adoption and the type of farming system practised by farmers ($r= 0.58$, $p< 0.00$) has a positive substantial relationship. The study further revealed a positive moderate correlation between rate of adoption of commercial pineapple technologies and related variables with position in household ($r= 0.31$, $p< 0.00$) as well as low positive relationship with farm size ($r= 0.26$, $p< 0.04$) and number of visits by AEAs ($r= 0.26$, $p<0.00$).

However, there were negative moderate relationship with sex (r= -0.39, p< 0.00) and contact with AEAs (r=-0.32, r= 0.00)

Table 27: Relationship between Demographic Background Characteristics of Pineapple Farmers and Rate of Adoption of Technologies

Independent Variables	Correlation Coefficient (r)	Significance (p)	Type of Correlation	Strength of Correlation
Farming system X_1	0.58**	0.00	Biserial	Substantial
Sex X_2	-0.39**	0.00	Point Biserial	Moderate
Education X_3	0.08	0.42	Spearman	Negligible
Household head X_4	0.31**	0.00	Biserial	Moderate
Membership of organization X_5	-0.12	0.21	Biserial	Negligible
Farm size X_6	0.26**	0.04	Pearson	Low
Ownership of land X_7	0.14	0.13	Biserial	Negligible
Contact with AEA X_8	-0.32**	0.00	Point Biserial	Moderate
Number of times AEAs visit X_9	0.26**	0.00	Pearson	Low
Training X_{10}	0.15	0.87	Biserial	Negligible

Source: Field Survey, Ametepey (2020). **.p<0.01 *.p<0.05

Collinearity Diagnostic Test from Socio-demographic and work related characteristics of farmers and Adoption

Collinearity diagnostic test was conducted to examine the variance inflation factors (VIF) and the tolerance of the independent variables used in the regression analysis. According to Pallant (2005), there exist collinearity in a

study when the independent variables in the regression analysis are excessively correlated. Likewise, O 'Brien (2007) noted that, collinearity can increase the estimates of parameter variance in a model in which no variables statistically significant although R^2 may be large. Collinearity can lead to strange results from the study in the attempt to understand how each independent variables relate to the dependent variable. Furthermore, VIF measures the amount by which the parameter estimate is inflated as a result of the independent variables being highly correlated. In the event of a collinearity issue, the VIF will be very large for the variables used. It will therefore mean that some variables must be deleted to adjust the VIF and tolerance values. Bosompem, Annor-Frempong and Achiaa (2013) emphasised that, VIF close to 10 calls for concern whilst tolerance of 1 depicts no issue of collinearity. However, a tolerance value of zero shows that a severe sign of collinearity issue exist. The study therefore examined the collinearity by estimating the VIF and tolerance values of the independent variables. The result of multicollinearity is presented in Table 28. It was realised from the study that there was no issue of collinearity among the independent variables. Hence, the variable were used for the prediction.

Table 28: Collinearity Diagnostic Test from Socio-demographic and Work related characteristics of farmers and Adoption

Independent Variable	Variable Inflation Factor	Tolerance	P. value
1. Type of farming system practises X_1	1.109	0.902	0.000
2. Sex of farmers X_2	1.108	0.903	0.002
3. Total acre of land cultivated by farmers X_3	1.032	0.969	0.034

Source: Field Survey, Ametepey (2020). ** N = 120

OLS Stepwise Regression on Rate of Adoption of Commercial Pineapple Technologies and Related Variables (Socio-demographic)

The results presented in the Table 29 shows that type of farming system practised by farmers, sex of farmers and the number of their acreage cultivated (farm size) predict the rate of adoption of pineapple production technologies in the study area among smallholder farmers. These related variables (socio-demographic) altogether recorded an adjusted R-square value of (r=0.425). This indicates that the related variables predicted adoption by 42.5 percent. Specifically, type of farming system practised by farmers contributed 34.3 percent, sex of respondent contributes 5.3 percent and the number of acreage of land (farm size) cultivated contributed 2.3 percent to the overall prediction power. It was revealed from the study that, conventional pineapple farmers are more likely to adopt commercialised pineapple production technologies at 0.59 margin as compared to the organic pineapple producers. Again, the negative beta coefficient sign associated with sex of respondents indicates that, the female pineapple farmers in the study area, are more likely to adopt commercialised pineapple production technologies by 0.24 margin as compared

to the male pineapple farmers. This finding is inconsistent with Doss and Morris (2000) who found out that, female household heads are less likely to adopt new commercial technologies than male household heads. Likewise, the positive beta coefficient associated with acre of land cultivated depicts that, a unit increase in the acreage of land cultivated by smallholder pineapple farmers will result in increment of their rate of adoption by (0.155). This means that rate of adoption of commercial pineapple production technologies upsurges with increase in land size. The result conforms to the findings of Akudugu, et.al, (2012); Baffoe-Asare, et. al, 2013; Melesse, 2018, Mendola, 2007; McNamara, et al., 1991; Abara & Singh, (1993) who found farm size to have a positive relationship with rate of adoption. In contrast to that assertion, Ogada, Mwabu, Muchai (2014) and Yaron, Dinar and Voet (1992) documented that farm size negatively and substantially influence farmers' decision to adopt commercial agricultural technologies.

Table 29: OLS Stepwise Multiple Regression on Rate of Adoption of Commercial Pineapple Production Technologies and Related Variables

Predictors	Step of Entry	Beta (Standardized)	R^2	Adj. R^2	R^2 Change	S.E.E	F. Reg.	P. Value
Type of Farming System X_1	1	-0.590	0.348	0.343	0.348	3.667	63.104	0.000
Sex X_2	2	-0.241	0.402	0.391	0.053	3.524	39.256	0.002
Acre of Land Cultivated X_3	3	0.155	0.425	0.410	0.023	3.023	28.547	0.033

Source: Field Survey, Ametepey (2020) ** N=120, * $p<0.05$

The linear equation for the OLS regression used for the analysis is described below;

Y = Dependent variable (Rate of Adoption of Commercial Pineapple Technologies)

X_1 = Farming System (0= Conventional, 1= Organic)

X_2= Sex of Respondents (0 = Female, 1= Male)

X_3 = Acre of Land of Cultivated (Number of Acreage)

$Y = C + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$

$Y = 13.00 + (-0.59) X_1 + (-0.24) X_2 + 0.155 X_3$

$Y = 13.00$ If, $\beta_1 X_1 = \beta_2 X_2 = \beta_3 X_3 = 0$

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Introduction

This chapter presents summary of research process, key findings from the study as well as conclusions based on the specific objectives of the study. It again includes recommendations and areas for further research.

Summary of Research Key Findings of the Study

The increasing demand for fresh pineapple in the Central Region for both the local and export markets in recent times cannot be overlooked. There is the need for smallholder farmers to shift from subsistence production to commercial pineapple production. To ensure commercialisation of pineapple production, however, smallholder farmers need to adopt commercialised technologies to enable them scale up production for the ever increasing market available in the Central Region and the nation at large. Again, farmers need to be abreast with improved commercialised pineapple producing technologies and must have the necessary competencies (knowledge, attitude and skill) to acquire the technologies and use in enhancing producing pineapple.

Meanwhile AEAs are mandated by the Ministry of Food and Agriculture to ensure transfer of technologies and build farmers acumen for commercial production. Unfortunately, there was no literature that explains the competencies of AEAs and smallholder farmers in pineapple production in the study. The study assessed the competencies of AEAs and farmers for adoption of commercial pineapple production in the Central region of Ghana.

Descriptive survey design was used to gather data from 86 AEAs in 8 districts and 120 farmers in 4 pineapple growing districts in the Central Region

of Ghana. Data was gathered from all AEAs available whilst multistage sampling technique and simple random method were used to gather farmers' data. Frequencies, percentages, means, standard deviation, correlation and stepwise regression were the statistical tools used to analyse data collected.

Key /Major Findings of the Study

Summary of major findings are presented in the following paragraphs according to the specific objectives of the study. It was enlightening that there were more male for both AEAs and farmers than female in the study area. Most AEAs operate in rural areas where farmers are situated. Over 60 percent of AEAs were below 40 years and 40 percent of farmers belong to the same age category. While more than half 66.3 percent of AEAs had diploma to postgraduate education qualification, majority of farmers had up to senior high school education credentials. Most AEAs 63 percent had specialised in general agriculture and usually use demonstration method 63 percent often reach farmers. However, AEAs sometimes and often use text messages, drama, social media and radio in reaching farmers. Majority of AEAs 70 percent engage farmers with the native language (Fante /Akan) and close to two-thirds had not attended any training on pineapple production in the past two years. Moreover, it was again found that, majority of AEAs work directly with farmers and visit farmers about 30 times within an entire year.

Most farmers are into organic pineapple production and more than half 68.3 percent of the farmers had cultivated pineapple for the past ten years while almost half 50.8 percent had cultivated more than ten years. Majority 74.2 percent of the household heads in the study area are members of farmer groups. It was revealed that majority of the farmers cultivate less than ten acre of land.

Majority 77.5 percent of farmers' self-finance their production and are certain that they can always access personal resources for farming. More than half 52.2 percent of the farmers cultivate pineapple on rented lands whilst over 50 percent did not have contact with AEAs within 2019 farming seasons. Among those that had contact with AEAs, a little over half had received 4 visits in the year 2019. Over 60 percent had attended about 5 trainings on pineapple production since the year 2018. About 90 percent of farmers indicated that they have readily available market. Majority 56.7 percent of farmers had up to ten (10) people in their households while half 50 percent did not engage any member of their household to work on the farm.

Majority 87.5 percent of farmers select suitable land (slightly acid with pH of 5.5 – 6.0) to grow pineapple and apply MAP fertilizer responsible for promoting root growth a week after planting. An encouraging number of farmers use disease free planting materials whilst planting double row along the beds.

The overall attitude of smallholder pineapple farmers towards pineapple production is high (mean = 4.1). The knowledge (mean= 3.2) and skills (mean=3.0) were however, moderate. The overall competency of farmers in pineapple production was moderate (mean= 3.4).

Again, in assessing the competencies of AEAs in pineapple production, the results indicated a high attitude (mean= 4.1) with moderate knowledge (mean=3.0) and skills (mean=3.0) respectively. Meanwhile the overall competency of AEAs in commercialising pineapple production was moderate (mean=3.2).

Farmers in the selected districts are confronted with several constraints that affects their shift from subsistence to commercial production. The perceived constraints are; input, management, market, and government policy related constraints in pineapple production. Specifically, input constraints perceived by farmers are challenges with land acquisition, unavailability of production information, lack of credit facilities; high cost of labour, lack of irrigation facilities, unavailability of planting materials, difficulty in accessing planting materials and lack of information on agronomic practices. Likewise, the management constraints perceived by farmers are; pests control, disease control, visit by extension agents, labour availability, plant and water management as well as weed control. In addition, farmers perceive the flowing, seasonal price fluctuations, distance to the market centres, unavailability of information, post-harvest handling, and poor road networks as market related constraints. Likewise, government policy related perceived constraints are; appropriate policy environments for pineapple production and government subsidy on pineapple production.

Exclusion of education, membership of organisation, type of land ownership and training attended, there were significant relationship between adoption and farming system practised, position in household, number of visit by AEAs, sex and contact with AEAs. Furthermore, farmers' decision to adopt commercial pineapple production technologies is predicted by the system of farming they practise, sex of farmers and the number of acre of land cultivated by farmers.

Conclusion

From the summary of the key findings of the study, these conclusions were drawn;

- Smallholder farmers interviewed in the Central Region were mainly male with low education qualification. These farmers were mostly into organic pineapple production in their communities. Hence they require extensive training on conventional pineapple production in the attempt to commercialise production;
- The farmers in the study area generally cultivate pineapple on rented lands with self-financed resources, and usually do not have much contact with AEAs to discuss production related issues. Extension advisory provision for smallholder farmers in the study area is inadequate, and therefore leads to the deficiency in competency of farmers.
- Smallholder pineapple farmers had substantial years of farming experience in pineapple production, but only a considerable number (30%) did attended few trainings on pineapple production in the past two years. This could be a key reason for the low technological usage among farmers;
- Most smallholder pineapple farmers had adopted and are practicing a few commercial oriented pineapple production technologies as assessed by the study. This could be a reason why their production levels are still low.
- There was significant relationship between rate of adoption of commercial pineapple production technologies and six independent

variables (i.e. farming system practised, sex of farmers, position of farmer in the household, farm size cultivated, contact of farmers with AEAs and the number of visits received by farmers) of the study. It is concluded that these socio-demographic characteristics play a crucial role in the life of pineapple farmers and must be considered;

- Farmers' in the study areas decide whether or not to adopt commercialised pineapple producing technologies based on the type of farming system they practise; The sex or gender inclination of farmer and the total acre of land the farmer cultivates.
- There is readily available market for the sale of fresh pineapple in the study area (Central Region) which farmers could take advantage of such an opportunity to enhance their livelihoods. Hence commercialising pineapple production should be embraced to enhance livelihoods;
- There were more males AEAs working in the pineapple growing districts with significant educational qualification up to postgraduate level. This means these AEAs have the capacity to build their competencies in commercial pineapple production when the opportunity is created for them.
- AEAs in the pineapple growing districts preferably use the native language (Fante/Twi) and frequently use method demonstration in reaching farmers. Farmers are more comfortable with the native language and are able to learn quickly when engaged with method demonstration during training and introduction of technologies.
- Majority of the AEAs had professional specialisation in general agriculture and therefore had broad acumen in essential aspects of

general agriculture, which makes it easy for them to render their services to targeted farmers (pineapple farmers) as required.

- Likewise, most AEAs had many years of working experience, however, they did not attend any in-service training on pineapple production within the past three years. It is not surprising that their acumen and overall competency is moderate as noted in this study.
- Most AEAs and farmers perceived attitude towards pineapple production is high but demonstrated moderate knowledge and skills in pineapple production. They perceived pineapple production to be important. However, the knowledge and skills they possessed need to be enhanced; and
- The competencies of AEAs and smallholder pineapple farmers in commercial pineapple production in the study area is comparatively similar. AEAs and farmers all perceived pineapple production to be important and have moderate knowledge and skills.

Recommendations

1. The Ministry of Food and Agriculture must endeavour to recruit more female AEAs to work in the pineapple growing districts to bridge the gender gap between male and female staff. Again MoFA, should take advantage of the currently recruited staff (AEAs) and support them with the necessary logistics to work effectively since they are fairly young and full of energy.
2. MoFA in conjunction with other gender sensitive organizations should encourage more females to venture into pineapple production considering the huge potentials in the sector. Female farmers should be

supported with subsidies and technologies to offset the difficulty in pineapple production that made it unfriendly for women. Again, MoFA and the department of Agricultural Economics and Extension at the University of Cape Coast should design out of school adult learning education programmes to allow farmers acquire knowledge and skills to enhance their appreciation and understanding of concepts and technologies.

3. AEAs must be encouraged to use the local language (Twi and Fante) in reaching farmers since farmers are more conversant with the local language. MoFA should build the acumen of AEAs in the use of method demonstration and support them with the needed equipment to use this method to reach farmers. Adults learn best when they can see and participate in the learning process. The use of method demonstration provides them the opportunity to participate in the learning process
4. AEAs must be encouraged to engage farmers with technologies that are friendly in communicating more with farmers to increase the contact periods with farmers. AEAs must be trained to use both formal and informal means in meeting the production needs of farmers in the study area.
5. There should be a collaboration between MoFA and traditional leaders in charge of lands in the study area to negotiate on land prices to a reduced rate to enable farmers own their own lands. The use of rented lands demands frequent payments which could be a hindrance to adoption of commercialised pineapple technologies.

6. Government through MoFA, must recruit more AEAs to work with farmers to help address their production challenges. AEAs must be motivated enough with means of transport, fuel, allowances etc. to be able to discharge their duties professionally and effectively.
7. MoFA, stakeholders in the pineapple value chain and RUFORUM through the Carp + project that seeks to 'Develop a Sustainable Pineapple Production in the Central Region' should provide frequent well targeted training to farmers on their production. Farmers should be motivated, encouraged and supported to participate in these trainings to build capacity in all endeavours of pineapple production.
8. Government through MoFA, Department of Agricultural Economics and Extension, University of Cape Coast and other stakeholders in the horticultural sub-sector must assist AEAs in transferring commercial pineapple production technologies to smallholder farmers in the study area. Again, subsidies should be provided to reduce cost of inputs such as ploughing, harrowing, ridging, use of plastic mulch, cost of chemicals etc. Furthermore, disease free plantlets should be developed for farmers in the study area to ensure that farmers plant quality planting materials in their farms.
9. Pineapple producers and potentials farmers in the study area must be encouraged by Government and stakeholders to venture into pineapple production more considering the availability of market to sell pineapple fruits. Production should be more coordinated and supervised to ensure farmers produce base on standards and quality.

10. MoFA, RUFORUM and other stakeholders in the pineapple value chain should assist in providing in-service training for AEAs to increase their overall competencies (knowledge, attitude and skills) in pineapple production. Training workshops and short courses on pineapple production and the entire pineapple value chain must be organized for AEAs to enhance their competencies in pineapple production.
11. The trained AEAs must be empowered to also train all pineapple producers in their catchment area to build the capacity of farmers to adopt commercial pineapple production technologies to ensure maximum productivity. Method demonstration, field trips exhibitions and fanfares should be organised to expose farmers to new technologies of pineapple production to provide farmers with more insight into pineapple production.
12. When transferring new technologies to pineapple smallholder farmers in the study area, one must consider the type of farming system being practised by farmers, the sex or gender orientation of farmers and the number of acreage of land cultivated by farmers. The author identified these farmers to influence farmers' decision to adopt improved technologies.

Limitations and Suggested Areas for Further Studies

1. Recommends a nationwide and inter-regional studies on competencies of Farmers and AEAs in pineapple production. Trends could be studied based on regions for policy purposes;
2. Replicate this study in other districts across the nation where pineapple is grown to fully appreciate AEAs and farmers' competencies in order

to design policy documents to enhance pineapple production nationwide; and

3. An overall understanding of the competencies of AEAs and farmers in the horticultural sub-sector nationwide would have to be researched to help address policy issues regarding the sector.

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APPENDICES

APPENDIX A

UNIVERSITY OF CAPE COAST

COLLEGE OF AGRICULTURE AND NATURAL SCIENCES

SCHOOL OF AGRICULTURE DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

QUESTIONAIRES FOR FARMERS

Introduction

Dear Farmer, this interview is being conducted as part of action research study to develop a pineapple value chain system to increase productivity and improved livelihood of smallholder farmers in the Central by a team of researchers from University of Cape Coast. All the information provided will be treated with maximum confidentiality and used for the above purpose only. Thank you.

Enoch Ametepey (student) Contact: (0541829926)

Name of enumerator……

District…… Questionnaire number…….

Contact number…….

PART 1: SOCIO-DEMOGRAPHIC INFORMATION OF SMALLHOLDER PINEAPPLE FARMERS

1. Which type of pineapple farming system do you practise?
   a. Organic farming [ ]
   b. Conventional farming [ ]
2. Age at last birthday ……years

3. Sex of respondent:
    a. Male [ ]
    b. Female [ ]
4. What is your level of formal education?
    a. Basic (Primary /JHS) [ ]
    b. SSS/SHS [ ]
    c. Training College /polytechnic [ ]
    d. University (Undergraduate) [ ]
    e. Postgraduate [ ]
    f. Do not have any.
5. Years of farming experience _____ (years)
6. How many years have you been cultivating pineapple? …… (Years)
7. What is your household size? ...……..……
8. Do you involve the above members in **Q 9** in pineapple farming? Yes [ ] No [ ]
9. How many members of your household can work on the farm ……..?
10. Are you the head of the household? Yes [ ] No [ ]
11. Are you a member of any social organization? Yes [ ] No [ ]
12. If **Yes to Q 14**, which of the following social organizations do you belong to? If **No to Q14** move to question 17.
    a. Farmer group [ ]
    b. Religious group[ ]
    c. Co-operative society [ ]
    d. Political group [ ]

13. What is your position (role) in the social organization?

a. Leadership position [ ]

b. Ordinary member [ ]

14. How many acres (farm size) of land do you cultivate pineapple on?

…….. (Acres)

15. On the average how many fruits do you harvest per acre? ……..

16. How much do you sell a fruit to your buyers? ……

17. What is your source of credit/funds for farming? (**Choose all that apply**)

a. Self-financing [ ]

b. Family/friends [ ]

c. Bank loan [ ]

d. Farmer group/co-operatives [ ]

e. NGOs [ ]

f. Other (Please Specify) ……..

18. How accessible are these sources of funds for your pineapple production?

a. Always [ ]

b. Sometimes [ ]

c. Never [ ]

19. What is your title to the land you are producing your pineapple on? (**Choose all that apply**)

a. Own land [ ]

b. Family land [ ]

c. Rented land [ ]

d. Shared cropping [ ]

e. Traders /sellers [ ]

f. Others (Please Specify) ……

20. Do you have contact with agricultural extension agents? Yes / No

21. How many times did AEAs visit your farm in 2019 farming seasons?

……

22. Did you ever attend a pineapple production training before? Yes/No,

(If Yes, continue with next Q. If No go to **Q 29**)

23. How many times did you attend training on pineapple production since 2018 till now? .....

24. Indicate the area of pineapple production you have received training on in 2018- 2019.

i. ……

ii. ……

iii. ……

PART 2: ADOPTION OF IMPROVED PINEAPPLE TECHNOLOGIES.

Please indicate the under listed improved pineapple production technologies you have adopted to enhance production. Indicate by ticking Yes for adoption or No for non-adoption.

Do you have readily available market to sell off the pineapple after harvesting? Yes [ ] No [ ]**Pineapple production technologies**	Yes	No
I select suitable land (slightly acidic with pH. of 5.5 -6.0) to grow my pineapple		
I plough my land before planting		
I harrow my farm before planting		
I prepare ridges for planting		
I use rubber mulch to conserve water and control weeds.		
I plant at 30-40cm in a double row along the beds.		
I use disease free planting materials		
I sort the planting materials into sizes before planting		

I control fungus on my pineapple farm		
I control insects on my farm.		
I control weeds on the farm using weedicides		
I apply 2kg of Sulphate of Potash every 4 weeks		
I apply 6kg of NPK(15-15-15) fertilizer every 4 weeks		
I apply 4kg of Urea fertilizer every 4 weeks		
I apply 2kg of MAP fertilizer within 1 week of planting		
I apply 2kg of Magnesium Sulphate fertilizer every 4 weeks period		
I use integrated pest management methods to control pest on my farm		
I use Ethephon or ethylene gas to induce flowering		

PART 3: COMPETENCIES OF FARMERS ON PINEAPPLE PRODUCTION

Choosing from the appropriate skill indicate your level of your knowledge, skill and attitude in the following competencies using the scale below. Knowledge: Having information about existence of pineapple production technologies using; 0 = Cannot tell, 1=Very low, 2=Low, 3= Moderate, 4=High and 5=Very High. Attitude: Perceived importance to commercial production using; 0= Cannot tell, 1= Not very important, 2=Not Important, 3= Moderately important, = Highly important and 5=Very highly Important. Skills: Extent to which you can practice these competencies using 0=No Skill, 1=Very low skill, 2= Low skill, 3=Moderate Skills, 4=High

	Knowledge (Having information)						**Attitude (perceive importance)**						**Skills (Ability)**					
Competencies of Farmers in pineapple production	**CNT**	**VL**	**L**	**M**	**H**	**VH**	**CNT**	**NVI**	**NI**	**MI**	**HI**	**VHI**	**NS**	**VL**	**L**	**M**	**H**	**VHS**
	0	**1**	**2**	**3**	**4**	**5**	**0**	**1**	**2**	**3**	**4**	**5**	**0**	**1**	**2**	**3**	**4**	**5**
a. Selection of suitable land to grow pineapple																		

b. Land preparation for pineapple production																		
c. How to prepare ridges for planting																		
d. Organic pineapple farming system																		
e. Conventional pineapple system																		
f. Water conservation in the farm																		
g. Use of plastic mulch and its benefits																		
h. Selection of disease free planting material																		

i. Use of appropriate planting space for planting																		
j. Pineapple crop maintenance and establishment																		
k. Integrated pest management in the pineapple farm.																		
l. Periods of fertilizer application																		
m. Managing soil erosion on the farm																		
n. Production of Sugarloaf variety																		
o. Production of MD2 variety																		

p.	Production of smooth cayenne variety																	
q.	Proper weed control measures																	
r.	Methods of flower induction																	
s.	Harvesting for the local market																	
t.	Harvesting for the export market																	
u.	Postharvest handling practices																	

PART: 4 CONSTRAINTS FACED BY FARMERS IN PINEAPPLE PRODCTION

Please kindly indicate whether the under listed statements is a constraint or not and explain your answer.

Constraints	**Yes**	**No**	**Please Explain your Answer**
Inputs			
Land acquisition			
Availability of production information			
Credit facilities			
Cost of labour			
Irrigation facilities			
Availability of planting materials			
Distance in accessing planting materials			
Information on agronomic practise			
Management			
Pests control in the pineapple farms			

Disease control in the pineapple farms			
Visit by extension Agents			
Labour availability			
Pineapple plant management			
Water management			
Weed control			
Market			
Available market			
Seasonal price fluctuations			
Distance to the market			
Available market information			
Post-harvest handling			
Road networks to farm			
Government policies			
Policy environments for pineapple production			

Government subsidy on pineapple production			
Others (Specify) ……			

THANK YOU

APPENDIX B

UNIVERSITY OF CAPE COAST

COLLEGE OF AGRICULTURE AND NATURAL SCIENCES

SCHOOL OF AGRICULTURE DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION

EXTENSION AGENTS' QUESTIONNAIRE

Introduction

Dear AEA, this interview is being conducted as part of action research study to develop a pineapple value chain system to increase productivity and improved livelihood of smallholder farmers in the Central Region by a team from University of Cape Coast. All the information provided will be treated with maximum confidentiality and used for the above purpose only. Kindly feel free and provide responses to the best of your ability. Thank you.

Enoch Ametepey (student) Contact: 0541829926

PART 1: SOCIO-DEMOGRAPHIC AND WORK-RELATED CHARACTERISTICS

Municipality/District_____

1. How many of the farmers in your catchment area grow pineapple_____
2. What is your current operational area?
   a. Rural [ ]
   b. Urban [ ]
3. Age at last birthday of respondent _____ years?
   a. Sex of respondent: a. Male [ ] b. Female [

4. What is your highest level of formal education?

[ ] Certificate level

[ ] Diploma level

[ ] Bachelor degree level

[ ] Master's degree Level

[ ] PhD degree

[ ] Others (specify)…….

5. Years of working experience as an AEA _____years.

6. What is your major area of specialization/ training?

[ ] General Agriculture

[ ] Agricultural extension

[ ] Animal science

[ ] Animal health (Veterinary)

[ ] Crop science

[ ] Horticulture

[ ] Agriculture engineering

[ ] Post harvest

[ ] Others (specific) _____

7. Which communication method do you often use in reaching out to pineapple farmers and indicate the extent to which you use that method? Please

Communication method	**Always**	**Sometimes**	**Often**	**Never**
Method/result demonstration				
Drama				

Radio				
Social media				
Text messages on phone				

8. Which language do you normally communicate with, when with the farmers?

   [ ] Fante / Akan

   [ ] English/Fante

9. How many trainings did you attend in the last two years on pineapple production? _____

10. What is your position?

    [ ] Frontline staff

    [ ] District/Municipal Agric. officer

    [ ] M.I.S officer

    [ ] Director

    [ ] Other (specify) _____

11. How many times do you visit yours farmer in a year? _____

12. What is your major job responsibility? (tick all that apply)

    [ ] Administration

    [ ] Supervision

    [ ] Extension delivery

    [ ] Report writing

    [ ] Training

    [ ] Research

[ ] Other (specify) _____

Name of Farmer	Contact	Location

PART 2: COMPETENCIES OF AEAS ON PINEAPPLE PRODUCTION

Choosing from the appropriate skill indicate your level of your knowledge, skill and attitude in the following competencies using the scale below. Knowledge: Having information about existence of pineapple production technologies using; 0 = Cannot tell, 1=Very low, 2=Low, 3= Moderate, 4=High and 5=Very High. Attitude: Perceived importance to commercial production using; 0= Cannot tell, 1= Not very important, 2=Not Important, 3= Moderately important, = Highly important and 5=Very highly Important. Skills: Extent to which you can practice these competencies using 0=No Skill, 1=Very low skill, 2= Low skill, 3=Moderate Skills, 4=High

	Knowledge (Having information)						**Attitude (perceive importance)**						**Skills (Ability)**					
Competencies of AEAs in pineapple production	**CNT**	**VL**	**L**	**M**	**H**	**VH**	**CNT**	**NVI**	**NI**	**MI**	**HI**	**VHI**	**NS**	**VL**	**L**	**M**	**H**	**VHS**
	0	**1**	**2**	**3**	**4**	**5**	**0**	**1**	**2**	**3**	**4**	**5**	**0**	**1**	**2**	**3**	**4**	**5**
a. Selection of suitable land to grow pineapple																		

b.Land preparation for pineapple production																		
c.How to prepare ridges for planting																		
d.Organic pineapple farming system																		
e.Conventional pineapple system																		
f. Water conservation in the farm																		
g.Use of plastic mulch and its benefits																		
h.Selection of disease free planting material																		
i. Use of appropriate planting space for planting																		

j. Pineapple crop maintenance and establishment																		
k. Integrated pest management in the pineapple farm.																		
l. Periods of fertilizer application																		
m. Managing soil erosion on the farm																		
n. Production of Sugarloaf variety																		
o. Production of MD2 variety																		
p. Production of smooth cayenne variety																		
q. Proper weed control measures																		
r. Methods of flower induction																		
s. Harvesting for the local market																		

t. Harvesting for the export market																		
*u.*Postharvest handling practices																		
v.Linking pineapple farmers to market avenues and other value chain actors																		