



Ashesi University College

Exploring Uses of Mobile Phones in Pineapple Production and its Livelihood Benefits for
Farmers in Akwapim South District, Ghana

By

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Declaration

Candidate's Declaration

I hereby declare that this thesis is my original work and that no part of it has been presented for another degree in this university or elsewhere

Candidate's Signature:

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Date:

Supervisor's Declaration

I hereby declare that the preparation and presentation of this these was supervised in accordance with the guidance on supervision of theses established by Ashesi University College

Supervisors' Signature:

Supervisors' Name: ...Dr. Kwami Justina Morris.....

Date:

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To the Savior Lord, I am eternally thankful for your mercies on my life on earth. Nothing but only Glory be thy your name.

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Abstract

The study explores the use of mobile phone in pineapple production and the benefits farmers gain from this usage in the Akwapim South district of Ghana. It uses sequential mixed method research approach. A multistage sampling technique was used to select five major pineapple producing areas for an initial in-depth interview and subsequently administered questionnaire to collect data on 125 farmers who were purposively sampled. The initial qualitative study helps in mapping out the supply chain of pineapple production in the area. The study reveals that farmers use mobile phones to coordinate input supply, gather information on the market, facilitate the exchange of agricultural information and access financial services. This helps them ascertain information on produce prices and demand trend that empowers them to negotiate for better prices. Specifically, about 93.6% of the pineapple farmers perceived that the use of mobile phones improves their communication while 92% of the farmers perceived that it improves their access to information on market and agricultural information. In the end, farmers indicated an improvement in their livelihoods with the use of mobile phones. Although farmers benefit from the use of mobile phones, they are particularly concerned about high call tariffs and the growing mobile money fraud. Therefore, the study recommends the need to make the use of mobile phone affordable and improvement in security measures to reduce the incidence of mobile money fraud. Additionally, the study recommends further studies to focus on the use of mobile phone by the major players in the supply chain to identify ways of improving the efficiency of the pineapple supply chain with the use of mobile phone

Keywords: Mobile Phones, Pineapple Production, Information, Sustainable Livelihood Framework, Farmer.

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List of Definitions

Asymmetric /Imperfect information: It occurs when economic agents have incomplete information when making decision to buy or sell a given product

Law of One Price: It is an assumption that a market with available information, goods, and commodities are sold or bought at the same price.

Livelihood: It looks at things that human needs to make a living. It comprises material and social resources, activities and capabilities of the individual to convert the resources for their survival

Price Dispersion /Differential: It is a situation where prices of the same product differ across sellers or buyers.

Supply chain: It refers to different players that are connected to one another to ensure the final delivery of the product to the consumer

List of Acronyms

DFID - Department of International Development

GDP - Gross Domestic Product

GSS - Ghana Statistical Service

ERP - Economic Recovery Program

FOA - Food and Agriculture Organization

ICTs - Information Communication Technologies

ICT4D - Information Communication for Development

ITU - International Telecommunication Union

MOFA - Ministry of Food and Agriculture

NCA - National Communication Authority

NTAE - Non-Traditional Agricultural Export

SLF - Sustainable Livelihood Framework

UNCTAD - United Nations Conference on the Trade and Development

USAID - United States Agency for International Development

CHAPTER 1 - INTRODUCTION

1.1. Background of the Study

The era of technological innovation has come to substitute the then industrial society into a modern world of information technology and telecommunications (ICTs). The application of ICTs is dramatically changing the structure of institutions, business and affecting lives of many. Despite the fact that there were disparities in the number of countries that were affected during the previous technological advances like the industrial revolution, the current digital revolution seems opposite, in that, it is affecting both developed and developing countries (Chapman & Slaymaker, 2002). A clear example to buttress this observation is the rate of diffusion (i.e. penetration) of ICTs especially the use of mobile phones in both developed and developing countries. The International Telecommunication Union (ITU) in their *ICT Facts and Figures* report in 2017, estimated that at the end of 2017, about 7.7 billion people use mobile phones and other ICTs globally. This penetration rate for mobile phone subscription represents a dramatic rise from 96.3 % in 2016 to 98.7% in 2017 in developing countries (ITU, 2017). At the continental level, 386 million people in Africa use mobile phones as at 2015. This figure is projected to reach 518 million by the year 2020 (JUMIA, 2016).

Given the longstanding developmental quest of Africa, examining ways to squeeze development out of mobile phones proliferation cannot be underestimated. Reinforcing this agenda is the empirical evidence of causative power of mobile phones and other ICTs tools alike on economic development. In a study involving 92 countries from both developed and developing countries, Waverman, Meschi & Fuss (2005) predict that the use of extra ten phones per every 100 in the population can lead to an extra increase in gross domestic product (GDP) of a developing country by 0.59%. This prediction is consistent with Deloitte (2012) conclusion

that a 10% increase in mobile phone penetration of a country will result in 0.65% annual growth rate in GDP per capita. The foregoing empirical evidence shows a macro-level impact of mobile phones and since per-capita and GDP analysis may be deceptive indicators of broader livelihood effect of economic growth (Mankiw, 2009), it becomes imperative to trace the beneficial effects of mobile phones at micro-level. Thus, assessing the links of livelihood benefits of mobile phone usage on inter-personal and community level.

In terms of livelihood, it is worth noting that agricultural sector represents a major source of livelihood for many in developing countries especially Africa. To this end, creating an efficient agricultural supply value chain is an important step to improving the lives of people on the continent (World Bank 2012). The agriculture sector is, however, bedeviled with many problems. Some of which include, weak marketing structures, poor infrastructure, high price of inputs and low technological adoption (Ajwang, 2014). Introducing technology like the mobile phone as a means for solving these problems has been an uncontested consensus (Aker & Mbiti, 2010; De-Silva & Ratnadiwakara, 2008; Pingali, Kwhaja & Meijer, 2005; World Bank, 2012). But how can the mobile phone solve some of the sector's problems to improve the livelihood of players in the agricultural sector?

Abraham (2007) responds to this question by aligning the communication, information sharing and coordination capabilities of the mobile phone to some of the challenges in the sector. A review of the Theorem of Welfare Economics¹ and Law of One Price² underscore that price information on the market determines optimal trade level or arbitrage seeking activities. As such, when there is price differential on the markets, traders or suppliers seeking profit will sell their

¹ Theorem of Welfare Economics assumes that competitive equilibrium is Pareto efficient

² Law of One Price rely on the assumption that a market with available information, goods, and commodities are sold or bought at the same price.

product on the market with high margin. The supply level increase in the market with premium prices that will push down prices, resulting in a higher welfare for the market participants. Therefore, in a market economy, information is a greater function of welfare. However, accessing information is time consuming and incomplete (Stigler, 1961). This phenomenon exists in agricultural market where the farmer is ignorant of the market and the buyers or traders keep prices of both inputs and output products in order to dictate the prices on the market. For example, in a 13-year longitudinal study of maize prices in Ghana between two outlying markets, Bolegatanga and Mokola, Badiane and Shivey (1998) observe that it takes about 4 months for price information to flow between these markets. In the case of pineapple production, the farmer is left to take prices the trader offers. To identify other existing prices across different markets, the farmer has to visit these markets which is costly in terms of transport, time and effort. This is even worse, given the perishability of the produce that often times tie the hands of the farmer to accept the price the buyer offers, leaving the farmer worse off.

What mobile phone does in the market with this asymmetric information is to help circulate information of prices and other welfare determinants like demand shift to the farmer, for better decision making. Coyle (2005) identifies that the flow of information in agricultural market especially in perishable fruits, reduces monopsony power (an existence of a single buyer of a product that allows discrimination on price). It is not only market information that mobile phone transfers, but the mobile phone has also been a conduit for communicating real time information on weather changes, appropriate quantity, quality of input, better agricultural practices for effective farm management practices resulting in higher yield and welfare (Arokoyo, 2005; Jirli, 2011).

Another area that the use of this technology is solving the agricultural problem is in accessing financial services. The World Bank (1998) identifies lack of access to financial resources as a major cause of poverty. Nevertheless, the use of mobile phones is changing this narrative with mobile money services. Farmers use mobile money services to make payment for their inputs, receive payments, remittances, take micro-credit and for saving. Consequently, farmers' expenditure incurs in accessing finance decrease and even the farmer could bank with the use of mobile phone (Kirui, Okello, Nyikal, & Njiraini, 2013).

In order to harness the benefit of this digital revolution, the government of Ghana developed a policy titled Ghana's ICT for Accelerated Development (ICT4AD) in 2002. Although the policy represents an overall signature of the country on ICT, the vision of the policy on agriculture is to facilitate the modernization of the agriculture sector through the deployment and exploitation of ICTs to improve on efficiency and productivity (Ministry of Communications, 2004). Little is known on the dividends reaped from this policy, especially in the face of downward trend of agricultural growth in Ghana (Ghana Statistical Service [GSS], 2016). Yet, the wave of mobile phone penetration in Ghana is skyrocketing. As of 2011, for every 100 people in Ghana, over 100 of them use a cell phone (United States Agency for International (USAID), 2013). In 2016, the mobile phone penetration jumped astronomically to 131.9% per every 100 people in the population (National Communications Authority [NCA], 2016). As stated earlier, the high penetration of mobile phones does not only call for macro-level enquiry into ITS dividends on economic growth as previous works show, but it requires a local to inter-personal analysis on the usage of mobile phones across different economic sectors such as pineapple production and how it is affecting livelihood.

Drawing from the above, it can be seen that; (1) mobile phones penetration is on the rise in Ghana; (2) farmers are vulnerable because they operate in markets with a lot of asymmetric information and lack of access to financial resources. More so, (3) mobile phones serve as conduit in transferring information faster; (4) mobile phones could make agricultural supply chain efficient and productive; and (5) mobile phones have a poverty reducing function, thus, it improves lives.

1.2. Research Problem

Pineapple production is one major source of livelihood for farmers in Ghana. One notable area for the cultivation of pineapple in Ghana is the Akwapim South District (Ministry of Food and Agriculture [MOFA], 2002). According to Ghana Statistical Service (2014), more than half of the adult population in the district engage in agriculture with more than 94% doing crop farming, mostly pineapple. There are pineapple-processing companies such as HPW Fresh and Dry Limited and Blue Skies Ghana Limited that purchase pineapple in the area. However, most of the produce are sold to the local market and some on the export market. Pineapple as a perishable product is susceptible to wastage when there is market failure. This shows that the functioning of the output market for the produce, which is perishable, influence the incomes of farmers greatly (Odhiambo, 2013). The sale of the produce, however, depends on the price of the available buyer, of which the farmer is oblivious of the prevalent market price, a usual characteristic of perishable produce market in developing countries (Coyle, 2005).

Notwithstanding the influence of output market on the farmer's income, the inputs and production process also determine the income of the pineapple farmer (Ayagiba, 2002; Ninson, 2012). This suggests that the production material, labor and type of production process, influence the farmer's income. However, up-to-date information on these factors is not existence, leaving

the farmer vulnerable. A case in point was the change in demand for a variety of pineapple on the European market. The European market, which used to be the destination for Ghanaian exported pineapple shifted its demand from Smooth Cayenne to "MD2". Due to this, the Ghanaian farmers who had cultivated the Smooth Cayenne variety lost out and crushed out of business. Addition to this was the high input cost of cultivating the MD2. It is estimated that about 30 large-scale commercial farms with hundreds of small scale farmers were crushed out business due to this situation (Food and Agriculture Organization [FOA], 2013). Besides, issues of pest, disease and access to credit facilities remain the bane of the pineapple farmer in the area.

The effect of these problems has amounted to a fall in Ghana's pineapple export volume for about 60% for the past five years (FOA, 2013). Aside the woes of the farmers who have been wiped out of business, the remaining ones continue to live in these vulnerabilities like abrupt demand change, price disparities, and lack of production cycle information; a situation that decrease the income the farmer and threatens their survival.

Finding ways to resolve these problems of the pineapple farmer becomes urgent and with the growing mobile phone penetration in Ghana, it requires strategically turning the "household technology" into a solution tool. Confirming this venture is the concrete evidence of the mobile phone play in terms of its information function to relay valuable business information; and the coordination capability to reduce the uncertainties surrounding the business of the pineapple farmer. It however, starts with an intellectual enquiry into the usage of mobile phones in the pineapple production, which is scanty prior to this study in Ghana. This is particularly worrying in effort to establish a baseline for analyzing the progress made by the Ghana's ICT4D vision of modernizing the agricultural sector by improving efficiency and productivity with the use of ICTs. What previous studies have done were to concentrate on the adoption of mobile phones in

cocoa production (Frempong, 2009), extension services in Akwapin North District (Nyaplue, 2015), poverty reduction in Northern Ghana (Aker & Wilson, 2010). Additional studies focus on use of mobile in micro and small-scale enterprise in semi-rural areas (Kwakwa, 2012), m-commerce adoption in fishing (Boadi, Boateng, Hinson, & Opoku, 2007), knowledge society contribution (Seidu, 2014) and usage of mobile in urban areas such as Accra (Bampoe, 2015). Therefore, this study builds on this body of knowledge and extends it to cover this unexplored area of pineapple production, particularly in analyzing the use of mobile phone in the supply chain and ways it is affecting the lives of pineapple farmers.

1.3. Research Objectives

Following the research problem, the study seeks to achieve the following objectives:

1. Describe the pineapple supply chain in the Akwapim South District
2. Assess the use of mobile phones in the supply chain in the Akwapim South District.
3. Identify associated livelihood benefits that pineapple farmers derive from the use of mobile phones in pineapple production in the Akwapim South District
4. Examine the challenges pineapple farmers face in the use of mobile phones in their farming activities in the Akwapim South District

1.4. Research Questions

The questions that this study then seeks to answer are:

1. What is the supply chain of pineapple in the Akwapim South District?
2. What are the uses of mobile phones in pineapple supply chain in the Akwapim South District?
3. What livelihood benefits do farmers derive from using mobile phones in pineapple supply chain in the Akwapim South District?

4. What challenges do pineapple farmers face in the use of mobile phones for their farming activities in the Akwapim South District?

1.5. Significance of the Study

The study is immensely significant in diverse ways to entrepreneurs, business leaders, marketing practitioners, policy makers and other stakeholders in the agricultural and telecommunication industry. To government and the ministry of agriculture, the findings of the study will provide a more reliable scientific measure and perspective for describing and evaluating the level of mobile usage in pineapple farming in one of the leading producing communities in the country.

Additionally, the study will provide empirical support for policy makers and agribusiness entrepreneurs to make strategic decisions in critical areas that they can operate to ensure the growth of pineapple production and achieve better results in their business operation. Lastly, it will add to the growing literature of development economics especially in areas of livelihood empowerment through the use of mobile phones by establishing development channels for mobile phones/information in that aspect of the farmers' life.

1.6. Disposition of the Study

The rest of the paper is structured as follows. It starts with literature review that examines the existing literature on mobile phones usage. It combines concept with empirical evidence concerning the use of mobile phones and its benefit farmers. It is organized in themes and concludes with the sustainable livelihood framework that provides the foundation of the study.

Further, the paper presents the methodology of the paper. The methodology chapter describes the procedures the researcher goes through in collecting data and analyzing data. The

chapter discusses the choice of sampling method, data collection procedures and finally the ways of analyzing the results.

The results and findings chapter follow the methodology. This chapter critically analyze the data collected and match it against each objective outlined in the introductory chapter to ascertain the various uses of mobile phones among pineapple farmers, and how farmers benefits from its usage in the area.

Lastly, conclusions and recommendations are made in the final chapter. This chapter summarizes the findings of the entire research, gives recommendations on uses of mobile phones in the pineapple production, and matches it with the livelihood benefits farmers derive from these uses. It also highlights the challenges farmers face in using the mobile phones. Besides, the study gives opportunities for improving the pineapple sector with the use of mobile phones and suggest areas for further studies.

CHAPTER 2 – LITERATURE REVIEW

2.1. Overview of the Literature Review Section

The literature review chapter focuses on previous studies on mobile phone usage, especially in the agricultural sector. It is broadly divided into the empirical and theoretical framework. Organized in themes, the empirical review first gives the historical and general overview of pineapple production in Ghana. It then reviews the use of mobile phones in pineapple production and other uses along the agricultural supply chain. The theoretical framework looks at the conceptualization of phones in enhancing livelihoods under the sustainable livelihood framework.

2.2. Pineapple Production in Ghana

Production of pineapple in Ghana dates back to the 16th century where pineapple was used for medicine and the production of clothes. As at this time, smallholder farmers cultivated it on a small-scale level. It, however, catapulted into a large production in the 1950s when the government introduced the Economic Recovery Program (ERP) and its concerted plan to diversify agricultural production contained in the Non-Traditional Agricultural Export (NTAE) plan (Anokye, 1975; Haizel, 1975; Solomon, 1976 cited in Ayagiba, 2002). Portuguese traders were the first people to introduce pineapple in Ghana and it was first cultivated in Samsam in Greater Accra region (Pinto, 1990).

Pineapple, as a tropical crop, thrives well in areas with rainfall averaging between 1000 mm to 1,8000 mm per year with a temperature range of 25 °C - 32 °C (MOFA, 2000). The crop is mainly cultivated in Central, Eastern, Greater Accra regions and the transitional belt of Brong Ahafo, Ashanti, Volta and Western regions. The notable areas for the large production of the crop are Nsawam, Aburi and Kasoa areas (MOFA, 2002).

Pineapple farms are categorized into privately owned, organized smallholders and non-organized smallholder farmers. In private owned farms, farmers cultivate on a minimum of 500 hectares of farms for export to the European Union (EU) market. An example of these farms is Gold Coast Exotic Farms. The organized smallholder farms are a pool of smallholder farmers who aim at fulfilling the needs of interested organizations such as Campagnie fruitiere, Pinora, Farmapine Limited, Blue Skies Ltd and Fairtrade Certification. They are mostly cooperatives in nature and assist farmers with marketing, technical and financial support to increase their production and returns. Lastly, the non-organized smallholder farmers cultivate pineapple on between 1-10 acres of land for the local market and larger producers. The smallholder farmers who maintain a consistent supplying chain to the larger producer and exporters are called *out-growers* (FOA, 2013 Trienekens, 2004). Ghana produce between 120,000 – 150,000 tons of pineapple annually (Kleemann, 2016)

The cultivation of the crop is labor-intensive (Obeng, 1990). Additionally, the production of pineapple requires capital for the purchase of item like fertilizers, chemicals for controlling weedicide, suckers, forcing, pests; warehouse, equipment, tractors, vehicles, funds for paying labor and others. However, accessing capital has been a major challenge for farmers. Farmers who engage in export and large-scale production access funds from their buyers such as exporters and processors. The remaining small-scale farmers had to depend on their limited personal capital. The few creditors from the informal financial sector lend money to these farmers on an unfavorable interest rate, with the formal financial sector denying them due to their inability to provide sufficient collateral (Abbey, 2005).

Sugarloaf, Smooth Cayenne, and the MD2 are the major varieties of pineapple produced in Ghana. These varieties are either cultivated through the organic or inorganic (conventional)

process. With the organic production, farmers do not use artificially manufactured products like fertilizers and chemicals, rather, farmers use ecological and environmentally friendly procedures. On the other hand, the chemical and fertilizers are prevalent in the inorganic farming. The large-scale producers normally engage in organic farming, which earns premium prices but requires a huge investment (Kleemann, 2016)

The exportation of Ghanaian produced pineapple to European market started in 1994. Initially, the Smooth Cayenne was the main variety with smallholder farmer contributing about 50% of the annual export volume. However, due to demand change from smooth cayenne to MD2 on the European market, Ghana's market share in the European market has decreased from 8% to 4% since 2004 (FOA, 2013). Notwithstanding this persistent problem, the issue of high-cost production, lack of credit facilities, diseased planting materials, poor agronomic extension services, uncoordinated players in the sector and low response rate to market shift, are other problems bedeviling the sector (FAO, 2013, Obeng, 1990). Aside from the limited use of technology among the large-scale producers (Obeng, 1990), the use of technology such as mobile phones can go a long way to solve the problem in the sector to sustain the source of livelihood for most of the players in the production of pineapple.

2.3. Use of Mobile Phones in Pineapple Production

Production of an agricultural product like pineapple is prone to vulnerabilities such as changes in weather, disease prevalence, demand trend, market price and input prices. Again, agricultural production supply chain involves a lot of players like suppliers, collectors, retailers, wholesalers, middlemen, buyers, and consumer. The issue of information asymmetry becomes pronounced in this instance by the problem of moral hazard or adverse selection that lead to inefficient allocation of resources (Akerlof, 1970; Ozer & Wei, 2006). Therefore, Aker & Mbiti

(2010) emphasize the need for information on agricultural production. Farmers use the mobile phone for their production and marketing activities (Ajwang, 2014) by communicating with customers and distributors to make on-time delivery (Rabayah & Qalalwi (2011). This revelation is consistent in pineapple production.

Although a search for empirical evidence to identify specific uses of mobile phones in pineapple production is limited, Adégbidi (2012) provides a foundational information for uses of mobile phone among pineapple farmers in Benin. In a random sample of 120 pineapple growers, Adégbidi identifies that 90% of the pineapple farmers use mobile phones to communicate with other actors in their business environment. The study shows that about 98% of the farmers use a mobile phone to communicate with input traders and 29% use it to order products from retailers through voice and SMS. This findings, however, fails to dig deeper into actual roles of mobile phones in its communicating-relational function. It is necessary to venture into the actual uses of the mobile phone in the supply chain and identify the potential benefits of the resource to farmers' livelihood. Inspired by benefits of mobile usage in other areas, the subsequent sections review literature into the general role mobile phones play in various activities in the supply chain in agricultural production and related underlying concepts.

2.4. Coordination Power of Mobile Phone in Agricultural Supply Chain

Agricultural supply chain refers to different players that are connected to one another to ensure the final delivery of the product to the consumer. These players may include growers, pickers, packers, processor, storage, transport facilities, marketers, exporters, importers, distributors, wholesalers, retailers and final consumers. These many different players are often organized in continuum (Roekel, Willems, & Boselie, 2002). The FOA (2007) adds that the network requires making a decision on the networks (processes) and flow of material,

information and money that ensure the product meets the customer's specification. The supply chain has a diverse impact on wide range of players. Therefore, FOA (2007) and World Bank (2012) advocate for collaboration among the partners and interventions to achieve a greater efficiency and productivity to improve on welfare.

What mobile phone does is to use its communication function to coordinate the needs of the various players and ensure decisions are made correctly for the greater returns on welfare (FOA, 2007; Hardy, 1980; Roller and Waverman, 2001). It is with this that Asad (2014) concludes that the farmer-trader coordination with the use of mobile phones leads to a reduction in post-harvest losses, especially for perishable crop production. In this study, Asad collected data from 30 villages and 450 households in Punjab, Pakistan. The findings of the study show that the use of mobile phone for coordination reduces post-harvest losses in perishable crops by 21-35 % and the number of days between harvest and sales by 5 – 7 days. The underlying reason for this conclusion was that mobile phones help the farmer and the traders to communicate and arrange harvest period, quantity and other preferences between them. In the end, farmers' incomes and household consumption increased 10-15 % and 8-10 % respectively.

2.5. Use of Mobile Phones in Agricultural Marketing

Fundamentally, mobile phones play the role of assisting farmers to obtain market information, access markets and allow farmers to participate fully in the market for greater returns (Etzo & Collender, 2010). A typical use of mobile phone in agricultural marketing is seen in the work of TradeNet and Esoko. TradeNet uses mobile phone SMS to provide up-to-date market information to farmers in Sri Lanka (Aker & Mbiti, 2010). Similarly, Esoko in Ghana provides a platform that signs up smallholder farmers to receive a package of weekly services that include current market prices, bids and offers, and market tips (Insyt, 2017).

In examining the use of mobile phones for agriculture marketing, Carmody (2012) argues that the mobile phone as a commodity does not have the intrinsic power to influence the organization of the market except that it facilitates information flow within the market. Hence, Jensen (2010) shows two ways that mobile phones influence market: access to market information and reduction in price dispersion. He juxtaposes this conclusion through a 5-year longitudinal study of sardine market prices in Kerala, India. The findings from the study show that fishermen use mobile phones to ask for prices in different landing sites to decide where to sell their catch. This reduces searching cost such as the cost of time, money and effort, leading to an increase in their returns. Overa's (2006) study buttresses Jensen's (2010) conclusion as her findings show that smallholder farmers in Ghana usage of mobile phone reduce their transportation cost and save time. Again, in Niger, Arker & Mbiti (2010) predict that mobile phones reduce search cost by 50%.

In the role of solving price dispersion, mobile phones have been seen as a special tool in breaking the problem of asymmetric information (Aker, 2008; Jensen, 2007, Overa, 2006). The problem of price dispersion arises when the price of commodities is different within a given community (Pingali, Khwaja & Meijer, 2005). Aker (2008) identifies that this problem is prevalent in Sub-Saharan Africa due to limited access to information. Mobile phones feed farmers, trader, and suppliers with quick information on all the prices existing on the market to establish the law of one price (Ajwang, 2014). To support this claim empirically, a study by Aker (2008) on the grain market in Niger shows that mobile phones significantly reduce price dispersion. Jensen (2007) in a further study on fishing in Kerala India, concludes that the fishermen usage of mobile phones stabilizes fish prices in the region to reduce price dispersion.

2.6. Mobile Phones Usage and Access to Financial Services

According to the World Bank (2012), the number of people who do not have access to formal bank account exceeds 2.5 billion globally. In developing countries, the number of adults with a formal bank account is approximately 41%. In Africa, only 20% of families own formal bank accounts and the most people who do not have access to formal bank account resides in rural areas in Africa. The lack of access to money, the high cost of running bank account, distant location of banks and lack of trust are an identifiable reason for the high number of the unbanked rural population (ITU, 2013)

The growth of mobile phones penetration has marked a transformation of the traditional bank to banking with the mobile phone (United Nations Conference on the Trade and Development [UNCTAD], 2012). Mostly referred to as digital finance or mobile money services, it is simply using provision of financial and banking services (Babcook, 2015; Sekabira & Qaim, 2016). The World Bank (2009) observes the use of mobile money reduce transactional cost by making payment from both individual users to another across a large distance. Most importantly, the voluntary nature of withdrawing money from mobile money accounts has re-engineered a new culture of saving via the mobile money wallet. Besides, some users of mobile money services save money in their account to prevent the risk of carrying too much cash (Kirui, Okello, Nyikal, & Njiraini, 2013). Hughes & Lonie (2007) reveal that mobile money is used for utility payment, salary payment, local and international remittances.

In applying mobile money services in agriculture, Rice mobile finance (RiMFin) led by Agribusiness Systems International and TigoCash, carried out a pilot study for using it for payment among 727 rain-fed rice farmers in Volta Region of Ghana. It emerged at the end of the pilot that mobile money payment had a positive impact on their on-farm activities (Babcook,

2015). Although this study was a pilot one where participants are controlled, in that, the results may not be widely realizable. However, Kirui et al (2013) support the of Babcook's (2015) in the pilot study. With the use of propensity score matching technique in examining the use of mobile money transfer services on farms incomes, agricultural input use and agricultural commercialization on 379 households in Kenya, Kirui et al (2013) identify that mobile phone-based money transfer services increased household farm income, agricultural input use, and agricultural commercialization by \$224, \$42 and 37% respectively.

2.7. Farmer's Livelihood and Use of Mobile Phones

The concept of livelihood has been a contention in literature. As one school of thought ascribes to economic fundamental which map livelihood to economic indicators like income, health and education (Ki, Faye, & Faye, 2005), others, from development orientation, view livelihood as an extension of the economic indices to cover freedoms and capabilities (such as Nussbaum, 2011; Sen,1999). Therefore, constructing a working definition for a livelihood for say a farmer must be a unification of the economic and developmental school of thoughts. One of the most recognizable livelihood frameworks is the one propounded by the U. K. Department of International Development. This framework defines livelihood in a broader dimension to include capabilities, assets (both material and social resource) and activities for making a living. Emphatically, a person's livelihood is sustainable when it can withstand stresses, shocks that improve assets or capabilities and not undermining the natural resource base (DFID, 1999). The description of the person in the context of livelihood may categorize the life of a person into poor (associated with poverty) and rich, an opposite in terms of definition. Poverty, as in the state of being poor, is associated with a living condition characterized by "chronic deprivation of the

resources, capabilities, choices, security, and power (United Nations Committee on Social, Economic, and Cultural Rights, 2001).

McNamara (2013) gives three dimensions that mobile phones impact on livelihood. This include its ability to easily provide access to information, increase accessibility of assets and opportunities available, and provides control over the life of the individual. The increased in opportunities is seen when mobile is used to access different market at both national and international level. This generally gives the farmer a good return on their products. Again, the use of mobile phones increases the accessibility of assets existing as natural, physical, human and financial assets (World Bank, 2001). High transaction cost bars farmer participation in the market (Lawrence, 2005) and with mobile phones, FOA (2003) realizes that farmers are fed with market information at a cheaper price reducing their exclusion from the market and contribute immensely towards their welfare.

Additionally, McNamara (2013) identifies mobile phone to give humans control over their lives. This he termed this as the empowerment construct. Here, empowerment is seen as the ability of the individual to influence, control and hold structures (thus, institutions that affect their lives) accountable through the expansion of assets and capabilities (World Bank, 2006). According to Narayan (2005), mobile phone empowers the poor by giving them choice to get support through associations such as cooperatives existing in farming communities in Africa. Apart from the empowerment and increased opportunities, the mobile phone provides farmers to access information to reduce risk associated with farmers. McNamara (2003) termed this livelihood benefit as vulnerability reduction construct. Given that farmers face risks such as drought, diseases outbreak and market risk, the use of mobile phone to access information

around these risks buffers the farmer from these shocks and take a decision that improves their wellbeing (Maxwell, 1999; InfoDev, 2005).

2.8. Role of Mobile Phones in Agricultural Development

In the expansive literature on the use of mobile phones emerged three pathways that mobile phones have affected agriculture (Chhachhar & Hassan, 2013; Hosseini, Niknami, & Chizari, 2009; Zakar & Zakar, 2009;). The literature shows mobile phones serving as an information dissemination tool, linking markets and helping in access to finance. In a study conducted in Pakistan on the use of mobile phones, Zakar & Zakar (2009) find that the use of mobile phones helps to disseminate vital information on seeds, fertilizers, pesticides, land preparation, intermixture cropping, water management and other relevant information to farmers. Although, they transfer this information via radio and television, Zakar & Zakar (2009) result show that mobile phones were the good medium to carry this information to the farmers. A close linked to this was the use of mobile phone by Kenyan farmers to obtain information on weather changes that is connected to solar-powered weather station. Other countries such as Uganda saw a significant improvement in farmers' production and income when mobile phones were used to deliver information on certified seeds and fertilizers (Kashem, 2010).

Additionally, Chhachhar & Hassan (2013) identify a growing usage of mobile phones in exchanging marketing and business information. To them, farmers use mobile phones to contact brokers and traders to sell their products and receives current information from these traders and brokers. In Malaysia, mobile line companies such as DIGI, CELCOM, MAXIX, and U-MOBILE provide a daily market rate of products to farmers which were used in their decision-making and enhance their production and sales (Lio and Chun Liu, 2006). Notwithstanding the tremendous use of mobile phones has seen a tremendous usage in developing countries, there continue to be

lingering challenges rural communities and farmers face in the use mobile phones. Challenges such as organizational complexities, technical capacity, financial and illiteracy. The apathy of high authorities and agricultural extension expects to deploy their services over the mobile phones was dominant in the literature. The few private companies who have taken the center stage in using ICT, however, were bedeviled with the poor quality of services (Hosseini, Niknami, & Chizari, 2009).

2.9. Challenges Farmers' Face in Using Mobile Phones

So far, the literature point to a direction where the use of mobile phone takes place throughout the agricultural value chain to empower, create opportunities and reduce the vulnerability of the farmer and increase their livelihood. However, the use of the mobile to access these livelihood benefits is marked with challenges. In a study involving 100 small-scale entrepreneurs in the Akwapim North District of Ghana, Kwakwa (2012) identify that 94.6 % of the respondents face the challenge of no reception whiles poor sound is a problem faced by 88% of the respondents. From the same study, 82.6% complained of the abrupt end of calls. Additionally, Frempong, Essegbey & Tetteh (2007) reveal that farmers could not read messages in the form of SMS and that constrains their potential to extensively utilize the capabilities of the mobile phone

2.10. Theoretical Framework: Sustainable Livelihood Framework

The study employs Sustainable Livelihood Framework (SLF). Few scholars have used this framework in operationalizing the capability approach in the context of development (e.g. Dasuki, Abbott, & Azerikatoa, 2014; Duncombe, 2007; InfoDev, 2005; Tanle & Abane, 2017). The U.K Department of International Development (DFID) initially propounded the framework to investigate the conditions of poor people through their social relations and ways of improving

on their conditions (Ellis & Bahiigwa, 2001; Ellis, 1999). It has however evolved to include ICTs into the discussions and analyze ways ICTs is beneficial to the poverty-reducing course (Duncombe, 2007; Sife, Kiondo, & Lyimo-Macha, 2010).

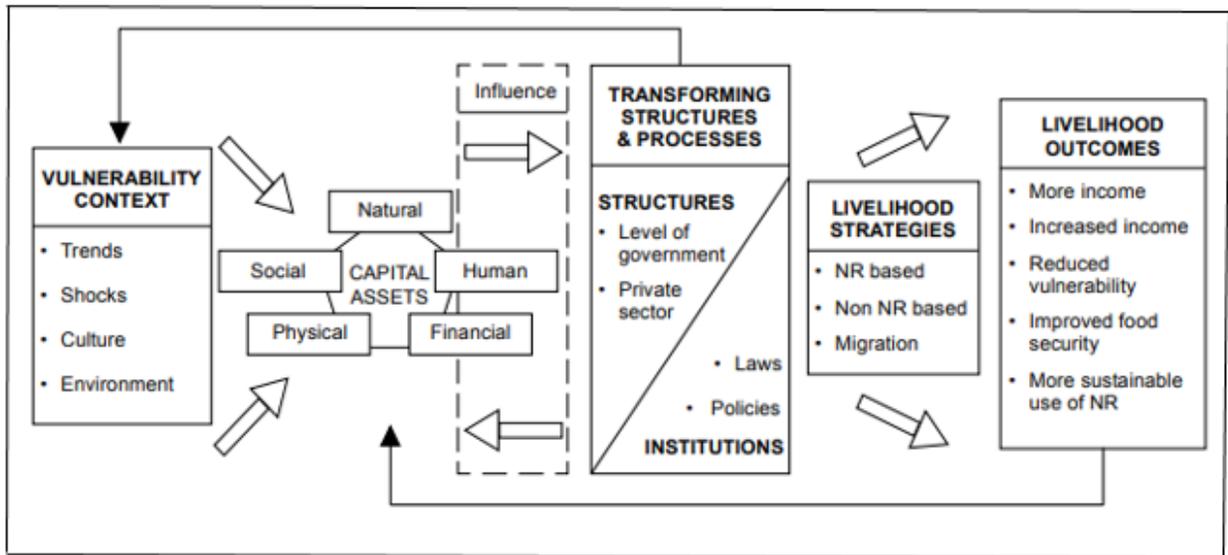


Figure 1: The DFID's Sustainable Livelihood Framework

(Source: DFID, 1999)

The framework (*Figure 1*) recognizes that individuals operate in vulnerabilities such as trends, shocks, and seasonality (DFID, 1999). Hume and Shepherd (2003) note that the vulnerability of the poor could increase when there is the existence of lack of economic opportunities, social exclusion, and ineffective governance. As such, the rate of vulnerability is positively related to the favorability of the shocks, seasons and trends on the poor people. In the face of vulnerability, the poor people make decisions that will enhance their livelihood using information derived from ICT tools. It is worth noting that people such as farmers require physical and monetary resources like money, skills, technological infrastructure, and social resources like trust, motivation, and power to use the information provided (World Bank, 1998; Heeks, 1999 cited in Duncombe, 2007). For example, information on climate, income-

generating activities and market fluctuations may influence livelihood outcomes when such information is provided to farmers and are utilized in making a decision. The farmer could make sound decisions from the information that may increase their income level, ultimately improving their lives (Duncombe, 2007).

Although poor people operate in vulnerabilities, there are people's strengths existing as assets or capital endowments that are converted into outcomes. The framework categorizes these assets into five; human, financial, social, physical and natural portrayed as a pentagon (DFID, 1999). The *human capital* (such as skills, and knowledge and good health) helps people to pursue the livelihood strategies. When information on this capital is either gathered from local indigenous or formal sources, farmers use it to make life-enhancing decisions (DFID, 1999; Duncombe, 2007). In agriculture, ICTs play the role of feeding people with information on production techniques, quality adherence, and marketing of products that are combined with indigenous knowledge to increase the overall knowledge of the individual. The human capital in the farmer is enhanced for the application in their farming activities to improve their lives (Chapman & Slaymaker, 2002). The *financial capital* describes the monetary resources like savings, gifts, remittances and other micro transfers (DFID, 1999). The World Bank (1998) attributes lack of access to financial resources as a contributing factor of poverty; hence, the ICTs provide mediums of accessibility to these financial tools.

The *social capital* comprises the social organizations that coordinate the actions of the individual in the society to realize the livelihood outcomes. It involves information that is transmitted between players via their social network like the players in the pineapple supply chain. Lyon (1999) posits that the individual achieves a better livelihood outcome when the information is up-to-date, and it is extensive in the context of a specific act or decision. The

framework considers *physical resources* as basic infrastructure and producer goods needed to support livelihood. Functionally, the producer goods help people to function more productively. The infrastructure is public goods such as water, transport, energy, and access to information that is valuable in supporting the individual to realize their outcomes (DFID, 1999). The *natural resources* consist of intangible goods (atmosphere; climate), land and other related land-resources used for livelihood outcomes. The framework shows that most of the vulnerabilities emanate from the natural resources (DFID, 1999) and information systems play a major role of monitoring these shocks and communicate to the recipients to safeguard them against making unsound decisions (Chapman & Slaymaker, 2002). Information systems are playing an increasingly important role in monitoring natural assets, giving rise to a broad range of information requirements for assessing environmental impact and sustainability (Chapman and Slaymaker 2002).

The other dimension of the SLF is *structure and processes*. These are institutions, organizations, policies, and legislation that helps the individual to utilize their capital assets in determining their livelihood strategies. In other words, they regulate the access, terms of exchange and returns on the individual capital assets (DFID, 1999). Here, information systems benefit the farmer by communicating these policies from the government, non-governmental organizations, market policies (through agricultural extension officers) to shape the decision of the farmer. The *livelihood strategies* present the choice, opportunity, and options for the individual to combine the capital assets to achieve their desired outcomes. Remarkably, the more choice and flexibility that people have in their livelihood strategies, the greater their ability to withstand the shocks of their vulnerabilities (DFID, 1999). Information provides capacity building through government-run extension services and empowers the farmer productively.

Additionally, information facilitates access to economic networks that help in participating in economic activity. For example, information on the market will help the farmer in deciding where to sell their produce to get the better returns (Duncombe, 2007). Combining these factors discussed above leads to what the framework termed *livelihood outcomes*. Some of the livelihood outcomes is to gain more income. The poor person's vulnerability is reduced, and they are able to have food security and sustainably utilize their natural resource. This, in turn, will increase the person's well-being (such as self-esteem, sense of control and inclusion, physical security, access to services) (DFID, 1999)

In summary, the SLF attributes the vulnerability of poor people to the origins of their conditions. Given such vulnerability, there are available assets that are either enhanced or constrained through the structures or process existing in institutions, organizations, social and cultural environment. This environment influences the ways of converting the available assets (i.e. termed as livelihood strategies) to achieve their livelihood outcomes (Carney, 1999; DFID, 1999; Duncmbe, 2007). Moreover, the framework can be summarily theorized that it traces livelihood of people to their vulnerability, opportunity, and empowerment.

CHAPTER 3: METHODOLOGY

3.1. Overview of the Method Chapter

The methodology of the study examines the methods that serve as guideline for conducting the study (Vanderstoep & Johnson, 2009). This section discusses the overall research design, data collection procedures and tools for arriving at the findings of the study. The chapter identifies the population, sample technique, study area, data and data collection tools, and procedure for analyzing the data. Additionally, the chapter explains the procedures for ensuring validity of the data collected and ethical issues that emerge from carrying out the study. Besides, the chapter discusses the challenges the researcher encounters in conducting the study.

3.2. Research Design

The research design revolves around the decision of the researcher on “what, where, how much, by what means concerning an inquiry or research study” (Kothari, 2004, pg. 31). The purpose of research design is primarily to give structure and direct the researcher on his or her actions (Trochim, 2009). Bryman & Bell (2015) identify three major research approach; qualitative, quantitative or mixed method. This study used mixed method research approach. The mixed method approach incorporates both the qualitative and quantitative research procedures to collect and analyse data (Bryman & Bell, 2015). The specific mixed method research design used in this study was exploratory sequential research design with the qualitative aspect as the major part of study. This type of research design has two phases. The first phase is a qualitative research that explore the views of participant and analysed for the second phase; quantitative research (Creswell, 2014). Given the exploratory nature of the study, the initially utilized qualitative approach to explore the pineapple production in the area and the uses of mobile phones in pineapple farming. The qualitative approach afforded the researcher to create a rapport

and had an in depth views of pineapple farmers in the area under study. The findings of the qualitative research phase was used to build appropriate instrument and to specify variables that used for the quantitative phase. This helped to apply the findings from the qualitative research to a larger sample for validation (Creswell, 2014). The quantitative phase of the study used descriptive and exploratory design with the use of survey questionnaire as an instrument and the use of statistical tools for data analysis.

3.3. Research Scope

The study focused on farmers in the pineapple production in Akwapim South district. It specifically looked at the perspectives of the farmers on the use of mobile phones in relating to other players in the supply chain of pineapple. Hence, the study explored the use of mobile phones in input supply, on-land farm activities, harvesting, trading, transportation, market and the ancillary and supporting services of farmers in the production of pineapple. The study examined the roles that mobile phones play in helping farmers in conducting these activities and the benefits they derive from its usage.

3.4. Study Population

The population for this study comprised solely of pineapple farmers in the Akwapim South District. The farm size of these farmers ranges from subsistence to small-scale with few commercial pineapple farmers. The reason to use different categories of farmers was to capture their varied opinions based on the operation scale.

3.5. Study Area

The area under study is the Akwapim South District. The district was established by the Legislative Instrument 2040 on February 6, 2012. The capital of the district is Aburi. It has a population of 37,501 with land area of 224. 13 kilometers square. The district shares boundary to

the west with Nsawam-Adoagyiri District, to the south-east with Kpone-Katamanso, to the south with Ga East District and to the North-East with the Akwapim North District (Ghana Statistical Service, 2014) (Appendix A)

The district is categorized into two zones based on the landscape of the area. These zones are the Akuapem-Togo Ranges and the Accra Plains. The plains form a major area for irrigation and mechanized farming while the range provides tourism and first class residential real estate development. More than one third of the labor force in the area engage in agriculture with the majority in crop farming. The district is one of the leading producers of farms produce such as pineapple, mangoes and citrus fruit in Ghana. Notably, the district is among the leaders in the volume of pineapple export in Ghana (Ghana Statistical Service, 2014) contributing to the decision of locating the study in this area.

3.6. Types and Sources of Data

The study employed both primary and secondary data. While the primary data was collected from the field through interview and survey questionnaires, the secondary data was gathered from the internet, journals and electronic articles available at Ashesi University College Library and other reputable databases.

3.7. Sampling Technique

The study adopted multistage sampling technique to select the sample. According to Alvi (2016) multistage sampling was used when the population of the study are spread over a wide geographical region and it is not possible to obtain a representative sample. There are more than 20 communities in the Akwapim South District. Given this vast geographical area, the multistage sampling was used to select five major pineapple-producing communities. The selected communities were Amanfrom, Fotobi, Akraman, Obodan and Berekusu.

Pertaining to the qualitative research, purposive sampling was used for the selection of participant in this study. This was particularly used given that there was no data on registered pineapple farmers in these communities. Again, the convenient sampling strategy helped with easy identification of the participants since the researcher sought for an in-depth discussion and the availability of the participants was key to achieve that aim. Similarly, purposive sampling method was used for the second face (quantitative phase) of the study to select equal proportions of sample size in all the five communities. The strategy was utilized to select pineapple farmers who own mobile phones and cultivate on different acreage of farms in the five communities.

3.8. Sample Size

The sample size represents the actual participants from the target population that will take part in the study. The attribute of a good sample is its representation of the target population (Vanderstoep & Johnson, 2009). Particularly to quantitative study, Fraenkel and Wallen (2000) assert that a minimum sample size of 30 is needed for the conduction of quantitative causal relationship study. Additionally, they also suggest that a minimum sample size of 100 and 50 is needed for correlation study and determinant of relationships among elements respectively. Since the quantitative aspect of the study sought to establish the relationship between mobile usage and farmers livelihood benefits, 125 farmers were sampled for study. Again, Delice (2010) advises that a minimum sample size of 100 with a representation of 24-sample size from the various sub-groups in the target sample is an ideal sample size for carrying out a survey research. Following this, 25 participants were selected from each community for the quantitative aspect of the study. Ten pineapple farmers were selected with two from each of the five communities for the qualitative phase of the study. Table 1 below shows the distribution of the sample size used for quantitative aspects of the various selected areas.

Table 1: Distribution of Sample Size in the Selected Communities

Study Area	Sample Size
Amanfrom	25
Fotobi	25
Akraman	25
Oboadaka	25
Berekusu	25
Total	125

(Source: Field Data, 2018)

3.9. Data Collection Instruments

The study employed interview guide (see Appendix B) and questionnaires (see Appendix C) to collect the primary data. The interview guide contained open-ended questions that allowed the research to ask follow-up questions. This was used for collecting the preliminary data for the qualitative aspect of the study. The data gathered from the qualitative research was used to develop questionnaire that contained closed-ended questions with a few open-ended ones using a survey approach to collect the data for the quantitative part of the study. As Patton (2002) note, questionnaires afford the benefits for the respondents to choose from a set of responses, making it easier for the researcher to analyze and compare with other respondents. The questionnaire contained seven sections structured to solicit responses to answer the research questions of the study. Two of the sections contained a five-form Likert scale ranging from 1-strongly agree to 5-strongly disagree, and 1-very low to 5-very high. In using questionnaires to collect data, Kothari (2004) advises that pilot study needs to be conducted to ensure the familiarity of the respondents to the questions hence this study followed suit. Apart from the qualitative research phase which briefed the researcher on the knowledge of the participants, the questionnaire was pilot tested before a final one was administered. In this study, the researcher administered the final questionnaires since most of the study participants were not literate in the English language.

3.10. Data Preparation, Collation and Processing

The data from the interview was recorded and collated for analysis. Data collected from the questionnaires from the field was entered in Microsoft Excel by coding. Then, the coded data was sorted out and cleaned to avoid mistakes and incomplete questionnaires that will affect the data analysis

3.11. Data Analysis and Presentation

The study combined the findings from both the initial qualitative study and the quantitative study for the data analysis. The initial qualitative data was analyzed using thematic analysis. The thematic analysis helped in the collation of various responses from the participants and establishing common themes (Vanderstoep & Johnson, 2009). Through the thematic analysis, some of the responses were reported directly and others summarized.

Furthermore, the coded responses from the questionnaires were used for statistical analysis with the use of Microsoft Excel and SPSS tools. Descriptive statistics was used to examine the demographics of the research participants and other findings presented in graphs and tables. The study used logistic regression to ascertain the effects of farmers' demographic profile on their perceived benefits of using mobile phones in their farming business. For the regression analysis, the five-point Likert scale responses was broken down to two-point Likert scale to suit for the data analysis.

3.12. Validity and Reliability

The validity of research instrument indicates the degree to which an instrument measures what it is supposed to measure (Trochim, 2009). Vanderstoep & Johnston (2009) asserts that the validity of the research instrument is the extent by which a test yields the same result across multiple research. This study ensured its validity by comparing its findings to the preliminary

findings from the qualitative research and other previous studies done in different agricultural sectors. Additionally, an experienced researcher (thesis supervisor) and the Ashesi Institutional Review Board (IRB) approved the validity of the data collection instruments.

3.13. Ethical Considerations

According to Vanderstoep & Johnson (2009), research ethics is concerned with three things; respect for persons, beneficence and justice. Respect deals with treating the research participants as autonomous agents that must be accorded with respect and dignity. Beneficence is where the researcher ensures the wellbeing of the participants by maximizing their benefits and minimizing their risks. They view ensuring fairness in the distribution of possible risks as ensuring justice. This study ensured objectivity in data presentation to avoid any falsification. All data taken from other sources were referenced appropriately. Concerning the research participants, the researcher maintained a high level of confidentiality by making the data collection instruments anonymous. Research participants was entreated to provide nothing but the true data. The research method avoided harm of any sort to the respondent, be it legal, mental or physical. Besides, participating in this study was voluntary. Therefore, study participants could withdraw their participation from the study at any time.

3.14. Limitations and Delimitations

The researcher faces some challenges in conducting this study. First, the researcher is time constrained. This means that the study needs to be conducted on a sample size that can ease the burden of data collection. Apparently, most of the studies done on mobile usage in other sectors employed panel data for analysis. However, the researcher was constraint by time to conduct such panel data. Besides, unavailability of data on registered pineapple farmers in the study area necessitated the use of non-random sampling which limit the generalization of the

findings for the study and the statistical data analysis employed. More so, the researcher administering the questionnaires may lead to data bias resulting from the researcher interpreting the responses given by the respondents.

CHAPTER 4 – RESULTS AND DISCUSSION

4.1. Overview of the Results and Discussion Chapter

This chapter presents data and analyzes to achieve the study's objectives. Given the sequential mixed method data collection used in this study, this chapter begins with the results obtained from the initial in-depth interview that describe the pineapple production processes and supply chain networks in the study area. Following this, the chapter accounts for the findings of the second stage of the study. It describes the respondents' profile collected from the questionnaire survey. Subsequently, the chapter looks at the various uses of mobile phones in pineapple supply chain and the livelihood benefit farmers derive from using mobile phones. Additionally, the chapter presents the results on the challenges farmers face in using mobile phones. The chapter ends with the implication of the results on the sustainable livelihood framework. In discussing the data, the findings from the questionnaire survey is used to support the data collected from the in-depth interview

4.2. Pineapple Production Processes and Supply Chain Networks in the Akwapim South District

The pineapple production and the supply chain in the district can be broken down into land preparation, acquisition of inputs, planting and crop maintenance, harvesting and post-harvesting activities including marketing. Figure 2 summarized the various activities and players in producing pineapple, various processes and market route in the district.

Land Preparation and Planting

The cultivation of pineapple starts with the acquisition of land. Farmlands in the district are owned either by the farmers or in the thrust of others as in the "Abunu and Abusa" tenure

system³. The land size varies in sizes with a minimum land size of 1-5 acres for the small-scale farmers, 5-10 acres for medium farmers and land size greater than 10 acres engaging in large commercial farming. Most of the farmers clear the land using labor hands with the use of cutlasses. After weeding, the weeded materials are burnt to kill excess plants. Some farmers apply weedicides to kill the emerging weeds on the land. Planting beds are prepared with special hoes for the actual planting of pineapple suckers. With farmlands that require extra labor, the farmer hires labor hands within the community. Sometimes, the farmers ask for help from colleague farmers to prepare the planting beds before planting.

There are three varieties of pineapple grown in the district: Smooth Cayenne, MD2 and Sugar Loaf. The selection of a variety depends on the market and the investment capacity of the farmer. Farmers who supply for export use the MD2 because of its demand in the European market and other players in pineapple export industry. Its production, however, involves high investment outlay. The Smooth Cayenne and the Sugar Loaf are mostly cultivated for the supply to local market. Existing pineapple farmers use the suckers obtained from the previous harvesting for the planting of the new season. For farmers without their own suckers, they acquire new volume either from the same or nearby communities and transport it to the farm for planting. About 5000 pieces of suckers cost GHS1, 000 which farmers consider very expensive. The farmers use their head or vehicle to transport the suckers to the farmlands. Due to financial constraint, few farmers treat the suckers with insecticides from infestation before planting. This

³ The Abunu and Abusa is a land tenure system where farmers who do not own their farmland share the produce with the landowners. The Abunu means the produce will be shared into two equal halves while Abusa means the produce will be shared into three and the farmer takes either one-third or two-third.

greatly affect the yield. Farmers estimate that “one rope” (one-ninth of an acre) of land could cultivate 5000 pieces of suckers with a yield between 3500 - 4000 pineapple fruits.

Pineapple Crop Maintenance

This stage involves the care given to the pineapple after planting for harvesting. It includes weed control, fertilizer application, disease control and maturing strategies. Farmers consider this stage a crucial period because it determines the fruiting and quality of pineapple produced. Farmers that engages in inorganic farming use weedicides to control their weeds. The ring method is normally used for fertilizer application. Besides the use of insecticides to control insects on the farms, the pineapples are sprayed twice before maturation — *forcing* and *de-greening*. The forcing stage is where the pineapple plant is forced to fruit. The chemical used for the forcing is carbide. De-greening helps to change the color of the pineapple from green to yellow at the de-greening stage. Most times, farmers who engage in exports de-green their pineapple to suit the demand patterns of the export destination. Pineapple takes between 18 – 20 months to mature, thus from sucker planting to harvesting. The farmers estimate that after forcing, it takes approximately 5 months for the pineapple to mature. Hence, the forcing period must be well calculated, documented and planned to meet a favorable market period.

Harvesting.

As mentioned earlier, pineapple ready for harvesting between the periods of 12-18 months after planting. Farmers hire farm hands to cut pineapple fruits. Sometimes, the farmers go with the local sellers to the various farms for cutting off the pineapple fruits. The harvested pineapples are sorted out and packaged for transport to their destination.

Trading/Marketing

The perishability nature of harvested pineapple demands quick market for the selling of the produce. Farmers in the district consider readily available market and pricing as major determinants of their returns. Generally, farmers in the district sell their produce to exporters, local market traders, wholesaler, retailers, processors, and consumers. Some of the small-scale farmers sell their produce to other colleague farmers that engage in exportation of pineapple to the European market. These large-scale farmers reside in the producing communities. The difficulty farmers face is meeting certification standards. However, Fairtrade Organization operates in one of the communities by forming cooperative society and educate farmers on these quality standards. There are other small-scale farmers' cooperative (in Fotobi) who engage in pineapple exporting. Most of the farmers sell their produce to local market traders who come from nearby towns: mostly from Accra, Nsawam and Kumasi. Pineapple processing companies like Blue Skies Ghana Limited (in Nsawam) and HPW Fresh and Dry Limited (in Adeiso) purchase pineapple from selected farmers who meet the quality standard operation. Farmers who sell to these processors consider it profitable but cumbersome. This is because they need to convey the produce to the companies' factory site demanding high transportation cost.

Additionally, farmers supply directly to the local market in the nearby towns. Also, there are petty traders — table traders — in the local communities who buy and sells the pineapple in small quantities. Most of the traders (exporters, retailers, wholesalers, and processors) come with their own transport for the conveyance of the pineapple but gives their own price. The farmers that supply to the local market uses taxis, trotro, and vans to transport these products to the market. These local market places are not organized which leads to supply surplus leading to price reduction. A farmer narrated that

It is sometimes better to give the pineapple for free at the market than selling it because it wastes time and you get nothing (Author's Fieldwork, 2018).

Farmers consider the business profitable but the increasing cost of inputs, market failure, transport cost and lack of access to financial services threatens their continuous participation in the business as a source of livelihood.

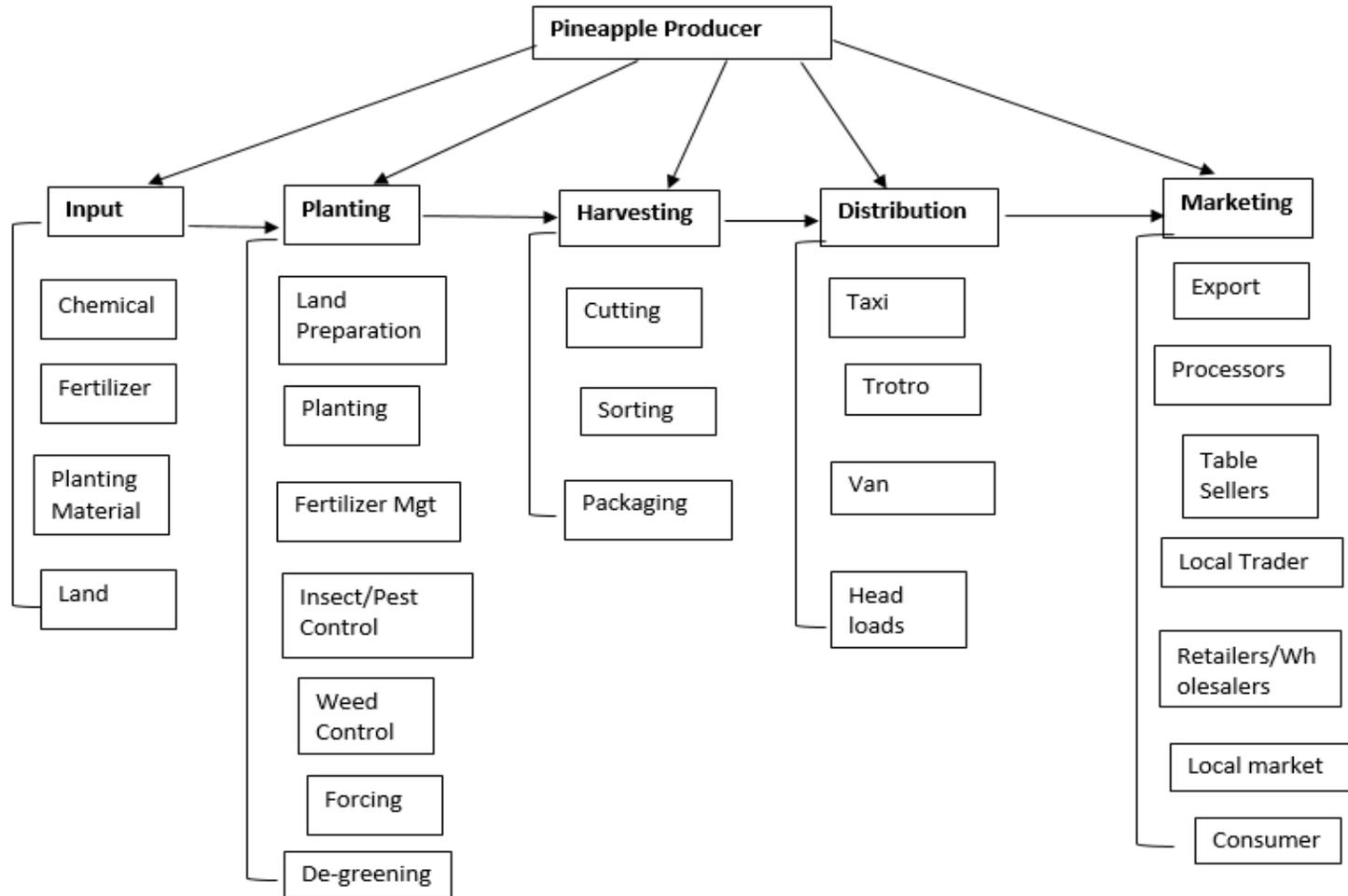


Figure 2: A Chart Showing Pineapple Production Processes and Supply Chain Network in Akwapim South District

(Source: Compiled by the Author based on Fieldwork, 2018)

4.3. Sample Demographic Characteristics

The descriptive statistics of the respondents in this study is summarized in Table 2. The result shows that majority of the respondents are males, constituting 88.88% of the respondents as against 11.2% of females. This results buttresses Ogbeide & Ele's (2015) claim that the agricultural sector is a male dominated industry in that the male, designated as family head, dictates the means of livelihood. This finding, however contradict MOFA's (2010) assertion that women farmers form the larger agricultural labor force in Ghana.

Again, from Table 2, about 43.20% of the respondents have had some form of primary education while 36% have had Junior High (Middle School) education. Furthermore, 16% of the farmers are without any formal education. Only 1 out of the 125 farmers have had a tertiary education, with 5 farmers attaining secondary education. The level of education affects the ability to use mobile phone to access information and the rate to learn innovations that come with the mobile phone which in turn, affect the income level (CIMMYT, 1993; DiMaggio & Cohen, 2004; Schiffman & Kanuk, 2004). In terms of respondents' experience in farming pineapple, a little over one third of the farmers (33.6%) have been cultivating pineapple between 6 – 10 years. This is closely followed by those in the pineapple farming business between 16 – 20 years (23.2%). While about 8% of the farmers have been engaging in pineapple for more than 21 years, 13.6% of the farming have been in the business for 11-15 years. Additionally, the findings point out large value of new entrants into pineapple farming. This is shown by 21.6% of farmers engaging in the business for less than 5 years. Experience in farming has been identified as a factor that helps farmers quickly use technology in highly needed areas to help improve their business (Ibrahim, Adejoh & Edoaka, 2009)

Table 2: Distribution of Demographic Profile of Sampled Pineapple Farmers

Variable	Frequency	Percentage (%)
Sex		
Male	111	88.80
Female	14	11.20
Age (years)		
≤ 20	2	1.6
21 - 30	23	18.4
31- 40	24	19.2
41 - 50	39	31.2
51 - 60	31	24.8
61 +	6	4.8
Educational Level		
No formal schooling	20	16
Primary school	54	43.2
Junior High School	45	36
Senior High School	5	4
Tertiary	1	0.8
Work Experience (years)		
≤ 5	27	21.6
6 -10	42	33.6
11- 15	17	13.6
16 – 20	29	23.2
21 +	10	8
Farm Size (acres)		
≤ 5	92	73.6
6 – 10	30	24
11 – 15	3	2.4
16 – 20	0	0
21 +	0	0
Mobile Phone Type		
Basic phone	80	64
Smart phone	45	36
Years of Using Mobile Phone		
≤ 5	32	25.6
6 – 10	78	62.4
11 - 15	12	9.6
16 +	3	2.4
* Network Used		
Vodafone	31	24.8
AirtelTigo	27	21.6
MTN	110	88
Glo	-	-

Source: Author's Fieldwork, 2018. N = 125. * Multiple responses were allowed

More so, from Table 2, more than two thirds (73.6%) of the farmers cultivate on a land which is less than 5 acres with about 24% cultivating on farm size between 6 – 10 acres. Further, a little over 2% of the farmers cultivate on farm size between 11- 15 acres. Farmers explained that due to problems such as high input cost, lack of available market and difficult in accessing finance, one of the farmers cultivate on farms exceeding 16 acres. Another

The results from Table 2 shows that 64% of the farmers use basic mobile phone while 36% use smart phones. A basic phone has features like Bluetooth, alarm clocks, text messaging, address book, simple video capturing capability. A smartphone is more of small computer with features such as fast wireless speed for streaming data, internet surfing, camera, Wi-Fi connectivity and could run applications for editing documents as well as social networking (Roberts & McIntosh, 2012). The type of mobile defines the functional capability of the phone in affecting the farmer's usability in accessing information and other features to improve their farming business. It was evident from the in-depth interview that, farmers prefer to use smart phones; however, they are constrained by financial demand, unfamiliarity and inability to use it due to illiteracy. The study also revealed that that many of the farmers (62.4%) have been using mobile phones for 6 – 10 years. About 9.6% of the farmers have used mobile phones for 11-15 years now. The farmers who have used mobile phone for more than 16 years constitute 2.4 of the respondents. Considering the fact that mobile phones were introduced in Ghana in the year 1992 (NCA, 2017), the result showed that farmers in the area have been using the device for long and may have adapted it fully in their farming business.

MTN has the largest network subscription among the farmers with 88% followed by Vodofone (24.8%) which slightly edged over the newly combined network AirtelTigo, with a subscription rate of 21.6%. No farmer subscribed to the Glo network. The result confirmed NCA

(2017) report that MTN dominate the penetration rate in Ghana. From the in-depth interview, most of the farmers choose MTN network because their relatives or contact list uses it, thus, the network effect is expanding the market share of MTN.

4.4. Farmers' Usage of Mobile Phone in Pineapple Production Processes and Supply Chain

This section focuses on the uses of mobile phones in the pineapple supply chain. It combines the findings from both the -in-depth interview and the data from the questionnaire, presented in themes as follows.

4.4.1. Mobile Phone Use in Pineapple Production Input Supply

Starting a pineapple farm requires availability of certain inputs. Apart from the land, which is immobile, the rest of the inputs such as water, labor, chemicals (fertilizers, weedicides, and insecticides), food and planting material (suckers) are conveyed to the farm. From the in-depth interview, farmers source the chemicals from local shops either in the community or nearby markets. They sometimes walk to these local shops to buy it themselves or pass the purchase through their relatives. With the invention of mobile phones, some of the ways of sourcing these inputs have changed. Respondents were asked to indicate major ways of purchasing the supply of the inputs before and after their use of mobiles. The results from *Table 3* showed that before the adoption of mobile phones, 60% of the farmers walk to the local source of the inputs while 26.4% of them contact agents, middlemen, to buy these inputs.

Table 3: Ways Farmer Access and Purchase Inputs before Mobile Phone Adoption

Ways of Buying Inputs	Frequency	Percentage
Contact local agent to buy inputs	33	26.4
Relatives helps to buy inputs	17	13.6
Walk to source of inputs	75	60
Total	125	100

(Source: Author's Fieldwork, 2018)

However, after the adoption of mobile phones, the rate at which farmers walk to acquire farm inputs decreased by 14.4% (60% -45.6%) while 29.6 % of farmers suggested they use the mobile phones to coordinate the supply of their farm inputs. This is shown in Table 4 below.

Table 4: Post Adoption Ways of Accessing and Purchasing Inputs

Ways of Buying Inputs	Frequency	Percentage
Contact local agent to buy inputs	23	18.4
Relatives helps to buy inputs	10	8
Walk to source of inputs	54	43.2
Coordinate the purchase with mobile phone	38	30.4
Total	125	100

(Source: Author's Fieldwork, 2018)

Concerning specific inputs mobile phone is used to coordinate its supply, as shown in Figure 3, 37.6% of the farmers use the mobile phone to coordinate the purchase of fertilizers. Following this, 32% and 25.6% of the farmers indicated the use of mobile phone for coordinating the supply of insecticides and labor respectively.

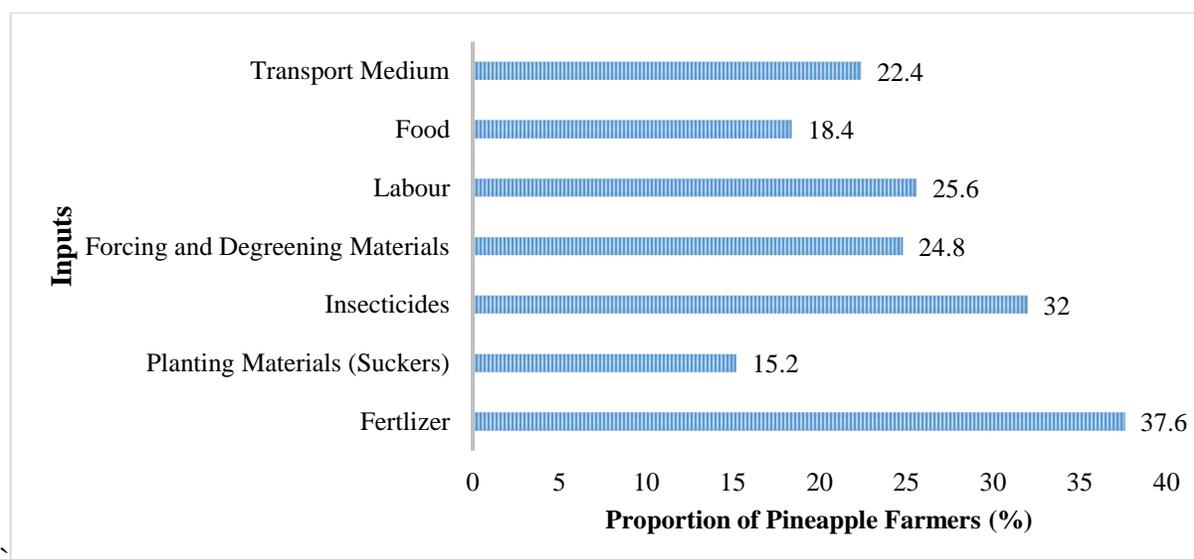


Figure 3: Proportion of Specific Inputs Farmers Use Mobile Phone to Coordinate its Supply

(Source: Author's Fieldwork, 2018). Note: Multiple responses, N = 125

From the in-depth interview, one of the farmers explained the coordinating function of the mobile phone in inputs supply as follows:

Getting a laborer to fulfill their commitment is a problem. Some of them will make commitment and will never show up. Since I started using mobile phones, I will call all the laborers early in the morning to ascertain their availability. This saves time because I do not have to go to their individual houses and check on them. It makes planning easier. Additionally, I use the mobile to contact the local input seller to check on chemical stocks so that I will not waste my time and energy to walk to the shops only to find otherwise (Author Fieldwork, 2018)

4.4.2. Mobile Phone Use in Agricultural Information Facilitation

Farmers consider information crucial in their business. They obtain agricultural information from different sources. The major source of information was through mobile phone, accounting for 32.8% of farmers' source of information (Table 5). Additionally, about 32% of farmers considered community radio to provide them with valuable agricultural information. Cooperative society follows this with 30.4% of the respondents and then government extension services, 22.4%. Farmers indicated television as the least source of agricultural information

Table 5: Sources Farmers Obtain Agricultural Information

Sources of Information	Frequency	Percentage
Extension services	28	22.4
Cooperative Societies	38	30.4
Radio Stations	21	16.8
Television	15	12
Community Radio	40	32
Mobile Phones	41	32.8

(Source: Author's Fieldwork, 2018). Note: Multiple responses. N = 125

Although farmers obtain information from sources such as radio stations, community radio, television and agricultural extension services, most of the farmers considered information received with mobile phone as quick and personal. The mobile phone ensures free flow of information in the community and draw farmers attention to vital agricultural information. Farmers indicated a peer-to-peer information sharing with their adoption of mobile phone. A farmer has this to say:

The mobile phone gives me a lot of information. For example, a friend called me last year that he applied a specific insecticide and it was very good in contributing to his yield. I applied the same chemical on my farm and it was good. More so, there are some NGOs and organizations who come here to educate us on things that we need to do to improve our farms. In case I am not aware of these organizations' presence, my friends will call to inform me. Sometimes, they brief me on the minutes of these meetings. Again, if I am in a farm and say, I forget how to mix a certain chemical; I will call a friend to ask for advice. Moreover, I receive information on weather and this save my chemical when there is imminent rainfall (Author Fieldwork, 2018).

To validate this information, farmers were asked in the questionnaires on specific information they obtained or searched with their mobile phones. The results in Figure 4 showed that information related to market, post-harvest handling, disease management and weather were the major information farmers obtained with their mobile phones. About 94.4% of the farmers obtained information related to market whiles 46.4%, 32.8% and 32% on weather, post-harvest handling and disease management respectively. This finding is in line with Adégbidi (2012) who realise that farmers mostly use their mobile phone to access market related information.

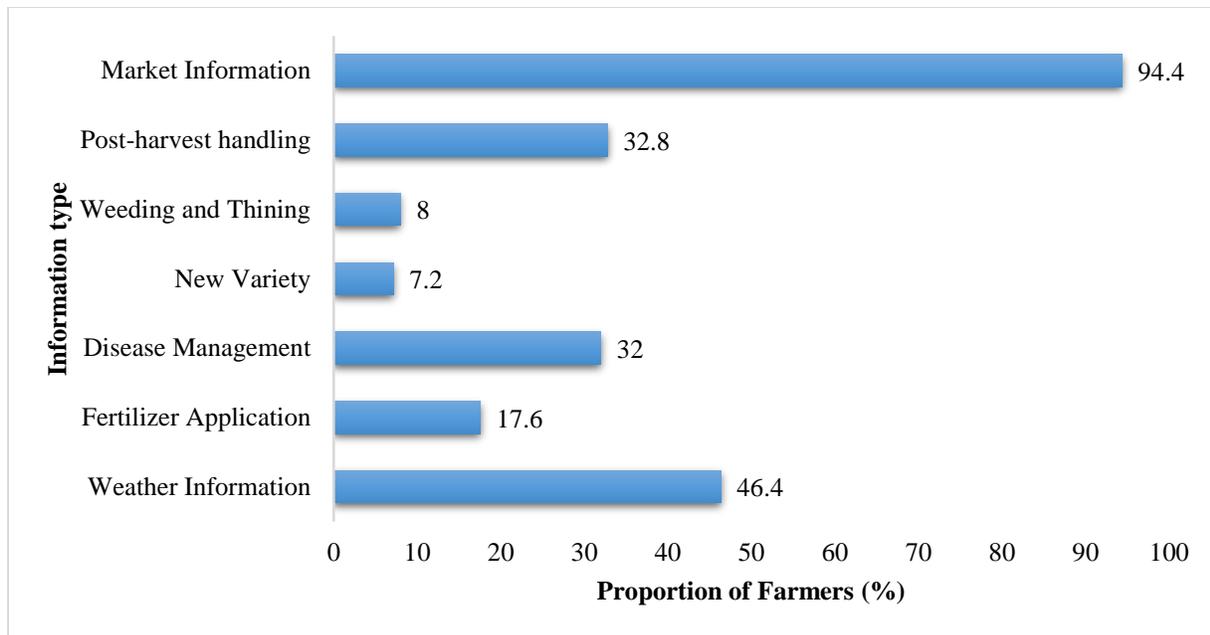


Figure 4: Proportion of Specific Information Farmers Obtain from Mobile Phone

(Source: Author's Fieldwork, 2018). Note: Multiple responses. N = 125

4.4.3. Mobile Phone Use in Accessing Market and Selling Pineapple

Pineapple farmers agreed with Odhiambo (2013) that the output market determines the return they obtain on their yield. To this, farmers use the mobile phone to aid the sale of their produce. Farmers use the mobile phone to access market with demand for pineapple. They also use it to contact local traders and ask for prices they offer. As shown in Figure 5, 78% of the farmers use the mobile phones to search for prices on the market. Additionally, 76.8% of the farmers access demand changes in the market especially the local market with their phone and more than half of the farmers use the mobile phone to contact new trades (intermediaries, wholesalers, retailers) in the market. This finding is consistent with Overa's (2006) conclusion that small-holder farmers use the mobile phone to search for market prices for their produce

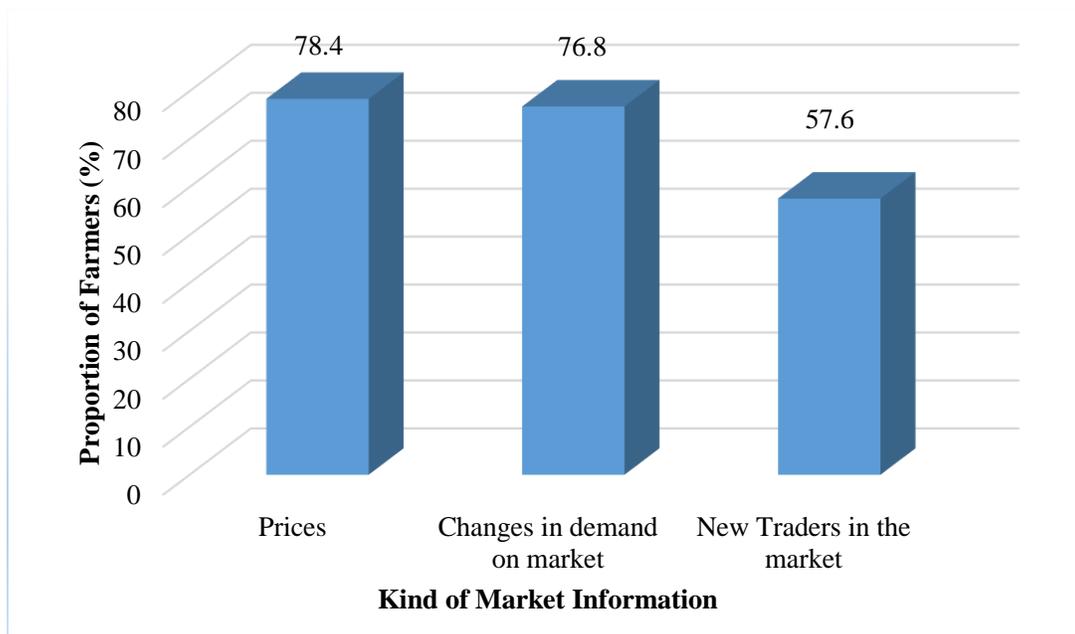


Figure 5: Proportion of Farmers and the Kind of Market Information Receive/ Search with Mobile Phones

(Source: Author's Fieldwork, 2018). Note: Multiple responses. N = 125

On why they use the mobile phone to access this market information, the following was a response from one farmer:

The traders (local traders) come from different places. Some come from Kumasi, Accra, Cape Coast and nearby to buy the pineapple. Because pineapple is perishable, I always wait for the traders to arrive on the farm before we do the harvesting. I negotiate for prices at the farm. Before that, I will use the mobile phone to contact some of the traders and ask for their prices. Then, I benchmark my prices at the given price. This has helped me change customers and get a high return on my produce (Author's Fieldwork, 2018).

The price differential obtained from the market has made a lot of farmers to change their business partners (local consumers, local traders, wholesaler, retailers, exporters, distributor, processors and transport operators). About 65% of the farmers posited that mobile phone has

made them change their customers while only 35% thinks opposite (See Figure 6 below).

Farmers indicated that the use of mobile phone has therefore decrease price dispersion as they get informed about the existing prices on the market. This result dovetail with Odhiambo (2013) assertion that the use of mobile phone level prices among landing sites of fishermen in Kenya

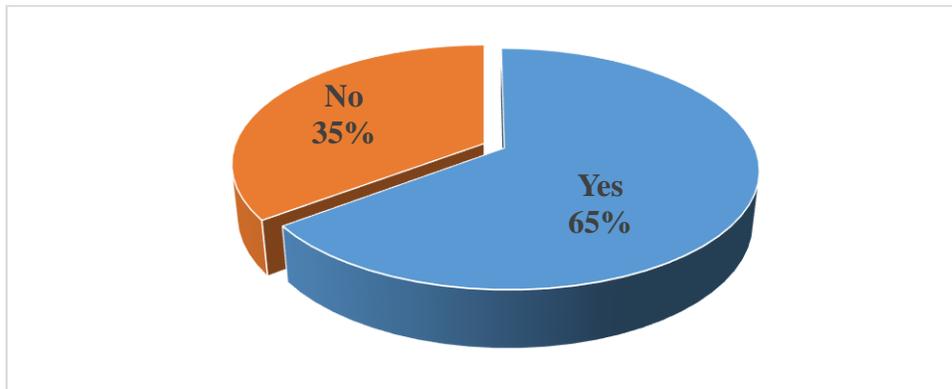


Figure 6: Farmers' Response on Whether Mobile Phone Has Made Them Change Customers

(Source: Author's Fieldwork, 2018). N = 125

More so, pineapple farmers in the area considered mobile phones as a storage of information such as contact of their customers. This gives them the opportunity to contact many customers as possible to arrange for the sale of their produce before the pineapple matures for harvesting. The farmers' claim that mobile phones has helped them reduce post-harvest losses. Find below a respondent response in supporting this claim

Because of this mobile phone, I have about 10 contact address of traders. Immediately after forcing, I call and inform them of my farm yield. I do remind them always so that I will be sure of their intention. Even before they come, I call them to ask if they on their way. Me, the phone is my book (Author's Fieldwork, 2018)

4.4.4. Mobile Phone Use in Accessing Finance in Pineapple Farming

In an opening statement in the use of mobile phone for finance service, a respondent says;

At first, I do not get paid easily from the traders that I sell the pineapple on credit. You cannot even find them and if you will do, you incur a lot of travelling cost. Some market women owe many farmers here. Some of the debt are to the tune of GHS1, 000 to GHS 3, 000. For mobile phone, I will call to follow up on the buyer and receive my money from the comfort of my home (Author's Fieldwork, 2018)

Farmers consider mobile phone as a special tool in helping them with their financial needs. The mention of finance with mobile money is tantamount to mobile money services. Because of the importance attributed to mobile money, about 98% of the respondents use mobile money (See figure 7 below).

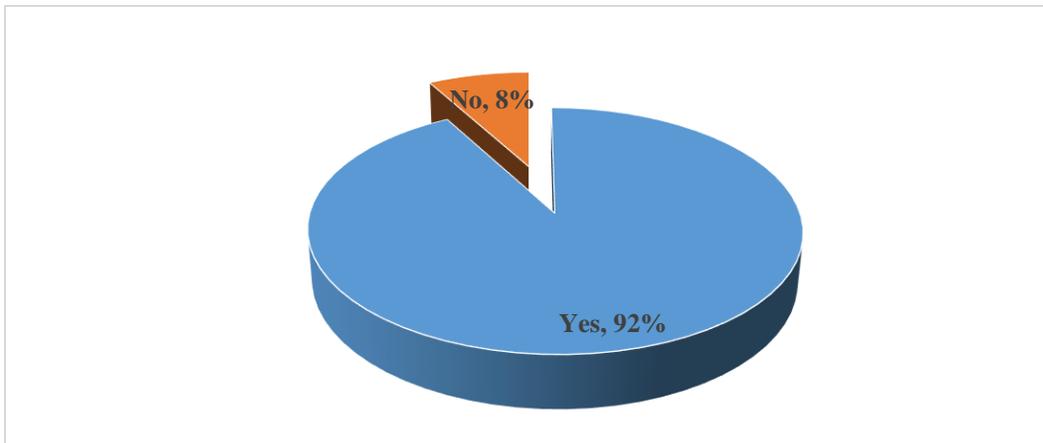


Figure 7: Percentage of Farmers Using Mobile Money

(Source: Author's Fieldwork, 2018). N = 125

Farmers indicated many ways of using the mobile money services. Some of them consider the money services as a saving medium and prefer it than depositing their money at a formal bank. One of the respondents mentioned that:

Since I am using mobile money, why should I be in a long queue at a bank to deposit money? It is even stressful withdrawing your money from the bank. But with mobile money, I just

have to take it to the merchants over here, then I have my money saved and I can withdraw it at any time” (Author’s Fieldwork, 2018)

Not only do farmers use mobile phone for saving and receiving payment, farmers also use the mobile money platform to pay for their inputs and receive credit facilities. For its convenience and cost reduction, farmers buy their inputs and negotiate with suppliers on favorable credit terms. Additionally, farmers indicated that the mobile money services have made it possible to obtain credit financing from their buyers. They receive this money from the buyers occasionally to purchase inputs for their farms. More so, farmers receive remittances from relatives from different places to help finance their farming business. In short, mobile phone through the mobile money services increases access to finance facilities.

In confirming the various usage of mobile phone for finance in pineapple farming, 62.4% of the farmers said they received remittance while 44% receive payment from mobile money, as shown in Figure 8. Using mobile money for taking loan is the least way (16%) farmers use the services to help with their farming business.

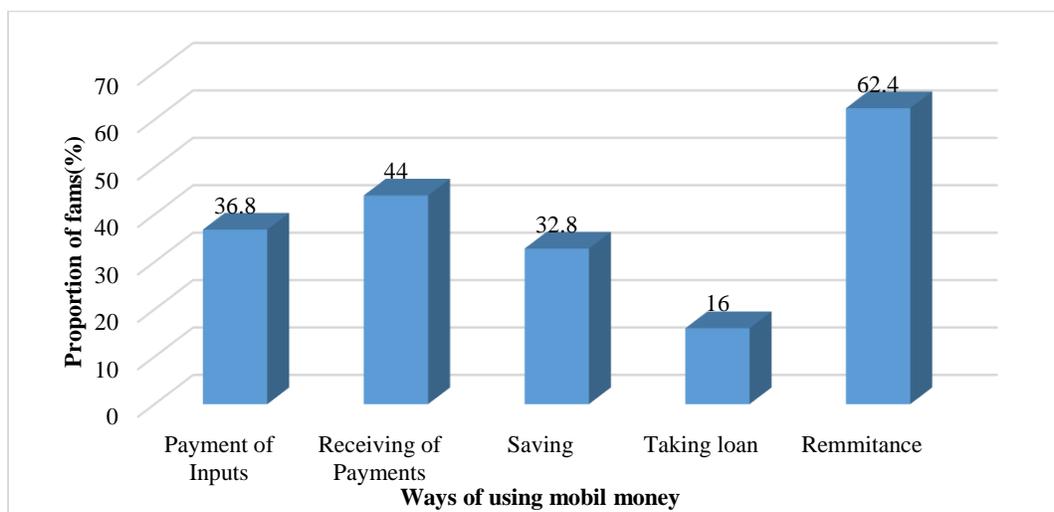


Figure 8: Proportion of Farmers and Ways of Using Mobile Money in Pineapple Farming

(Source: Author’s Fieldwork, 2018). N = 125 NB: Multiple responses allowed

4.5. Benefits of Mobile Phone Use for Pineapple Farmers

Farmer's perceived mobile phones beneficial to their businesses and on their lives. The idea of mobile phone benefits thrives on a lot dimensions. Most of the farmers consider the use of mobile phones to help them improve their farm business. They trace the benefits of mobile phones in reducing time it takes to coordinate the supply of their inputs. This usability reduces their transportation cost. Again, farmers use the mobile phones to search for produce prices existing on the market without physically travelling to those places; thus, reducing their travelling cost. Some of the farmers agreed that mobile phone helped them decrease the price difference, resulting in the benefits of increasing their profits. Additionally, pineapple farmers in the study area considered the benefits of mobile phones in improving their product delivery. This occurs when they use the mobile phone to communicate with their distributors, transport owners and their customers to ensure their produce get to the destination. A respondent from the initially study narrated that;

Mobile phones are beneficial because it helps to communicate with market women to know their offer price. I will then harvest the pineapple based on their quantity prescription and call the driver to convey it the local market. This reduces the stress of getting the products on the market and make it easier. It also prevent wastage

Besides the ease of coordinating the delivery of produce that comes with the use of mobile phones, the other benefits farmers consider in the use of mobile phones is the improved access to information on the market and other agricultural information. The pineapple farmers indicated the rate of perishability of the pineapple hence the need for ready market. The benefit that mobile phones bring to this course is the swiftness to gather information on prices of the produce over the different buyers. On the local markets, nearby, where majority of the farmers in

the study sell their produce, farmers posited that mobile phones help in aggregating the going prices. This in turn assists in their decision on where to sell their product and the individual customers to sell their produce to for a better return. At times, the market information gathering ability of mobile phones helps them to negotiate well with the buyers to achieve a better deal. Therefore, mobile phone helps in determining “*who*” to sell their pineapple to and to some extent at “*what price*”.

Even before planting, the mobile phones help in equipping them on the weather information to make decision on when to start planting. Farmers indicated the use of the mobile phones to obtain information on planting materials and chemical to achieve a better yield. In all, the farmers associated their improvement in their wellbeing with the use of mobile phones.

During the questionnaire survey, farmers were asked to rate their perceived benefits of mobile phones. The result is summarized in Table 6 below. More than two-thirds (93.6%) of the farmers perceived that, the use of mobile phones has significantly helped them improve their communication with their business partners as against 24.8% who think otherwise. Similarly, about 90% of the farmers perceived it as high benefits for the use of mobile phone to help gather market information. On the contrary, a little more than half of the farmers (54.4%) agreed that mobile phone is of low benefits in reducing post-harvest loses. In all, 84.8% of the farmers perceived that mobile phone usage has substantially improved their livelihood (Table 9)

From the above findings, the major perceived benefits farmers derive in the using mobile phones are its improvement in communication and access to information. This is consistent with Abraham (2007) position that mobile phones help farmers by its communication and information access powers. Therefore, it is important to identify whether these major impact ways of using mobile phones is affected with the assets (human, financial, physical assets) of the individual as

predicted by the sustainable livelihood framework. It must be noted that the sustainable framework considered the socio-economic factors as mostly asset. The section below responds to this proposition.

Table 6: Pineapple Farmers Perceived Benefits of Using Mobile Phones

Benefits	Low Benefits	High Benefits	Total
Reduce transport cost	24.8	75.2	100
Give update information	48.8	51.2	100
Increase farmers' profits	25.6	74.4	100
Improved product delivery	20.8	79.2	100
Improve communication with partners	6.4	93.6	100
It helps cut out middlemen	40.8	59.2	100
Stay in touch with customers	12.8	87.2	100
Gather market and agricultural information	8	92	100
Reduce post-harvest loses	54.4	45.6	100
Improve my wellbeing	15.2	84.8	100

(Source: Author's Fieldwork, 2018. N = 125 Note: Responses on five-point Likert scale have been grouped into two (Moderate –Low = *Low Benefits*; High – Very High = *High Benefits*)

4.6. Effects of Farmers' Demographic Profile on Perceived Benefits of Mobile Phone Usage

Studies suggest that socio-economic factors (such as educational level, age, gender, incomes etc.) affect the adoption and impact of technology especially mobile phones in agriculture (Jain & Rekha, 2017). This study also sought to ascertain the effect of farmers' demographic profile on their perceived benefits of using mobile phones in terms of the two major benefit impact ways; improvement in communication with business partners and access to information.

Firstly, the logistic regression was performed to assess the effect of age, educational level, work experience, farm size, type of mobile phone and years of using mobile phone on the likelihood that farmers will perceive the use of mobile phones as beneficial in terms improvement in communication. The logistic regression was statistically significant at $\chi^2(6) = 13.651, p < .0005$. The model explained 27.3% of the variation in the perceive benefits of mobile phone usage in terms of improving communication. In addition, the model correctly classified 92.8% of the choice of farmers' perceived benefits of using mobile phones. Although the entire model was significant, only educational level was significant showing that education affects the perceived benefits of using mobile phones in improving farmers' communication. From the logistic regression, those with formal education were 0.121 times more to perceive the use of mobile phone in improving communication as high benefits than those without any formal education (See Table 7 below). This result buttresses Jain & Rekha (2017) findings that educational level of farmers affect the impact of mobile phone usage in India.

Table 7: Model Summary of Logistic Regression of Effects Farmers 'Demographic Profile on Perceived Benefits of Mobile in Improving Communication

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Age(1)	-1.320	.911	2.102	1	.147	.267	.045	1.591
Educ(1)	-2.108	.911	5.361	1	.021	.121	.020	.724
Exper(1)	-.299	.912	.108	1	.743	.741	.124	4.431
FarmSize(1)	-.392	.938	.175	1	.676	.675	.107	4.250
MPType(1)	1.119	.830	1.818	1	.177	3.063	.602	15.585
YrsusingMP (1)	18.934	6799.721	.000	1	.98	167034823.286	.000	.
Constant	3.153	1.294	5.940	1	.015	23.402		

R^2 (Nagelkerke R Square) = 27.3%, $p = 0.034$, Overall percentage = 92.8, significance level = 0.05

Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
	Step	13.651	6	.034
Step 1	Block	13.651	6	.034
	Model	13.651	6	.034

Secondly, the study sought to ascertain the effect of farmers' demographic profiles on the likelihood that farmers will perceive the use of mobile as beneficial in terms of improvement in accessing information such market prices, demand trend and agricultural information. The logistic regression from Table 8 shows that education level of the farmers has significant ($p < .0005$) effect on the benefits a farmer derives from using mobile phone to access information. Thus, a farmer with formal education is 0.226 times more to perceive the use of mobile phone in accessing information as high benefits than those without any formal education. Although the model correctly classified 92% of the choice of farmers perceive benefits of using mobile phones in accessing information and explained 24.4% variation of farmers' perceived benefits in using accessing information using mobile phones, the entire model was not statically significant at $\chi^2(6) = 11.374$, $p < .0005$. Hence, educational level has effect on perceived benefits from using mobile phones, the farmers' demographic profile used in the regression (i.e. age, work experience, mobile phone type, years of using mobile phone etc.) do not have any effects on perceived benefits farmers gain from the use of mobile phone in accessing information. The above finding is presented in the Table 8 below.

Table 8: Model Summary of Logistic Regression of Effect of Farmers' Demographic Profile on Perceived Benefits of Mobile Phone in Accessing Information

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Age(1)	-1.026	.809	1.607	1	.205	.358	.073	1.751
Educ(1)	-1.485	.759	3.829	1	.050	.226	.051	1.002
Exper(1)	-.498	.759	.431	1	.512	.608	.137	2.689
Step 1 ^a FarmSize(1)	.412	.729	.319	1	.572	1.509	.362	6.297
MPTType(1)	.461	.726	.402	1	.526	1.585	.382	6.579
YrsusingMP(1)	19.030	6934.542	.000	1	.998	183945076.176	.000	.
Constant	2.493	1.008	6.113	1	.013	12.100		

R² (Nagelkerke R Square) = 20.4%, p = 0.077, Overall percentage = 92%, significance level= 0.05

Omnibus Tests of Model Coefficients

	Chi-square	df	Sig.
Step	11.374	6	.077
Step 1 Block	11.374	6	.077
Model	11.374	6	.077

4.7. Challenges Pineapple Farmers Face in the Use of Mobile Phone.

Although farmers agreed the importance of using mobile phones, there were challenges that hinder their overall gain. From table 11 below, majority of the farmers consider high call tariff (88.8%), mobile money fraud (66.4%) and loss of information (64.8%) as the major challenges they face in using mobile phones in their farming business. Conversely, most farmers do not perceive the problem of unreliable network (56.8%), poor sound quality (61.6%) and calls ending unexpectedly (65.6%) as a challenge in their farming business. These findings contradict Kwakwa's (2012) findings at the Akwapim North that 94.6 % of the respondents agreed that

poor network and poor sound (88% of the respondents) and 82.6% complained of the abrupt end of calls as their major problems of using mobile phones.

Table 9: Perceived Challenges of Pineapple Farmers in Using Mobile Phones

Challenges	Disagree	Agree	Total
Calls ends unexpectedly	65.6	34.4	100
There is poor sound quality	61.6	38.4	100
They charge high call tariff	11.2	88.8	100
Recharge card is high	16.8	83.2	100
Mobile money fraud occurs	33.6	66.4	100
Unreliable network coverage	56.8	43.2	100
Thieves steal mobile phones	64	36	100
I lose information (contacts missing)	35.2	64.8	100

Source: Author's Fieldwork, 2018. N = 125 Note: Responses on five-point Likert scale have been grouped into two (Neutral –Highly Disagree = *Disagree*; Agree – Strongly Agree = *Agree*)

4.8. Implication of Findings on the Sustainable Livelihood Framework

SLF attributes the vulnerability of poor people as the origins of their conditions. In the face of such vulnerability, there are available assets that are either enhanced or constrained through the structures or process existing in institutions, organizations, social and cultural environment of the person. This environment influences the ways of converting the available assets (i.e. termed as livelihood strategies) to achieve their livelihood outcomes (Carney, 1999; DFID, 1999; Duncombe, 2007). From the findings, the vulnerability of the pineapple farmer is associated with the changes in the demand of pineapple variety (as MD2 crisis depicts), changes in the prices of the pineapple produce on the market and even the prices the local traders that comes to their various communities offer. Besides, the changes in weather such as drought and disease spread affect their yields and returns on their farms.

A major reason identified in the literature explaining the cause of these vulnerabilities is the lack information and sharing of real time information for making decision to mitigate these vulnerabilities. The farmers in the study area handle this gap in information by sourcing information from different sources. The study identified that farmers obtained information from these source, arranged in descending order, mobile phones, community radio, cooperative societies, and community radio and extension services. Mobile phone as a dominant tool was used in the supply chain from the coordinating of input supply up to the selling of the produce. The study identified that mobile phones served farmers with information on weather and other agricultural practices existing elsewhere. Farmers communicate with other colleagues to gain knowledge on practices such as application of fertilizer and weedicides that affect the yield of their farm produce. With the use of mobile phone, pineapple farmers receive information on weather that help in deciding when to apply their chemical on their farms in the face of eminent rainfall. For the vulnerabilities on the output market, the study identified that mobile phones help farmers to access information on different price offerings on the market. Additionally, farmers identify new customers with mobile phone and coordinate the sale of the produce. The farmers identified price differentials as major source of change of customers and all contributing to gaining a better return on their farm activities. To this end, mobile phone can be said to reduce farmers' vulnerabilities. This finding is in tandem with Tanle & Abane (2017) who observed that the use of mobile used reducing the vulnerabilities of rural folks in Ghana for their ability to obtain valuable information.

The next stage in the livelihood analysis is the examining the livelihood assets. In terms of social assets, the study identified that farmers' educational level is significant in determining the utilization and the benefits they derive from using mobile phones. Meanwhile, the study

shows that about 16% of the farmers do not have any formal education. Out of the 125 sampled pineapple farmers only one of them have had tertiary education. By extension of this, it will constrain farmers ability to use the mobile phone to access information and the rate to learn innovations that come with the mobile phone. This will affect the income level (CIMMYT, 1993; DiMaggio & Cohen, 2004; Schiffman & Kanuk, 2004).

In terms of financial capital, farmers identified the chronic problem of accessing capital for the purchase of input especially with the increasing prices of inputs (specifically fertilizers). However, the mobile money services have helped farmers access credit from their buyers. Other farmers also receive remittances from relatives and invest it in their farming business. More so, the use of mobile phones is creating a social capital in its coordination capability of providing farmers with the ease of networking with other participants in the supply chain. Clearly, from the findings, mobile phones help farmers to easily connect with input suppliers, farm hands, and their buyers of the produce. Another dimension seen in this study is shown in the growing of family networks in remitting money through the mobile phone. Besides, the study showed the importance of mobile phones in scheduling meeting of cooperatives and sharing information among the peers in the study area. This finding is in line with Heeks and Duncombe (1999; 2002) revelation that ICTs is creating an environment where information sources are formalized and expanding networks to strengthen socio-cultural aspects of communities.

In assessing the structures and processes, the study ascertained the information received from government extension services that helps in their farming business. More than half of the farmers denied receiving information from agricultural extension services. This suggests less government effort in giving vital information on the current dynamics of the sector which increase the vulnerabilities of farmers. However, in one of the communities, the existence of

cooperatives organized by Fair Trade Organization brief farmers on the current trends and policies in the sector.

The livelihood strategies present the choice, opportunity, and options for the individual to combine the capital assets to achieve their desired outcomes. From the study, mobile phones have empowered farmers to negotiate for a better deal. This is mostly traced to the power derived from information on prices on the market that helps them to gain a better alternative. The livelihood outcome is evidence from the perceived benefits of mobile phone usage. Although farmers consider the reduction in transport cost, post of harvest loses, stay in touch in customers, and increase in profit, farmers consider the improvement in communicating with their business partners and easing access to information as most beneficial aspect on their lives. In all, farmers perceived an improvement in their wellbeing with the use of mobile phone.

CHAPTER 5 – CONCLUSIONS AND RECOMMENDATIONS

5.1. Overview of the Conclusion Chapter

This chapter summarizes the overall findings of study. It starts by summarizing the findings of the results and concludes with suggestions for using mobile phone in improving the pineapple farming sector. Lastly, it gives recommendation on areas for further research to deepen the literature in Ghana.

5.2. Summary of Findings

Pineapple production in the Akwapim South district is mostly on small scale with about 73% farming size less than 5 acres. Farmers mostly plant three main varieties of pineapple namely smooth cayenne, sugar loaf and MD2. The cultivation of pineapple in the area involves land preparation, planting, crop maintenance, forcing, degreening and harvesting. Farmers acquire land through leasing or land tenure arrangement. Their cultivation is labor intensive and is sourced from family hands, hiring or assistance from colleague farmers. Already existing farmers use their suckers for the new planting season and in cases where there is shortage, the suckers are bought from colleague's farmers. Farmers estimated that 10,000 pieces of suckers is suitable to fill one ninth of an acre and 5,000 pieces of suckers cost GHS 1,000.00. Additionally, farmers apply carbide to force the plant to bear fruit and it takes up to 5 months for the plant to mature from the date of forcing. In all, the pineapple plants have a gestation period of 18 – 20 months.

Furthermore, the study revealed that pineapple farmer in the area sell their produce mainly to traders on the local markets. In this case, the farmers harvest the crops and hire transport vehicles to convey it to the nearby market like Nsawam and Accra. There are also cases where these local traders come to their farmlands to buy the produce. Next, farmers agreed that

the two nearby fruit processing companies, Blue Skies Ghana Limited (in Nsawam) and HPW Fresh and Dry Limited (in Adeiso), buy the pineapple at premium prices but require conveying the products to their premises and meeting their standards. Additionally, some of the farmers supply their produce to colleague farmers who engage in exports of their produce to the European markets. There are instances that farmers sell their produce to resident petty traders who sell the pineapple in the community.

Evidence from the study showed that pineapple farmers use the mobile phones from land preparation up to selling of the produce to the buyer or consumer. In the cultivation of pineapple, farmers use the mobile phone to coordinate the supply of various inputs. The study showed that before the adoption of mobile phone, about 75% of the respondents mainly walk to source of inputs. However, with the use of mobile phones, the percentage of farmers that walk to the source of input reduced to 60%. Although farmers use the mobile phone to coordinate the access and purchase of inputs such as fertilizers, suckers, labor, transport, food, insecticides, weedicides, dreegreening/forcing materials, majority of the farmers use the mobile phone to coordinate the supply of fertilizers, insecticides and labor.

Apart from this, farmers use the mobile phone to access vital information in their farming business. From the study, the majority of farmers (94.4%) use the mobile phone to access market information. The market information is to search for prices, market with high demand and call for prospective traders. The study showed that 78.4% of the farmers search for information about produce price on the market. Beside market information, it was evidence from the study that farmers also obtain agricultural information on weather and other farm practices elsewhere.

The other useful findings identified from the study was the use of mobile phone to access financial services. From the sampled pineapple farmers, 92% of them use mobile money services

which aids farmers to pay for their inputs and receive payments from the sale of their produce. In addition, farmers use the mobile money services as a saving medium and access credit from their buyers. Relatives also send money through the mobile money to the farmers occasionally to invest in their farming business.

In terms of benefits of using mobile phones, farmers perceived the use of mobile phones as a useful tool in their lives. From the study, the benefits of mobile originate from two major ways: the improvement in communicating with business partners and access to market information. The facts from the study showed that 93.6% of the pineapple farmers perceived it as high benefits in the sense that mobile phones improve their communication with their business partners. Similarly, about 92% of the respondents perceived that it as high benefits in that, the use of mobile phone improves their access to market and agricultural information. These two major benefits in turn generate other benefits of using mobile phones. Farmers perceived that using mobile phone reduces transport cost, it helps them to stay in touch with their customers, reduces post-harvest costs and in all, improves their well-being. A particular evidence identified in the benefits of using mobile phones is the increasing ability of farmers to participate fully in the market given the information they receive from the market. To ascertain the effect of farmers demographic in the use and benefits obtain from mobile phones usage, a result from a logistic regression revealed that educational level of farmers is significant in enhancing the perceived benefits obtained using mobile phones in communicating with their business partners.

Although farmers agreed the importance of using mobile phones, there were challenges that hinder their overall gain. Majority of the farmers considered high call tariff (88.8%), mobile money fraud (66.4%) and loss of information (64.8%) as the major challenges they face in using mobile phones in their farming business. Conversely, most farmers do not perceive the problem

of unreliable network (56.8%); poor sound quality (61.6%) and calls ending unexpectedly (65.6%) as a challenge in their farming business

From the study, the use of mobile phone has provided the platform in accessing vital information on changes in weather, price and demand. These changes mostly termed as vulnerabilities, has been minimized given the ease with which the farmers access information and communicate this information using the mobile phone. Additionally, the study revealed that mobile phones leads to expansion of social networks with the families, players in the supply chain and colleague farmers through its coordination abilities and communication. Additionally, farmers' financial asset is enhanced with the use of mobile money service by increasing their access to finances from family members and creditors. Finally, the pineapple farmers perceived that, the use of mobile phone has increased their livelihood outcomes such as reduction in transportation cost, post-harvest loses and increase returns from their produce as well as a decrease of their vulnerabilities.

In conclusion, the study sought to investigate the use of mobile phones in pineapple production and benefits farmers gain from this usage. Clearly, the findings showed that there is a considerable usage of mobile phone in pineapple production in the Akwapim South. This usage transpires from the organization of inputs used in the pineapple production up to the selling of the pineapple produce. Again, the study revealed the contribution of mobile phones in the lives of pineapple farmers. Mention can be made of improving farmers communication with their business partners and increasing their access to vital agricultural information.

5.3. Recommendations.

With the growing mobile phone penetration, it presents an opportunity for agricultural extension officers and other players to design information accessing programs on the mobile that

can be received and interpreted easily given farmers educational background. The study confirmed an increase in the use of mobile phone for financial services among pineapple farmers, the study advocate for innovations to increase financial inclusion and enhance farmers' accessibility of credit to boost investment. More so, it is recommended that mobile network operators look into ways of making call tariff affordable to farmers and minimize the risk associated with mobile money services to enhance full utilization of mobile phone's capabilities and its associated benefits.

Given the non-random sampling strategy used in this study, the results of the study is attributable to the pineapple farmers at our research locations. It will be useful for further studies to examine the results in other pineapple producing areas to gain much understanding and achieve external validity of the study's results. Additionally, the study isolated the pineapple farmer in the supply chain and looked at how it uses the mobile phones vis-a-vis other players. Therefore, it is recommended that other studies focus on participants of the supply chain such as distributors, exporters, local buyers, government extension officers and other supporting organizations. The knowledge from this assessment could identify gaps in the production and supply chain networks and opportunities to make the supply chain more efficient and create value to all the players with the use of mobile phones. Lastly, to gain a better understanding of the impact of using mobile phones in pineapple production, a longitudinal quantitative study will serve as a good approach to track significant changes and show major live-impacting effect of pineapple farmers in the area.

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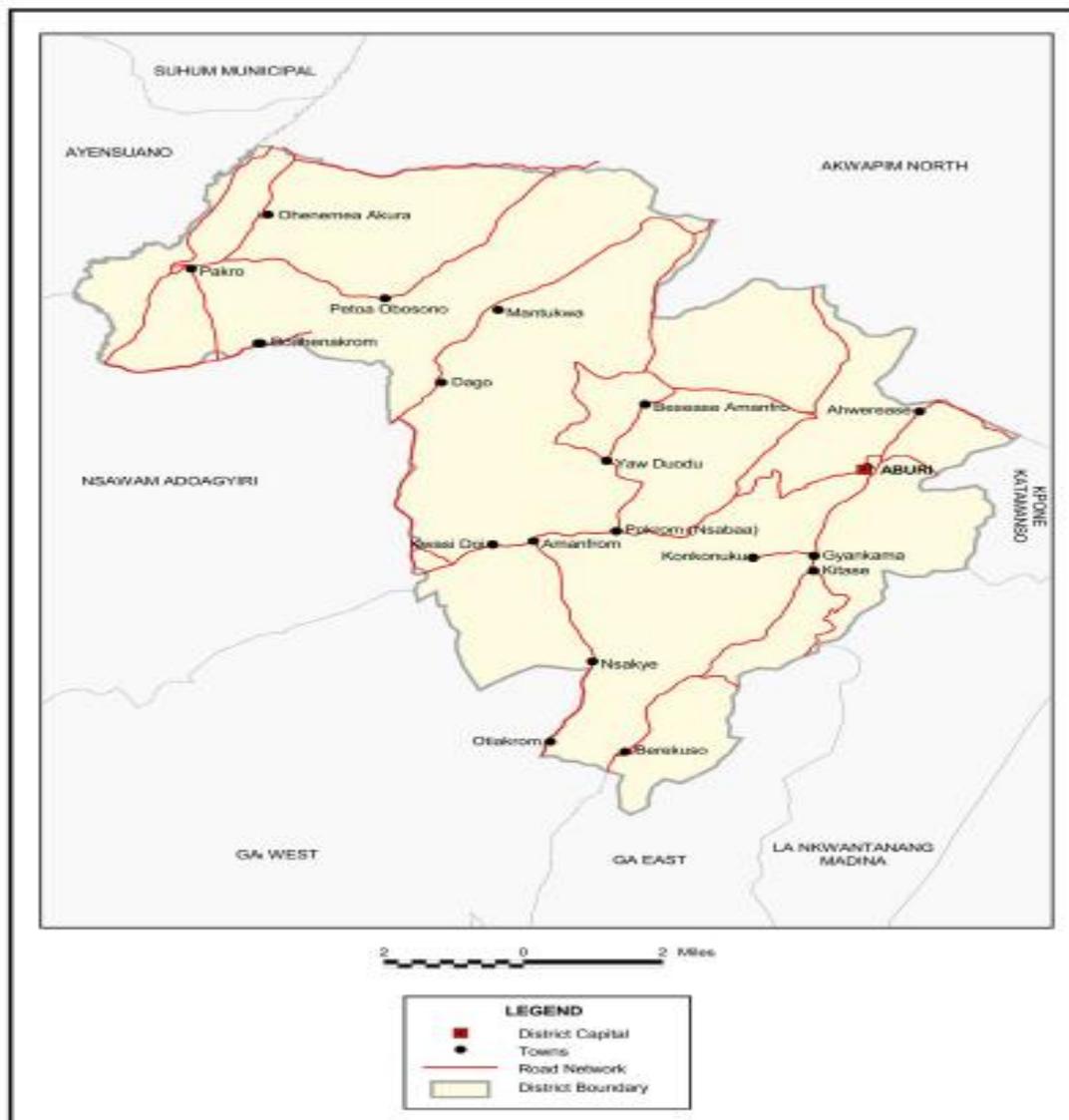
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APPENDICES

A. Map of Akwapim South District



Source: (Ghana Statistical Service, 2014)

B. Interview Guide Questions for Farmers

Note: Interview Guide used for the initial stage of the study

1. Please how long have you been engaging in pineapple farming?
2. What inputs do you use in pineapple farming?

3. Please, describe the processes involves in the production of pineapples?
4. Who are the major customers /companies do you sell your pineapple?
5. Please, what services do you receive from other players in the sector that support your farming activity?
6. What are the major problems you face in cultivating and selling of pineapple?
7. How do you use mobile phones in your pineapple farming?
8. Please, what are the challenges you face in using mobile phones in pineapple farming

C. Questionnaires for Farmers

My name is Stephen Gyan. I am an undergraduate student of Ashesi University. I am conducting research on the use of mobile phones among pineapple farmers in the Akwapim South District. The study aims to explore the uses of mobile phones in the value chain of pineapple and its associated benefits to farmers in the Akwapim South District of Ghana. I humbly ask you to help answer the following questions that is vital for the completion of the project. Please note that this exercise is purely academic and all information given will be kept confidential. Thank you	
Date and Interviewee No.	Date: / /
Location	
Section A: Demographic information	
1. Gender	1. <input type="checkbox"/> Male 2. <input type="checkbox"/> Female
2. Age in years	1. <input type="checkbox"/> 20 yrs. or less 2. <input type="checkbox"/> 21 – 30 yrs. 3. <input type="checkbox"/> 31 – 40 yrs. 4. <input type="checkbox"/> 41 - 50 yrs. 5. <input type="checkbox"/> 51 – 60 yrs. 6. <input type="checkbox"/> 61yrs or more
3. Level of Education	1. <input type="checkbox"/> No formal schooling 2. <input type="checkbox"/> Primary school 3. <input type="checkbox"/> Junior High 4. <input type="checkbox"/> Senior High 5. <input type="checkbox"/> Tertiary
4. Number of years engaged in pineapple farming	1. <input type="checkbox"/> 5 yrs. or less 2. <input type="checkbox"/> 6 - 10 yrs. 3. <input type="checkbox"/> 11 – 15 yrs. 4. <input type="checkbox"/> 16- 20 yrs. 5. <input type="checkbox"/> 21 yrs. or more
5. Size of pineapple farm (Indicate the size in acreage)	1. <input type="checkbox"/> ≤ 5 2. <input type="checkbox"/> 6 - 10 3. <input type="checkbox"/> 11 – 15 4. <input type="checkbox"/> 16- 20 5. <input type="checkbox"/> 21 +
7. If yes, what type of mobile phone do you use	1. <input type="checkbox"/> Basic 2. <input type="checkbox"/> Smartphone
8. How many years have you being using mobile phones?	1. <input type="checkbox"/> 5 yrs. or below 1. <input type="checkbox"/> 5 – 10 yrs. 2. <input type="checkbox"/> 11 – 15 yrs. 3. <input type="checkbox"/> 16 yrs. or more
9. What type of network operator do you subscribe to? (Tick as many that apply)	1. <input type="checkbox"/> Vodafone 2. <input type="checkbox"/> AirtelTigo 3. <input type="checkbox"/> MTN 4. <input type="checkbox"/> Glo 5. <input type="checkbox"/> Expresso

Section B: Farmers usage of mobile phone in pineapple farming input supply.	
10. Before using mobile phones, how do you normally order for the purchase or supply of inputs?	1. <input type="checkbox"/> Contact local agent /intermediary to buy inputs 2. <input type="checkbox"/> Help from others to buy inputs (e.g. relatives, friends) 3. <input type="checkbox"/> Walk to source of inputs Other
11. When you start using mobile phones, how do you normally order for the purchase or supply of inputs?	1. <input type="checkbox"/> Arrange by mobile phone to buy inputs 2. <input type="checkbox"/> Walk to source of inputs 3. <input type="checkbox"/> Contact local agent (intermediary) to buy inputs 4. <input type="checkbox"/> Help from others to buy inputs (e.g. relatives, friends)
12. Which input (s) do you use your mobile phones to order for their purchase/supply? (Tick all applicable)	1. <input type="checkbox"/> Fertilizer 2. <input type="checkbox"/> Planting materials 3. <input type="checkbox"/> Insecticides 4. <input type="checkbox"/> Herbicides 5. <input type="checkbox"/> Labor 6. <input type="checkbox"/> Food 7. <input type="checkbox"/> Transport vehicle Other
Section C: Uses of mobile phones for on-farm practices and agricultural information	
13. Have you had access to agricultural information for the past year?	1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
14. If yes, what are the sources of this information? (Tick all that apply)	1. <input type="checkbox"/> Extension services 2. <input type="checkbox"/> Co-operatives meetings 3. <input type="checkbox"/> Radio station 4. <input type="checkbox"/> Television 5. <input type="checkbox"/> community radio 6. <input type="checkbox"/> Mobile Phones Other.....
15. What kind of information do you receive ? (Tick all that apply)	1. <input type="checkbox"/> Weather information 2. <input type="checkbox"/> Fertilizers application 3. <input type="checkbox"/> Diseases management 4. <input type="checkbox"/> New variety of crops 5. <input type="checkbox"/> Weeding and thinning 6. <input type="checkbox"/> Post-harvest handling 7. <input type="checkbox"/> Market information Other
16. Which of the following information do you receive/search with your mobile phones? (Tick all that apply)	1. <input type="checkbox"/> Weather information 2. <input type="checkbox"/> Fertilizers application 3. <input type="checkbox"/> Diseases management 4. <input type="checkbox"/> New variety of crops 5. <input type="checkbox"/> Weeding and thinning 6. <input type="checkbox"/> Post-harvest handling 7. <input type="checkbox"/> Market information Other
Section D: Use of Mobile Phones for Pineapple Marketing	
17. Which of the following business partners do you contact using mobile phones? (Tick all that apply)	1. <input type="checkbox"/> Local consumer women 2. <input type="checkbox"/> Local trader / market 3. <input type="checkbox"/> Wholesaler/retailers 4. <input type="checkbox"/> Exporters 5. <input type="checkbox"/> Distributers 6. <input type="checkbox"/> Transport operators 7. <input type="checkbox"/> Processors Other, specify
18. Do you arrange to sell pineapple to customers with mobile phones?	1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
19. Has the use of mobile phones made you change your customer?	1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No

20. If yes, what made you change the decision? If no, why	
21. What type of market information do you access with your phone (Tick all apply)	1. <input type="checkbox"/> Market with demand 2. <input type="checkbox"/> Prices 3. <input type="checkbox"/> Contact new buyers
Section E: Mobile phone use for finance services	
22. Do you use mobile money services?	1. <input type="checkbox"/> Yes 2. <input type="checkbox"/> No
23. If yes, what kind of things do you use mobile money for in your farming business.	1. <input type="checkbox"/> Payment of inputs 2. <input type="checkbox"/> Receiving of payments 3. <input type="checkbox"/> Saving 4. <input type="checkbox"/> Taking of loan 5. <input type="checkbox"/> Receiving of remittance Others.....

Section F: Benefits of using mobile phones

24. Indicate the extent at which the following benefits relate to the use of mobile phone

Benefits	Very low (1)	Low (2)	Moderate (3)	High (4)	Very High (5)
I. Reduce transportation/ travelling cost					
II. Give me update information					
III. Increase farmers' profits					
IV. Improved product /service delivery					
V. Improved communication with suppliers and customers					
VI. It helps cut out middlemen					
VII. Stay in touch with customers					
VIII. Help to gather information on prices, market & good agricultural practices					
IX. Reduction in post-harvest loses					
X. Improve my wellbeing					

Section G: Challenges in Using Mobile Phones

25. Indicate the extent to which you agree or disagree with the following challenges in using mobile phones

Challenges		Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
I	Calls ends unexpectedly					
II	There is poor sound quality of mobile phones					
III	They charge high tariff					
IV	Recharge card is costly					
V	Mobile money fraud occurs easily					
VI	The network coverage is unreliable					
VII	Mobile phones are attractive to thieves					
VIII	I loss data easily (contact missing)					