

**A Thesis Submitted
in fulfilment of a PhD Degree**

**Mobile Phone Adoption in Rural Ghana:
Understanding How Technologies and
Platforms Influence Farming Business Activities**

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List of Abbreviations and Publication

ADB	African Development Bank
AT	Activity Theory
CRM	Customer Relationship Management
DADU	District Agriculture Development Unit
ExL	Experiential Learning
ESOKO	An information and Comms service for agricultural markets in Africa. <i>Soko</i> is Swahili for ‘market’; the ‘E’ represents ‘electronic’.
FAO	Food and Agriculture Organisation
FSBE	Farming Small Business Entrepreneurship
GDP	Gross Domestic Product
GSS	Ghana Statistical Service
ICT	Information Communication Technology
ICT4D	Information Communication for Development
IMF	International Monetary Fund
ITU	International Telecommunications Union
ME	Mobile Phone Ecosystems
MOFA	Ministry of Food and Agriculture
MPP	Mobile Phone Platforms
MSMEs	Micro, Small and Medium Enterprises are small businesses
NCA	National Communications Authority
NCSC	National Cyber Security Centre
PEOU	Perceived Ease of Use
P2P	Persons to Persons
RBV	Resource-Based View
SBE	Small Business Entrepreneurship
SMS	Short Message Service
USAID	United States Agency for International Development

Publication

Asiedu, E.M., Shortland, S., Nawar, Y.S., Jackson, P.J. and Baker, L., 2019. Supporting Ghanaian micro-entrepreneurships: the role of mobile technology. *Journal of Entrepreneurship in Emerging Economies*, 11(3), pp. 306–327.

Declaration

I declare that the study is the report of my own research and that any additional sources of information has been referenced. I also declare that any published or unpublished works or internet sources that have been quoted or drawn on or referenced in the text has been fully referenced.

Signature

A handwritten signature in black ink, appearing to read 'Emmanuel Mensah Asiedu', with a horizontal line underneath.

Emmanuel Mensah Asiedu

Date November 2022

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Abstract

Mobile phone technology and related platforms play an important role in developing economies, helping to bridge the gap between rural areas and cities. They are also used to support business activities, manage family relationships, and provide instructions and educational material for high school children. The technology is particularly important in rural Africa because many of these areas lack telecommunication landlines and infrastructure facilities, and therefore rely on the mobile technology to connect with the outside world. For developing economies like Ghana, which depend significantly on agricultural businesses in the rural areas, the freedom offered by mobile technology allows these businesses to connect with customers and suppliers in the cities and across the country. Farming small business entrepreneurships (FSBEs), upon which the study focuses, which are hard-to-reach for research purposes – are making increasing use of mobile phone technology. However, little extant literature addresses how these farmers adopt the mobile phone technology, how it influences their farming businesses and behaviour, the skills and knowledge they acquire in learning to use the technology, and how they integrate these into the farming businesses. This study aims to fill the knowledge gap by understanding why the farmers adopt the technology, how they learn to use it, and how the technology influence farming business activities. At the theoretical level, the study draws on the Resource-Based View, Kolb's Experiential Learning (ExL) cycle, the Technology Acceptance Model (TAM) and the Boundary Object theory. At the empirical level, it draws on two farming groups in the Kwahu district – a remote area of rural Ghana. For the study, 24 farmers were interviewed, 12 each from Ministry of Food and Agriculture (MOFA) farmers groups and ESOKO farmers groups – the two main farming groups in the district. The interviews were backed up by participant observations of two farmers, during which a day was spent with each farmer to try to understand and to complement the in-depth interviews on how these rural farmers use the mobile phone technology beyond farming activities. The study shows that farmers in rural Ghana learn to adopt mobile phone technology as a resource and a boundary object and incorporate it into their farming business activities to achieve competitive advantage. Theoretically, the study contributes to knowledge by providing a framework that integrates the role of ICT and ICT4D with the four theories to understand mobile phone adoption by rural farms in Ghana.

Empirically, it confirms some aspects of the theories while refuting others. The study extends Barney's VRIO theory, suggesting that farmers using the technology did not achieve a competitive advantage because of the VRIO criteria, as the mobile phone is not rare and its use can be copied. Rather, in rural Ghana, farmers achieved a competitive advantage because of the capabilities and the competencies they acquire in areas of financial resource mobilisation, use of social media platforms, research and communication and customer relationship management.

These capabilities and competencies provide access to new local and international markets. Regarding TAM, the study contributes to the literature by suggesting that though the adoption of mobile technology by farmers in rural Ghana was influenced by the perceived ease of use (PEOU) of the technology and the perceived usefulness (PU), the PEOU and PU are themselves influenced by specific external factors such as family, friends, and community and network providers, topography, transportation challenges and weather issues. Other variables that influence adoption are a lack of confidence in traditional banks, perceived trust, security associated with the technology use, support from the media and telephony companies in educating farmers, a sense of pride for owning a mobile phone, self-belief and self-sufficiency and social status.

The study contributes to Boundary Object theory by showing that farmers use the mobile phone technology to connect with farm workers, customers, suppliers, family and friends from any location that they find themselves. The domestication of the mobile phone technology also reduced gender, generational and demographic boundaries, allowing women and university graduates who had previously not been involved in farming to join the farming business community. It also helped to connect farmers to institutions that support farming. In terms of how Kolb's Learning Cycle, the study contributes to the theory by showing that rural farmers combine concrete experience with experimentation simultaneously while learning.

The study shows that while farmers do gain concrete experience in using the technology, it is done through self-learning, sometimes through trial and error. Farmers also used non-reflective observation methods as they seek support from the community or from children and family in the learning process, in contrast to the reflective observation premise of Kolb's model. Furthermore, farmers did not use any scientific approach or follow any logical plan but instead used informal learning or non-abstract conceptualisation methods. The study has implications for practice and policy.

Key words: Mobile Phones, Technology, Farming, Small Businesses Entrepreneurship, Platforms, Capabilities, Mobile Money, Kwahu District, Ghana

CHAPTER 1 – INTRODUCTION

1.0 Introduction

The aim of this study is to understand how mobile phone technology and related platforms influence farming business activities in rural Ghana, and to understand how farmers learn to use the technology to improve their skills and capabilities by integrating the technology into their business activities. The existing literature provides information on how mobile phones benefit individuals and large businesses by enabling them to make financial transactions through mobile banking and mobile money (Nstiful *et al.*, 2019; Karakara and Osabuohien, 2019; Mustapha, 2021; Agyei *et al.*, 2020). The literature delineates the technology's benefits to the agriculture sector and the role it plays in supporting developing economies like Ghana, including through mobile agriculture (m-agriculture) (Emeana *et al.*, 2020). What the literature appears to be silent on is why and how the rural farmer adopts mobile phone technology, and the ways in which the adoption of the technology influences farming business activities in rural Ghana and this study aims to address this gap.

Digital technologies are known as Information and Communication Technologies (ICT) and comprise various other forms of technology (computers and mobile phones) to facilitate the exchange and transmission of information, with the support of internet facilities (Krauss, 2021). ICT is not only shaping today's environment but is also helping to create a world in which everyone will be connected by technology, supporting globalisation (Bissyandé *et al.*, 2013; Samoilenko and Osei-Bryson, 2021). In developing economies, where there is a lack of infrastructural facilities such as transportation and landline communications, mobile phones help to facilitate business processes and activities. In addition to various other responsibilities, ICT organisations help to promote the use of technology in developing economies, particularly in the education, health and commercial sectors (Mohanty and Mishra, 2020). While developing economies have spent about \$800 billion on ICT, Africa has spent only about \$60 billion, the reasons being corruption and minimal government support because of the high capital outlay required (Heeks, 2017; Heeks, 2020). Huggins and Valverde (2018) posited that ICT expenditure helps to facilitate operations, create jobs, reduce unemployment, and improve socio-economic development.

Yet the benefits come with a high investment outlay, and most governments in Africa have relied on external support from the developed world. To determine ICT's contribution to development, it is necessary to differentiate between ICT and ICT for Development (ICT4D). Steve and Kwami (2012) posit that ICT comprises the infrastructure and components that support computing and communications. This broad definition encompasses all devices, networking components, and applications that allow individuals and organisations to interact with the digital world, including mobile phone technology. ICT is also described as the use of a complex set of technology resources and applications to produce and process information to support activities.

This definition indicates that ICT is evolutionary and dynamic (Samoilenko and Osei-Bryson, 2021). Different situations require different ICT solutions and, as situations change, ICT solutions must also change. Infrastructure is fundamental to successful ICT implementation. Infrastructure comprises both hardware and software, which are continually redeveloped to meet the ever-changing needs of the digital world (Mbuyisa and Leonard, 2017).

Software and applications support the development of products and service processes (inputs) and facilitate sales and consumption of services and processes (outputs). Studies such as Ala-Uddin (2022), Tillett (2020) and Kwami (2012) show that through mobile phone technology, ICT helps entrepreneurs and businesses to identify market opportunities via communications with other stakeholders (outputs). These in turn assist businesses to develop and take advantage of opportunities in the market, either through customer expansion or through improved relationships with stakeholders (Steeves and Kwami, 2012; Mbuyisa and Leonard, 2017). For small business entrepreneurs within the agriculture sector, ICT supports processes such as ordering fertilisers and pesticides (inputs) and facilitates the sales of produce (outputs). However, there is a dearth of studies on the use of ICT in Africa, and particularly in rural Africa (including Ghana) where farmers rely on the use of the mobile technology to connect to the rest of the world. Information Communication Technology for Development (ICT4D) is an initiative aimed at bridging the digital divide between the developing and the developed economies aimed at improving socio-economic development through digital and up-to-date technologies (Hanson and Heeks, 2020).

With infrastructural problems and a lack of investment in Africa, using information communication technologies to support development (ICT4D) has transformed people's lives and kept them connected to the rest of the world using mobile phone technology and related platforms (Schelenz and Pawelec, 2021). The use of mobile phone technology and related platforms is fundamental to the success of ICT4D in Africa. For the past twenty years, mobile phone technology has become ten times more available in sub-Saharan Africa than landlines (ITU, 2018; Mohanty and Mishra, 2020).

The mobile phone has revolutionised aspects of life in countries in Africa. The benefit has been highlighted in many journals and reports, with superlatives used to describe how it has influenced the way Africans communicate, do business and stay connected with the outside world (Bhavnani *et al.*, 2008; Etzo and Collender, 2010; Danquah and Iddrisu, 2018; Karakara and Osabuohien, 2019; Mensah *et al.*, 2020). The technology is no longer the luxury product it was first perceived to be and is now a necessity for most people in Africa, where it is used for business, to maintain social networks and for relationship-building (Agwu and Carter, 2014; Akinyemi and Mushunje, 2020). Small businesses in towns and rural areas where communication infrastructure is not available rely on mobile phones to facilitate business activities (Agwu and Carter, 2014). Unlike landlines, mobile phone technology can support a wide range of social and business activities. This is because mobile phones are easy to acquire without going through complex processes of documentation. The cost of acquiring a mobile phone is also cheaper compared to the cost of installing landline facilities (Sey, 2011; Salia *et al.*, 2011; Adjei Kwakwa, 2012; Folitse *et al.*, 2018; Adams *et al.*, 2020; Butakor, 2021). While mobile phone usage stands at about 90%, fixed network landline use stands at 0.9%.

Yet, there is not much found in the extant literature on how the technology influences farming business activities, especially among rural farmers, even though many African countries' gross domestic product (GDP) and employment creation both depend on agriculture. Furthermore, in some African countries (including Ghana) farming artisanal works are seen as a profession for the old and the uneducated (Newbury *et al.*, 2019). This is particularly true for those rural farmers in remote locations, where bad road networks mean they are cut off from the rest of the world.

1.1 Problem Statement

Ghana enjoys a fair share of the benefits associated with ICT and that is transforming the lives of many people, including farmers in rural Ghana. Economically, mobile phone technology enables businesses and individuals to trade, connect with customers, and carry out banking activities (Asongu, 2013; Okocha and Awele Adibi, 2020). Technologically, the mobile phone is simple and easy to use, whatever the individual's educational background. The extant literature on the adoption of mobile phone technology indicates that the range of benefits it offers explains why businesses and individuals in Ghana adopt it. These businesses include large and medium-scale organisations, both in the formal and the informal sector (Sey, 2011; Tanle and Abane, 2018; Folitse *et al.*, 2018; Asante *et al.*, 2018; Jahanbakht and Mostafa, 2019; Asravor *et al.*, 2021).

The agricultural sector is the backbone of the Ghanaian economy (FAO, 2022). Nevertheless, it is the sector most in need of infrastructure, including technological investments. Particularly for most Ghanaian farmers who practise small-scale farming in rural areas, they have obstacles that impede transportation and access to technology which supports planting, harvesting, and sales (Anang *et al.*, 2020). This is also compounded by the fact that there is no access to landline telecommunication infrastructure in these areas. Landlines are mostly used in the cities and by medium and large-scale businesses, and generally not by farming businesses in rural Ghana. Therefore, for the farmers, mobile phones provide the cheapest way to communicate, given the lack of resources needed to support the development of landline facilities to conduct landline telephone communications (Adams *et al.*, 2020; Heeks, 2020; Mohanty and Mishra, 2020). Adopting mobile phone technology is the only way to stay connected with their customers, their families, and the world.

Yet, there is little knowledge in the literature about whether farmers in rural Ghana adopt the technology for the same reasons as other users and how they learn to use it to conduct their farming business activities (Owusu, 2021; Sey, 2011). Hence, this study aims to understand why and how rural farmers adopt mobile phone technology, how they learn to use it, and how it influences their farming business activities, giving them a competitive advantage.

The study involved two farming groups, ESOKO and MOFA, in the Kwahu district of Ghana. Specifically, the study sought to explore why and how these farmers adopt the technology and related platforms, and whether adopting the technology improves their skills and knowledge in the farming business. Underpinned by the Resource-Based View (RBV) (Barney, 1992), Technology Acceptance Model (TAM) (Davis, 1989), the Boundary Object theory (Star and Griesemer 1989) and Kolb's (2014) Experiential Learning Cycle, the study also highlights how the adoption and use of the technology influences the learning, behaviour and skills of the farmers and how the skills they develop by using the technology help them to acquire capabilities and competencies that give them a competitive advantage.

1.2 Research Aims and Questions

The aim of the research was to understand how farmers in rural Ghana adopt mobile phone technology and platforms and how this influences farming business activities. Ghana's agricultural sector, like that of most African countries, plays a pivotal role in the country's socio-economic development through the generation of employment, the reduction in rural-urban migration, and contribution to GDP (Oduro and Doss, 2018; Ali *et al.*, 2021). Facilitating the farming business activities is the use of the mobile phone technology and related platforms. Yet, how these farmers adopt the technology and learn to use it in supporting their farming businesses has yet to be studied. To address the research aim, the thesis sets out to answer the following questions.

Research Questions

- 1. In what ways does the adoption of mobile phone technology influence the farming business activities of rural farmers in Ghana?**
 - a. How can the Resource-Based View of the firm help to frame an understanding of mobile phone technology use by Farming Small Business Entrepreneurship in Rural Ghana?
 - b. How can the Technology Acceptance Model explain the behaviour of farmers in rural Ghana when adopting mobile phone technology as part of their farming business activities?

2. How do rural farmers in Ghana learn to adopt the technology and integrate it into their farming business activities?

- a. In what ways does mobile phone technology become a boundary object in influencing farming activities and relationships in rural Ghana?
- b. How can Kolb's Learning Cycle help to explain the process of mobile phone adoption by Farming Small Business Entrepreneurship in rural Ghana?

1.3 Theoretical Approaches to the Study

The study recognises that the use of mobile phone technology is a complex process and, in seeking to understand how and why rural farmers adopt the technology, and how it is changing their farming business processes, the study draws on the theories of Resource-Based View (RBV) (Barney, 1992), the Technology Acceptance Model (TAM) (Davies and Venkatesh, 1995), the Boundary Object Theory (Star and Griesemer, 1989) and Kolb's (2014) Experiential Learning Theory.

Barney (1992) posited that the Resource-Based View is a managerial framework that is used to determine the strategic resources a firm can exploit to achieve competitive advantage. This theory is relevant because it allows organisations to draw out relationships between the resources that gives them competitive advantage. For farmers in rural Ghana this theory will help determine how the ownership of the technology gives them competitive advantage based on the capabilities and competencies that come with it. The Technology Acceptance Model (TAM) is an information systems theory that provides the traditional viewpoints of technology acceptance from the aspect of users based on the perceived ease of use (PEOU) and perceived usage (PU) (Davis, 1989). This theory is important for the study because it will help determine how farmers adopt the mobile phone technology for which information could be found in the extant literature. The Boundary Object Theory according to Star and Griesemer (1989) are information, or objects used in different ways by different communities for collaborative work.

Using this theory will help provide an understanding of how the rural farmer perceives mobile phone technology and whether it indeed enhances collaboration of work between farmers and other stakeholders or otherwise. Another important theory that will be used is Kolb's (2014) Learning Cycle. The Kolb's (2014) Learning Cycle is a four-stage process that describes how learners acquire and embed new knowledge into their activities. The four stages of the process are experimentation, reflective observation, abstract conceptualisation and concrete experience. The use of this learning theory will help determine how the rural farmers learn, the knowledge they acquire and how they integrate it into their farming business as the extant literature provides little information. These factors are discussed in more depth in Chapters 2 and 3.

1.4 Methodological Approaches to the Study

In terms of research philosophy, this study uses an Interpretivist approach (Estherby and Smith, 2008). The reason for the interpretivist approach is because the study explores in-depth how adopting mobile technology influences farming business activities. Within interpretivism, participants or respondents can express their own views, share experiences and sometimes support their discussions with images, which all make it possible to understand their world (Easterby-Smith *et al.*, 2008). Interpretivist research is based on the belief of relativist ontology. This means that reality is subjective, and changes from one situation to another.

For this research, the ethics and moral values (axiology) of the farmers were considered too (Hammersley, 2015; Rajah, 2019). The empirical study reports on 24 farming small business entrepreneurs (FSBEs). These farmers are supported by two agencies in Ghana: The Ministry of Food and Agriculture (MOFA) and ESOKO. The name ESOKO originates from the Swahili word *Soko*, which means 'market'; the 'E' is for 'electronic'. ESOKO provides an agricultural profiling and messaging service to farmers who have registered with them. The farmers supported by MOFA were given general farming advice, not necessarily related to mobile technological support. The farmers supported by ESOKO were given farming information through mobile phone technology. Twelve Farming Small Businesses (FSBs) from each of these agencies were purposively selected for the study. All were based within the Kwahu district of the eastern region of Ghana.

The research was conducted in two phases. The Pilot work was undertaken in July 2018, and this was followed by the main study data collection, which was carried out in September 2018. The first study (pilot) which adopted a deductive approach was based on interviews with six farmers. The pilot study was underpinned by the Resource-Based View (Barney, 1992) and Kolb's (2014) Experiential Learning Theory after a review of the literature, see Chapter 2. Based on the findings of the pilot study, the literature was reviewed again, and two more theoretical frameworks were included in the study and embedded into the research questions. These were the Boundary Object Theory (Star and Griesemer, 1989) and the Technology Acceptance Model by Davis (1989) and Chapter 3 focuses on these two theories. The main study which adopted an Inductive approach was based on in-depth interviews with 24 farmers in the Kwahu district of the eastern region of Ghana. The semi-structured interviews each lasted between 45 minutes and 1 hour. The study also involved 2 participant observations dubbed 'A Day in the Life of the Farmer'. During the observation, the researcher spent a day each with two farmers, one from each agency. The reason was to understand how mobile phone technology is used in the farmers' business activities and life beyond farming. The observation complemented the interviews by providing a deeper understanding of how the farmers used mobile technology. The study was cross-sectional and was conducted over two years. The data collected were analysed thematically, with key findings presented throughout the empirical chapters. Detailed discussions of the methodological approaches are in Chapter 5 of this study.

1.5 The Context of Ghana

1.5.1 Ghana in Context

This study was conducted in Ghana. Ghana, formerly known as the Gold Coast, was the first place in sub-Saharan Africa where Europeans arrived to trade, especially in gold. Ghana was the first Black African nation to achieve independence from colonial power (in this instance, Britain) on 6 March 1957. It went on in 1960 to become a Commonwealth republic, with Dr Kwame Nkrumah as the first president. In 1966, Nkrumah was deposed in a coup that heralded years of military rule. In 1981, Flight Lieutenant Jerry John Rawlings staged a second coup, and the country began to move towards economic stability and democracy.

In April 1992, a constitution allowing for a multi-party system was approved in a referendum, ushering in a period of democracy. A well-administered country by regional standards, Ghana is often seen as a model for political and economic reform in Africa (UNDP Ghana, 2018; Charway and Houlihan, 2020; Kumi *et al.*, 2020). With a population of about 30 million, Ghana occupies a land area of about 238,533 km² (92,101 miles²) as at 2020 (www.worldbank.org). Currently, Ghana is the world's second-largest cocoa producer behind Ivory Coast and is Africa's biggest gold producer followed by South Africa. It is one of the fastest-growing economies and has made progress in the attainment and consolidation of growth (De Jong and Harts-Broekhuis, 2018). Although Ghana's growth has been robust, its source has always been biased in favour of the extractive and capital-intensive service sectors, which do not have a poverty reduction effect (Robson and Obeng, 2008).

The endemic poverty areas, mostly the towns and villages with a greater percentage of the population, are often constrained by a lack of roads, telecommunications and health infrastructure (National Human Development Report Ghana, 2020). Significant progress has been made in poverty reduction, although there is more to be done (Dagunga *et al.*, 2020). Notwithstanding, Ghana was the first country in sub-Saharan Africa to achieve Millennium Development Goal 1, halving extreme poverty (Ansong and Boateng, 2019). Ghana has recently become a middle-income country. The discovery of major offshore oil reserves was announced in 2007, encouraging expectations of a major economic boost. Since then, oil production has contributed to the country's GDP as well as creating jobs for most of the people in the western region (Musah, 2017; Moulton, 2019). Ghana still sometimes relies on the International Monetary Fund (IMF) for financial support to cushion its budget. In 2015, Ghana secured a \$600 million, three-year loan from the IMF to support its budget amid instability in the prices of crude oil, cocoa and gold (Yamoah *et al.*, 2020). Currently, in 2022/2023, the current government has asked the IMF for a bailout of \$3 billion to cushion the growth of the economy, with digitalisation of the various sectors and support for agriculture being paramount (Bloomberg, 2022). The country has also made progress as a developing economy in the areas of good governance, youth and gender empowerment, disability, domestic violence, social protection and media freedom (Kpienbaareh *et al.*, 2020).

The media is free to criticise the authorities without fear of reprisal. Radio and TV are the two most powerful media, used to criticise and to share government policies. Increasingly, social media platforms, including Facebook and WhatsApp, are also being used to share information (Appiah-Adjei, 2020). Ghana has enjoyed stable and deepening democratic governance. Six successful elections between 2000 and 2020 have strengthened the effectiveness of the key national institutions, enhanced investor confidence and anchored the new economy in an environment of growth.

Ghana is classified as a developing economy, with about 30% of the population having lower-middle-income status, but there is relative poverty, illustrated by children hawking food on the streets to support their families. About 52% of Ghanaians live on less than \$2 a day. Another 27% live on between \$3 and \$5 in between the two extremes is an emerging middle class (Worldbank, 2019). In terms of development in all the districts of Ghana, Aryee and Aboagye (2008) and Sefa-Nyarko (2021) posited that not all 261 receive the benefits of adequate infrastructure – including good roads, and health and telecommunication facilities – especially because most districts are within the mining and agricultural zones, as is Kwahu district (Doe *et al.*, 2021). Agriculture is one of the sectors upon which the country relies, both for local consumption and for export (MOFA, 2019).

1.5.2 Ghana's Agricultural Sector

Agriculture is a key sector that has received little support, but which creates significant employment (Banson *et al.*, 2015; Ali *et al.*, 2021). It plays a pivotal role in Ghana's economy and employs about half of the population (Lambrecht *et al.*, 2017; Essegbey and McCarthy, 2020). In rural areas, businesses focus on farming, fishing and agro-based processing. More than 45% of the population in Ghana live in rural areas and therefore depend heavily on agriculture, highlighting the strength of this sector (Ghana Statistical Service, 2018; Sackey, 2018) and the extent to which it supports the growth of the national economy through job creation and tax payments (Obeng *et al.*, 2014; Sackey, 2018; Weyori *et al.*, 2018; Acheampong *et al.*, 2021). These businesses are a characteristic feature of the production landscape and account for about 85% of the employment statistics (Weyori *et al.*, 2018, Mathew *et al.*, 2020).

However, the sector is dominated by men, with a few women doing farming as a business rather than to feed their family. This is because women have traditionally lacked access to and control of land, marketing information, and storage and processing facilities, limiting their ability to engage in small- and medium-scale farming to raise extra income. However, the use of mobile phone technology seems to have improved women's access to information on farming (Owusu-Bempah, 2019).

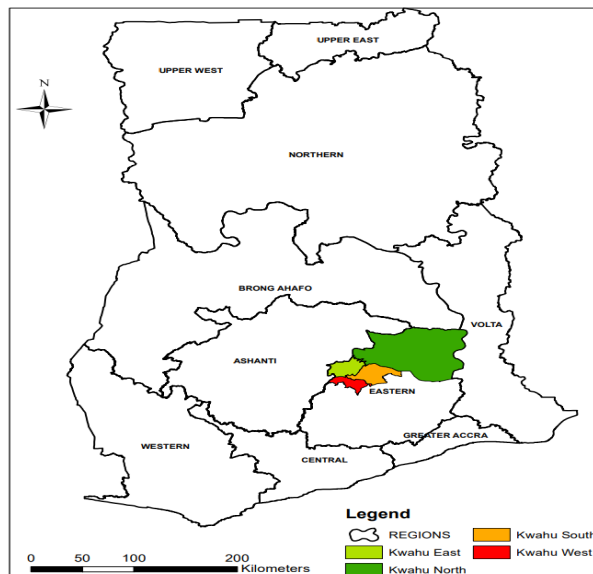
Despite the relevance of this sector to the economy, growth has stagnated compared to other sectors (McKay *et al.*, 2015). For example, in 2013 the growth rate was 5.7%, but then it grew by only 0.04% in 2015 (Poushter, 2016; Mohammed *et al.*, 2020). At the end of 2020, the sector accounted for 18.24% of GDP, down from 25.2% in 2015, and 28.2% in 2014 (Oxford Business Group, 2017; Ali *et al.*, 2021). This translated to \$7.1bn in 2017, with 76% generated from crops and the remainder from livestock, fishing and forestry (Ghana Statistical Service, 2019). The reason for the stagnated growth is that previous governments paid it only lip service, purporting to make huge investments that did not in fact take place (Amanor, 2017). The agriculture sector in Ghana contributes to 54% to the country's GDP and accounts for about 4% of the export earnings. (FAO, 2022; Ghana Statistical Service, 2019), and needs the support of both government and private sector investment if it is to grow. It is a sector that could help reduce unemployment and contribute to tax and revenue generation.

1.5.3 Kwahu District of Ghana

This study was undertaken in the Kwahu district of Ghana. The Kwahu are a group of people who live in Ghana and are part of the Twi-speaking Akan group based in the eastern region of Ghana. The district known as Kwahu derives its name from two words in the Akan language: *akoa*, which means 'slave', and *wu*, which means 'to die'. Initially, the Kwahu's were part of the Ashanti region, but because of wars, land acquisition and settlement issues, part of the Ashanti clan migrated to the mountains between the Ashanti Region and the Akim Region (Alhassan, 2017; Watson, 2018). When they decided to break away and move to the mountainous area, they were advised that they would not be allowed to return and would die due to the nature of that terrain. Once the first settlers arrived and found the land fertile for farming, they were later attacked by other wanderers from the Akim land.

These settlers, according to the history, based themselves in caves and on the tops of mountains, from where they rolled stones into the valleys where the enemies were camping, killing them all. This concretised the name *Kwawu*, which means ‘go and die’ (Watson, 2017; Watson *et al.*, 2018). Though the district is a mountainous area, the peak and the highest area is the town called Abetifi. There is a small village called Abene near the town known to have been the residing place of the Omanhene (Paramount Chief). This area was chosen strategically because it provides an escape route for the paramount chief in case of war. The chief could escape through the highlands and connect to the villages of Fodowa and Kwasiho, and/or access the Volta Lake. Historically once the paramount chief had been captured, the war was lost. Districts in the olden days would therefore protect their paramountcy (Watson, 2017; Watson *et al.*, 2018). During the colonial rule of the British, the district name Kwawu was pronounced *Kwahu* – which remains the case today. The district is known as the *Asaase Aban*, or the Natural Fortress, in view of its position as the highest habitable area in the country. Kwahu lies on the western shore of Lake Volta (Garlick, 1967; Watson *et al.*, 2018; Doe *et al.*, 2021). The district shares borders with the Akyem, Akuapim and Adangbe-Krobos regions.

Figure 1.1: Map of the Eastern Region of Ghana Showing where Kwahu is Located



Source: Ministry of Local Government (2019)

The main activities supporting the livelihood of the Kwahu are farming and fishing. As a result, a significant migrant population from the northern and Volta regions, as well as people from the Bono and Oti regions, have migrated to the northern area of Kwahu District, known as the Afram Plains. These migrants work as farming assistants, fishermen and caretakers in the fertile waterfront lands known as the Melting Pot (Watson, 2017; Doe *et al.*, 2021). Most of the farmers are small business entrepreneurs (SBEs), employing farm assistants and contributing to Ghana's economy in terms jobs creation and gross domestic product (GDP) (Alhassan, 2017), and support the food production to towns and cities. However, access to markets and customers is a fundamental challenge to the people in this area given the mountainous terrain and the Volta Lake. Reliable transportation and good telecommunication infrastructure, which support market access, remain a major problem for the farmers in the Kwahu district. Hence, they rely on the use of the mobile phone to connect to the rest of the world (MOFA, 2021). Yet, little has been done by researchers to understand how and why rural farmers adopt the technology, and how it is changing their farming business processes, and this study aims to bridge this gap.

1.6 Contributions

Theoretically, the study contributes to knowledge by providing a framework that integrates Barney's (1992) RBV, TAM (Davis, 1989) Boundary Object, (Star and Griesemer, 1989) Kolb's (2014) Experiential Learning theories with knowledge on the role of information communications technology (ICT) and information communications for development (ICT4D) to understand mobile phone adoption by rural farms in Ghana. Empirically, it confirms some aspects of the four theories while refuting others. The study extends Barney's VRIO theory, suggesting that farmers using the technology do not achieve a competitive advantage because of the VRIO criteria as the mobile phone is not rare, and its use can be copied. Rather, in rural Ghana, farmers achieved a competitive advantage because of the capabilities and the competencies farmers acquire in areas of financial resource mobilisation, use of social media platforms, research and communication and customer relationship management. These capabilities and competencies provide access to new local and international markets.

Regarding TAM, the study contributes to the literature by suggesting that the adoption of mobile technology by farmers in rural Ghana is influenced not only by perceived ease of use (PEOU) of the technology and perceived usefulness (PU), but also by specific external factors such as family, friends, and community and network providers, topography, transportation challenges and weather issues. Other variables that influence adoption are a lack of confidence in traditional banks, perceived trust, security associated with the technology use, support from the media and telephony companies in educating farmers, a sense of pride for owning a mobile phone, self-belief and self-sufficiency and social status.

The study contributes to Boundary Object theory by showing that farmers use the mobile phone technology to connect with farm workers, customers, suppliers, family and friends. The domestication of the mobile phone technology also reduced gender, generational and demographic boundaries, allowing women and university graduates who had previously not been involved in farming to join the farming business community. It also helped to connect farmers to institutions that support farming. In terms of Kolb's Learning Cycle, the study contributes to the theory by showing that rural farmers combine concrete experience with experimentation simultaneously while learning. The study shows that while farmers do gain concrete experience in using the technology, it is done through self-learning, sometimes through trial and error. Farmers also used non-reflective observation methods as they seek support from the community or from children and family in the learning process, in contrast to the reflective observation premise of Kolb's model. Furthermore, farmers did not use any scientific approach or follow any logical plan but instead they used informal learning or non-abstract conceptualisation methods. The study has implications for practice and policy.

1.6.2 Methodology

Methodologically, the study highlights the importance of rapport, informal relationships, and gaining the trust of hard-to-reach respondents. The study, conducted in two phases, was able to reach these respondents through sharing food and drink and cultural engagements as a data collection technique. This is especially applicable when respondents are reluctant to engage with public officials or foreigners due to their cultural or religious beliefs or for tax avoidance purposes (a particular issue in Ghana and other developing countries).

For example, in the northern area of the Kwahu district, the respondents are secretive, and the area is not open to the public. Chapter 5 captures in-depth discussions of these aforementioned insights. The inhabitants of the area are mostly farmers and fishermen on islands on Lake Volta in the Afram Plains. These people pay no taxes at all and do everything to avoid government officials contacting them. It was realised during the data collection that officials who tried to pursue them were not given access. This has been the case for some time, so no one wants to risk their lives visiting this area, despite the area being rich for research purposes. Lessons from this study on negotiating access to collect data could also be used by other researchers. Furthermore, data collection techniques using informal methods and negotiation through community leaders and chiefs, could be replicated by other academics looking to undertake further research in areas like the Kwahu district in rural Ghana.

1.7 Definitions of Key Concepts

Some of the key concepts discussed in the thesis are presented in the following section. For this study, Farming Small Business Entrepreneurships (FSBE) has been conceptualised as businesses run and managed by farmers who double up as the owner-managers of their farms (Nagler and Naudé, 2017).

Small Business Entrepreneurship (SBE) – The World Bank in the 1990s, through their Regional Project for Enterprise Development (RPED) in Sub-Saharan Africa (SSA), classified businesses as micro, small, medium, and large. Using these definitions, micro-businesses are businesses with 1 to 5 employees, small businesses comprise 6 to 29 employees, medium-sized businesses comprise 30 to 99 employees, and large businesses are classified as businesses with more than 100 employees (Abora *et al.*, 2014; Peprah *et al.*, 2020). This is also supported by Kusi *et al.* (2015) and Amoah and Amoah (2018). The Bolton committee report in 1971 defined small businesses (SBs) as businesses that employ 6 to 29 people, with fixed assets below \$100,000, whereas medium-scale enterprises employ between 30 and 99 people, with fixed assets of up to \$1 million. The definitions of the various business classifications are discussed extensively in Chapters 2 and 3.

MOFA – The Ministry of Food and Agriculture. This government agency is responsible for the development and growth of agriculture in Ghana. Farmers who register with this agency can access the support it provides through agricultural extension services and (Moses *et al.*, 2015). This ministry formulates policies to aid the agricultural sector and supports the implementation of the policies with the extension arm of the ministry. The ministry also monitors agricultural projects and programmes to ensure their success and benefits to the farmers. Even though this is a government agency, farmers are not obliged to register with them: they can choose to work with them or with any other agency they wish (www.mofa.gov.gh).

ESOKO – The name ESOKO originates from the Swahili word *Soko*, which means ‘market’; the *E* is for ‘electronic’. This is also a farming agency based in Ghana whose main aim is to provide an agricultural profiling and messaging service to farmers who have registered with them.

This is a private initiative built and supported with funds from international donors like the Food and Agricultural Organization (FAO). Like MOFA, ESOKO registers farmers and provides them with agricultural support in areas of agronomy, pricing, planting, and other services using mobile phone technology (www.esoko.com).

(MPP) MOBILE PHONE PLATFORMS – These are operating systems (OS) that support the running of mobile phones. They can be software in the phone which enables users to send and receive messages, make calls, send emails, and carry out various activities. They can also be part of the hardware, which is part of the phone itself (Gawer and Cusumano, 2014). The platforms enable the user to engage in social media activities, by allowing users to install and run apps, such as WhatsApp (Lazar *et al.*, 2020).

(ME) MOBILE ECOSYSTEMS – Mobile ecosystems are a collection of multiple devices such as tablets, phablets, and the mobile phone itself. They also include software and operating systems (Sun *et al.*, 2020). As part of this system, the mobile phone allows data (such as messages, SMS, and bank transactions) to be shared among the devices. The ecosystems also include mobile phone manufacturers and application (apps) developers (Xia *et al.*, 2010; Bresciani *et al.*, 2021).

1.8 Structure of the Thesis

The thesis has been divided into eight chapters. Chapter 1 introduces the research. Chapters 2 and 3 critically examine the literature. Chapter 4 discusses the conceptual framework and leads to the methodology discussed in Chapter 5. Chapter 6 provides insights on the findings and analysis, and leads to the discussion chapter, Chapter 7. Chapter 8 concludes the study. Details are as follows.

Chapter 1: This presents the background and broad context of the study: understanding how mobile phone technology and related platforms influence farming business activities in rural Ghana. The chapter outlines the aims of the study within the broader context of the research.

Chapter 2: This section of the thesis reviews the literature on ICT & ICT4D on mobile phone technology and learning in Africa. The chapter also highlights the intellectual debates on the role of ICT and ICT4D influencing adoption. The chapter focuses on technology adoption addressing two theoretical concepts reference to research question one.

On the ways the adoption of mobile phone technology influences the farming business activities of rural farmers in Ghana, the theoretical concepts are the Resource-Based View (RBV) (Barney, 1992) and Kolb's (2014) Learning theory. The Resource-Based View (RBV) explains the benefits associated with the reasons why the rural farmer adopts the technology considering it as a resource, which support them in various ways in carrying out the farming activities. In using the technology, farmers develop capabilities and the competencies that gives them competitive advantage. The chapter goes further to show that in the process of using the technology, learning takes place. Therefore, the review adopts Kolb's (2014) learning theory to discuss learning and development issues associated with the use of the technology. Kolb's (2014) learning theory indicates that there are four approaches to learning. These are experiential learning, reflective observation, abstract conceptualisation and experimentation.

Chapter 3: This section discusses how adopting mobile phone technology influences user behaviour under the theoretical lenses of the Technology Acceptance Model (TAM) by Davis (1989) and the Boundary Object theory by Star and Griesemer (1989). Following Davis *et al.*, (1989), the chapter discusses that users behaviour being influenced by adopting a technology depends on the following factors.

These are external variables, perceived ease of use (PEOU) perceived usage (PU), behavioural intention to use the technology (BI) and attitude towards the technology which influences the Actual Systems Use (AU). As part of understanding behaviour changes in using the technology the chapter aligns the discourse with the Boundary object theory by Star and Griesemer (1989). The theory describes the Boundary Object as an artefact, information or an object that allows users to work with it no matter their location. The behavioural influence in using the mobile phone technology by the users make it easier for them to adapt, tame or domesticate the technology, and is used for different purposes and by different communities. Hence the mobile phone is discussed as a boundary object (Star and Griesemer, 1989).

Chapter 4: This chapter formulates the research questions and conceptualises the theoretical framework for this study. The conceptual framework is developed in response to the gaps identified in the literature in Chapters 2 and 3 and seeks to answer the four sub research questions.

- (i) How does the Resource-Based View (RBV) of the firm help to frame an understanding of mobile phone technology used by Farming Small Business Entrepreneurship in Rural Ghana?
- (ii) How the Technology Acceptance Model can influence the behaviour of farmers in rural Ghana when adopting mobile phone technology as part of their farming business activities.
- (iii) In what ways does mobile phone technology become a boundary object in influencing farming activities and relationships in rural Ghana?
- (iv) How can Kolb's Learning Cycle help to explain the process of mobile phone adoption by Farming Small Business Entrepreneurship in rural Ghana?

Chapter 5: This chapter sets out the philosophical arguments that underpin the qualitative research for the thesis. The chapter further describes the methodologies employed – namely, semi-structured, in-depth interviews backed by participant observations. This chapter also discusses the methods employed to ensure reliability, validity, and ethical research, and also justifies the approaches used.

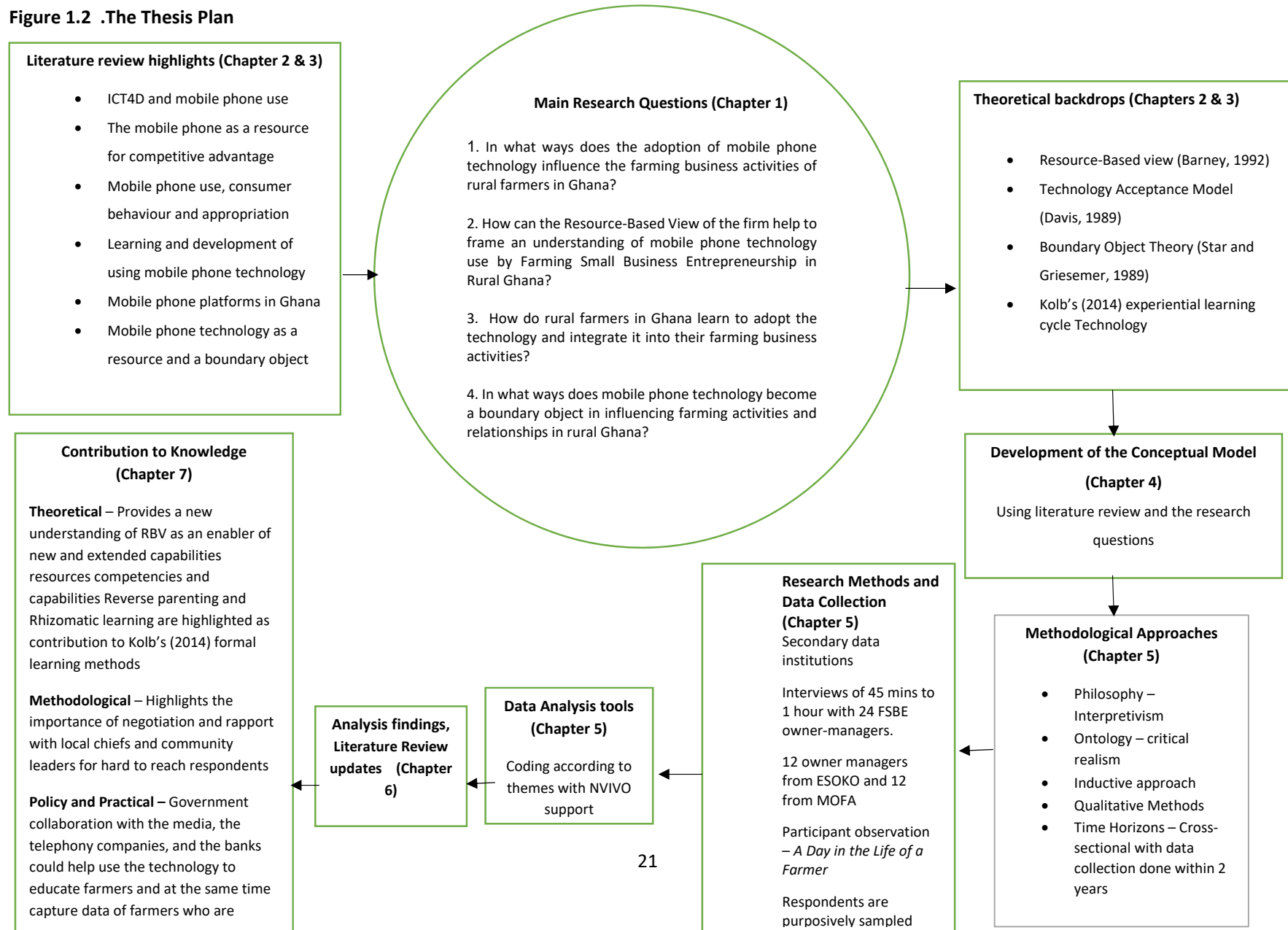
Chapter 6. This chapter discusses the empirical findings of the research four main research questions on the influences of technology adoption. Under Research Question 1, on the ways adoption of mobile phone technology influence the farming business activities of rural farmers in Ghana, the findings are underpinned by two theoretical lenses. These are the RBV theory Barney (1992) and TAM theory by Davis (1989). For the second main research question Ton how rural farmers in Ghana learn to adopt the technology and integrate it into their farming business activities, the findings are also underpinned by two more theories. These are the Boundary Object theory by Star and Griesemer (1989) and Kolb's (2014) learning theory. The chapter also sheds some light on how these farmers adopt mobile phone technology aligned with the research questions, taking into consideration the MOFA and the ESOKO farming groups. The chapter also discusses how the farmers learn to use the knowledge and skills they have acquired to support their farming business. The chapter concludes with insights from the report made of personal observations, dubbed 'A Day in the Life of the Farmer', which aimed to understand how the rural farmers use the technology in their daily lives.

Chapter 7: This chapter provides the discussion of the thesis findings. It reports on the outcome on how mobile phone technology adoption influences the rural farmers' business activities. The chapter begins by providing a summary of insights into the findings, followed by a focus on the big picture, with reference to the influence of ICT4D (Mobile phone adoption by farmers in rural Ghana) The study provides insights into the Resource Based View (Barney, 1992), extending it to suggest that achieving competitive advantage in using mobile phone technology depends on the enhanced, and new capabilities resulting from how the farmers use the mobile phone technology as a resource, the capabilities and the competencies they achieve during usage. The Technology Acceptance Model (TAM) (Davis *et al.*, 1989) is also extended by the study suggesting that the actual usage of a particular technology is influenced by perceived security and safety (PSST) and perceived trust (PT) which are external variables. The study goes on to say that the trust and safety issues influences behavioural intention, which then influences the farmer's attitude to adopt the technology. The study also provides insights into the boundary object theory as a technology that bridges boundaries between farmers and governmental and non-governmental institutions.

The Boundary Object Theory (Star and Griesemer 1989) is said to have reduced generational divides, bridging women farmers and graduates together to undertake farming as a business. In this chapter, how the rural farmers learn and the skills they acquire is explored in terms of the Kolb's (2014) experiential cycle.

Chapter 8: This chapter presents a summary of conclusions and contributions, as well as research limitations. The chapter begins with an introduction and touches on the research questions. These are then aligned with the insights from the findings and the contributions to knowledge set out in the discussion chapter. The chapter concludes with a revised framework, an acknowledgement of the study's limitations, and suggestions for future research. The thesis plan is provided in Figure 1.2 below:

Figure 1.2 .The Thesis Plan



CHAPTER 2 – LITERATURE REVIEW

ICT & ICT4D INFLUENCE ON MOBILE PHONE TECHNOLOGY ADOPTION AND LEARNING IN AFRICA

2.0 Introduction

This chapter examines the extant literature on the relationship between mobile phone technology usage and ICT for development (ICT4D). ICT4D helps in the creation of awareness and usage of information communication technology and mobile phone technology to facilitate economic development. It further reviews the literature on the two theories (Resource-Based View by Barney, (1992) and Kolb's (2014) Experiential Learning Theory that underpinned the pilot study and explores how they provide an understanding of why and how rural farmers adopt the mobile phone technology, and how it is facilitating their farming business processes.

The chapter follows the traditional thematic process (Behl and Dutta, 2019) with the themes split into sections. Section 2.1 introduces the chapter. Section 2.2 focuses on Information Communication Technology (ICT) and Information Communication for Development (ICT4D). Section 2.3 discusses mobile phone platforms and ecosystems. Section 2.4 discusses the mobile phone and its usage in Africa. Section 2.5 reviews the literature on the Resource-Based View (Barney 1991). Section 2.6 discusses Kolb's (2014) experiential theory. The chapter concludes with section 2.7, which provides a summary of the chapter and highlights gaps identified which the thesis aims to address. The next point of the review provides insights on Information Communication Technology (ICT) and ICT for development (ICT4D) in developing economies and Ghana.

2.1 ICT and ICT4D Contribution to Technology Development in Developing Economies

Developing and developed economies spend more than US\$800 billion annually on ICT (Information and Communications Technology), and Africa has its fair share of this expenditure (Heeks, 2010; Asongu *et al.*, 2020). This is spent on ICT sectors to help facilitate their operations, create jobs, reduce unemployment and improve socio-economic development. For example, mobile phones are an example of ICT that is used to support agricultural extension services and to communicate with farmers on planting, fertiliser and the availability of other resources (Cole and Fernando, 2012; Odhiambo *et al.*, 2020). There is therefore a difference between ICT use at large and ICT4D (Information and Communications Technology for Development).

ICT, according to Leslie and Kwami (2012), involves the use of a complex set of technology resources and applications to produce and process information to support business activities. This definition and explanation indicate that ICT is evolutionary and dynamic. As the environment changes, ICT software and applications are developed to meet ever-changing needs. These software and applications support the marketing of products and services.

In developing economies where infrastructural facilities like transportation and landline communication are lacking, the mobile phone helps to facilitate business activities – and this in turn helps to develop the economy (Leslie and Kwami, 2012; Gómez-Barroso and Marbán-Flores, 2020). ICT4D focuses specifically on how ICT can be used to support developing economies in the areas of agriculture, health, transportation, and trade (Qureshi, 2015).

The roots of ICT4D lie in the 1990s, when international development agencies and banks were brought in both to support countries in need of aid and to reduce poverty and hunger. Phrases like ‘first world’ and ‘developing economies’ came into existence in the years after World War II, and the phrase ‘developing economies’ still exists today. It is used to categorise countries that are less developed or developing, referencing indicators like the economy, stability, business growth, infrastructural facilities in ICT, transportation, and gross domestic product (GDP) (Leslie and Kwami, 2012; Ojo, 2020). Whereas developed countries have access to these indicators, developing countries lack them.

To bridge the gap between developed and developing economies, Schelenz and Pawelec (2021) and Willis (2011) indicate that technological knowledge, tools and techniques developed in the West should be used to help the developing and the under-developed worlds, and out of this debate emerged ICT4D.

The issue is whether ICT4D contributes to development. Heeks (2010) argues that ICT4D contributes to development when it is backed by financial resources. However, there is evidence that monies and financial resources provided for ICT4D in African countries have been channelled through governments and political institutions that do not use it for its intended purposes. In addition, some of the ICT4D policies and interventions are not always suitable for the countries targeted for improvement (Ojo, 2020). Notwithstanding that, Africans have embraced ICT and continue to use it to their advantage. The reason why mobile technology is important in ICT4D is because users are familiar with it, and the phones are handy and convenient for travel. From a wider perspective, the mobile phone performs the same tasks as landlines, but what is unique about the mobile phone is the cost and that it can be used in most places where there are no landline facilities. All that is required of a user is to stay close to the masts for access to the network (Densmore *et al.*, 2015; Alao and Brink, 2020). ICT facilitates communication and the exchange of information. These exchanges help individuals and businesses to make decisions in relation to travel, as well as enabling the ordering of goods and services, checking on clients and coordinating meetings – to mention just a few advantages. This helps improve productivity, as savings are made in the areas of cost and time. Productivity also increases, and this multiplier effect helps the economy to grow, as new jobs are created, and existing businesses improve their day-to-day operations. Heeks (2010) takes the discourse further by indicating that determining whether ICT contributes to development requires understanding how ICT has contributed to a nation's GDP.

GDP is the total economic activity within a nation's geographic borders, representing the monetary value of all goods and services. Given that economic activities take place within different sectors of the economy, Heeks (2010) could have expatiated on the role of ICT in these sectors, the infrastructural facilities that support the effectiveness and efficiency of ICT, and how ICT contributes to development in these sectors.

Lee *et al.* (2012) contributes to the gap identified in Heeks' (2010) discourse on ICT and GDP, suggesting that higher levels of mobile penetration through effective ICT increases GDP. Lee *et al.* (2012) continues further, indicating that in trying to understand how mobile phone technology (part of ICT) influences GDP, there is the need to consider the micro and the macro level factors and benefits. On the macro level, it is evident that there is a positive relationship between economic development and the GDP of countries whose activities are supported with mobile technology (Stork *et al.*, 2012). Mobile usage in these countries creates employment and improves productivity through the reduction of travelling costs for business people, while at the same time it facilitates trade transactions. In the process of usage, jobs are created for the sellers of the calling cards, credit or airtime, sales assistants for the telephony companies, sellers of the telephone accessories, and mobile phone repairers (Hanson and Heeks, 2020). The results are improved information use and poverty reduction in developing economies. These are indicators of economic growth and development (Lee *et al.*, 2012; Asongu *et al.*, 2020). However, Bhavanani *et al.* (2008) argue that it is not mobile phone usage which brings the development. Rather, it is the investment in the mobile technology infrastructure that is part of ICT development, which improves socio-economic development due to the level of work and the amount of investment involved. This leads to the generation of revenue and taxes for the government. But the questions left unanswered are the role played by mobile technology in ICT and the factors contributing to its usage, which warrant governments and stakeholders to invest more.

On the micro-economic level, Jensen (2007) – see also Anyasi and Otubu (2009) – discusses the relationship between ICT and economic development from the perspective of day-to-day activities, placing emphasis on mobile technology. Jensen (2007) posits an example of the use of mobile phones by fishermen in South India, which helped to identify available markets where there is demand for their produce. However, while the extant literature on ICT and ICT4D indicates the success of mobile phone technology in developing economies including Africa in terms of its contribution to economic development, it does not give specific examples in terms of how these apply to businesses in rural Africa (Abubakre and Mkansi, 2022). The literature also appears to be silent on how mobile technology, which is part of ICT4D, supports and facilitates business activities using specific social media platforms too.

Though indicating that ICT4D is an interesting area for study by scholars and academics, most of these scholars are not indigenes, nor do they stay in the areas in which they study the effects of ICT4D. Rather, they rely on the data they have gathered (Urquhart, 2011). There is also a sense that ICT4D is based on a Western discourse, with the concepts and theories developed by the West but transferred to people in developing countries (Leslie and Kwami, 2012; Solomon and van Klyton, 2020). What is important to know is how mobile phone technology has contributed to ICT4D being successful in developing economies at individual, organisational and governmental levels. On the individual level, mobile phone technology and related platforms help to achieve better livelihoods for the users of the technology. For example, in Malaysia, it enhances safety for fishermen out fishing and eases communication with their families (Hilson and Maconachie, 2020). On the organisational level, mobile technology helps to coordinate business activities. For example, the mobile phone helps store customer data and is used to check barcodes and packaging information.

Finally, on the government policy level, mobile technology helps governments to coordinate and disseminate information and resources to people who need them. For example, when it comes to health, policy makers cascade their information to rural areas via the mobile phone. Also, nurses and health professionals keep in contact with their patients using mobiles (Akter and Ray, 2010; Rodríguez-Torrico *et al.*, 2020). The clarity that needs to be established in reference to the above involves understanding the platforms and ecosystems that underpin the mobile phone technology and Section 2.3 discusses these points.

2.2 Mobile Phone Platforms and Ecosystems

The mobile phone is a device that is wireless and handheld, and which allows users to make calls. It is also used to send text messages and browse the internet. Early models of these phones could only make voice calls while on the move and did not have internet facilities. However, evolution in terms of memory capacity and processing performance have brought the addition of further functionalities such as navigators, barcode scanner facilities, and the management of multiple emails (Rasmusson *et al.*, 2004; Coffie *et al.*, 2021).

More recent phones have the capacity to access and process information at high speed thanks to 4G or 5G data networks. Mobile phones now have multimedia capabilities, as well as basic functionalities. For example, the iPhone's iOS is an operating system that allows users to download applications (apps). These enhance the capabilities of today's smartphones considerably by helping to improve the services and benefits they offer to individuals and small businesses (Tilson *et al.*, 2011). Initially the mobile phone was seen as an extension of the terrestrial telephone network (Donner, 2010; Rotondi *et al.*, 2020). Yet, while there is a relationship between the mobile phone and the landline, in that both make and transmit calls (Donner, 2010), the difference between the two is that the mobile phone has more varied uses than the land line phones (Balakrishnan and Raj, 2012; Solomon and van Klyton, 2020; Duncombe, 2016; Folitse *et al.* 2018). This enables users to conduct business wherever they are. For those in rural villages, the mobile phone facilitates communication and the exchange of information (Donner and Escobari, 2010; Paas *et al.*, 2021), and in areas where internet facilities are available, mobile phone technologies and platforms provide an opportunity for businesses to expand by offering the buying and selling of products via internet (e- and m-commerce) services (Asongu, 2013; Paas *et al.*, 2021, Senyo, *et al.*, 2022).

Mobile platforms are one part of a broader digital ecosystem (Deley *et al.*, 2020; Qiu *et al.*, 2021). The term *platform*, according to Thomas *et al.* (2014) – see also Agarwal *et al.* (2021) – is used as a metaphor and as a construct in management research. It is used to describe product systems and networks as well as markets. It has also been used in different contexts – for example, investment, technology and supply chain platforms (Gawer and Cusumano, 2014). The term is used most in high-tech companies or companies which use technology to support their operations (Gawer and Cusumano, 2014). Agarwal *et al.* (2021), Cusumano and Nobeoka (1998), and Khrisnan and Gupta (2001) discuss platforms from the perspectives of organisations, as subsystems and interfaces that form a structure, based upon which companies can develop products and services. Ye and Kankanhalli (2018) define platforms from the broader perspective of knowledge, assets, relationships, components and processes, which are shared by a set of products and/or services – for example, mobile money platforms that support the transfer of money using mobile technology.

Ciborra (1996) draws on platforms from the context of their usage in facilitating business processes, through which specific structures are developed during organisational transformations and restructuring (see also Shen *et al.*, 2021). Platforms here help mould the structure of organisations, helping them to shape their strategies. For small businesses in Africa, the most common platforms known and used to facilitate businesses activities are message platforms and social media – the WhatsApp platform for those with smartphones (Goldbach *et al.*, 2018). Gawer (2021) argues there are two main types of platforms: internal platforms, otherwise known as company-specific (including product-family platforms), and external or industry-wide platforms.

2.2.1 Internal Platforms

Gawer (2014, 2021) discusses internal platforms in the context of innovation and product development, including components, reusable technologies, supplier relationships, and products being developed or modified. Platforms in this sense are developed to support customer needs, either by facilitating the way a service is provided or by helping to modify the needs of existing product features (Wheelwright and Clark, 1992). Krishnan and Gupta (2001), however, see platforms as ecosystems.

This is in line with Ye and Kankanhalli's (2018) view of platforms as assets, subsystems and interfaces, based on which companies can develop products and services. Internal platforms that facilitate the use of the mobile phone include the Android, Apple iOS, Blackberry and Windows operating systems. As part of a broader ecosystem, these operating systems allow the mobile phone to perform its functions (Hyrnsalmi *et al.*, 2014) and facilitate small businesses in performing their business activities (Gawer, 2014). The literature on internal platforms reports on the benefits of minimising costs, on gains in effective and efficient ways of production and service provision, and on supporting improvements in the technical aspects of the business. An important aspect of the internal platform that supports business activities in facilitating the movement of goods and services is the supply chain platform. This help to create good relationships across, and benefits to, a range of external stakeholders. The internal platforms are core to the functions of the mobile phone technology in itself and includes SMS platforms, banking and social media platforms. These are fundamental to the adoption of the technology (Helfat and Raubitschek, 2018).

2.2.2 External Platforms

External or industry platforms are developed as products or services that provide a foundation on which other firms can innovate or build their products and services. Empirical studies on platforms and innovation ecosystems have focused on the computer and telecommunications industries (Greenstein, 2009). Various writers have defined external platforms from a range of different perspectives. For example, Valkokari and Ketonen-Oksi (2018) defines such platforms as architecture allowing modular substitution of complementary assets, such as software and peripheral hardware. Iansiti and Euchner (2018) also defined the platform as a 'keystone firm' – which, relationally, is equivalent to and in line with the Cusumano *et al.* (2021) perspective on platforms. The difference between internal and external platforms is that internal platforms are within a particular company or organisation, whereas external platforms are open to outside companies (Cusumano *et al.*, 2021).

It should also be noted that the openness of these external platforms depends on issues such as regulations, accessible costs and licensing (Ozalp *et al.*, 2018). There are also social media platforms like Facebook, Twitter and LinkedIn. These platforms form part of the business model of organisations, facilitating their development and growth processes (Pan *et al.*, 2015). Taking the discussion on external platforms further, Gawer (2014) posited that the positions of platforms within ecosystems change once a new platform emerges that is more innovative than the previous one. Therefore, the scope of innovation is always evolving, leading to the development of new platforms and the opening of existing ones, which create changes within the information systems in organisations as they accommodate the ever-evolving changes. Thomas *et al.* (2014) and Cusumano (2020) further supported the discussion on platforms from the perspectives of organisational streams, product family streams and market intermediary streams. Thus, the mobile phone technology could be an external platform in itself which uses Android, iOS, and Windows operating systems to facilitate its use. The same technology uses platforms like mobile money to facilitate relationships with the banks and the telephony companies in money transfer as well as mobile banking services for users.

With reference to the organisational stream, the platform is part of the organisational structure and stores the capabilities and resources of the organisation (Prahalad and Hamel, 1990). The organisational streams which carry the resources and capabilities enable rapid development and facilitation of activities within the organisation to ensure that objectives are achieved. Businesses use these resources as organisation information systems to take advantage of available opportunities and to help strengthen their competitive scope (Helfat *et al.*, 2018; Ozalp *et al.*, 2018; Cusumano *et al.*, 2021).

2.2.3 The Market and Intermediary Streams

The market intermediary stream is another growing area in the body of literature on platforms. This stream, according to Nambisan *et al.* (2018), is known as the double-sided market. The platform here becomes a linking bridge between two markets and facilitates transactions between two users. From this perspective, a market is considered as being multi-sided (more than two) when the intermediary influences the transactions between the markets. Research in this area has evolved from issues of competition and connectivity with external networks to a gradual focus on facilitating market structures and prices within a particular market. Although the market intermediary stream focuses on the multi-sided market, Eckhardt *et al.* (2018) argued that multi-sided platforms do not take ownership of the goods and services whose transactions they facilitate. Rather, multi-sided platforms help to remove bottlenecks and support market facilitation by improving the activities to help trade. The questions remain as to where and how the platforms might provide competitive advantage for users, and the role played by telephony companies, manufacturers and governmental instructions in this ecosystem.

2.2.4 The Ecosystems

The mobile phone is not a standalone product providing only communication services; it is one which works within a system of interrelated technological activities. This is known as an ecosystem (Sørensen *et al.*, 2015). An ecosystem consists of interrelated firms, players or a group of companies that support the delivery of products and services (Basole and Karla, 2011). Xia *et al.* (2010) also define an ecosystem as a network of actors ranging from network operators and manufacturers to application developers, including mobile devices.

There are also tools within the ecosystems that facilitate data transfers and processes between two devices, such as sending text messages, voice messages and multimedia. These devices can be grouped into physical (for example, tablets, phones and phablets) and software-related (which include development tools, operating systems and app stores) (Rao, 2012). Mobile ecosystems can be analysed from three strands (GSMA, 2014). These are software applications, manufacturers and operating systems, and are discussed below.

Operating Systems

The ease of use of a mobile phone depends, to some extent, on the operating system (Bagozzi, 2007). Operating systems also form part of the mobile ecosystem. This aspect of the mobile device controls the applications in the mobile phone. These are part of the mobile phone's platform, and users benefit from the services they can access over these platforms (Hyrnsalmi *et al.*, 2014). As the mobile technology environment continues to evolve, so do the actors in the network (Xia *et al.*, 2010; Shen *et al.*, 2021). Emerging actors, according to Hyrnsalmi *et al.* (2014), like the application developers within the ecosystems, could have a strong impact on the software business and are therefore likely to increase competition in that business (Gawer, 2020). There is also the need to consider the manufacturers as part of the review of platform ecosystems.

The Manufacturers (Original Equipment Manufacturers – OEMs)

The manufacturers produce handsets for telecommunication companies. These are developed with both changing customers' needs and the pace of technology in mind. Manufacturers work in close contact with application developers, especially for smartphones, to ensure they provide applications that benefit mobile phone users – typically in areas such as banking, transportation and entertainment (Hall and Anderson, 2009; Cusumano *et al.*, 2021). In developing countries, including Africa, smartphone applications are not generally used in rural areas but only in cities where internet facilities are available. In spite of this, Ye and Kankanhalli (2018) indicated that the application software which runs on mobile devices, especially those in rural areas, is able to support programmes in relation to health, agriculture and education, and mobile banking, so facilitating trade among rural businesses. On the African continent, notable manufacturers are Nokia, Samsung, Alcatel, Lenovo and, recently, Hisense (McIntyre *et al.*, 2020). These companies are known to provide mobile phones that are cheaper, have long battery life, and support the necessary applications for voice and

messaging used in rural areas in Africa. These handsets facilitate calls and information sharing, which helps to reduce costs – of transportation, for example, and by supporting mobile money transactions (Bharadwaj *et al.*, 2019). The success of the platforms also depends on the software and applications.

Software and Applications

Software and applications form part of the mobile phone technology ecosystem. For customers with smartphones, and in areas where they can have access to the internet, applications are normally downloaded to help access more benefits using the technology as mentioned earlier. For those in rural areas and in villages, it may be difficult to download applications, and this is also true for those without smartphones relying on a type of mobile phone that may not support them (Sun *et al.*, 2020). Small retail businesses, such as South African ‘spaza’ shop owners (informal convenience stores run out of homes) use the mobile phone to make calls and use messaging systems to place and take orders from main agents in the towns and in the cities when their stocks are running low (Matlala *et al.*, 2014). This indicates that the software and applications are a fundamental part of the mobile phone technology ecosystem and that without it, the mobile phone technology may not function properly. This research on how South African spaza shop owners utilise mobile phone technologies was based on a small sample size and carried out quantitatively but undertaking similar research qualitatively and with a larger sample size would enable respondents to give their opinions on how software and applications help to improve business activities in rural areas of Africa. In concluding the discourse on mobile phone platforms, there seem to be some limitations in the literature. Firstly, it has not been established how the platforms related to mobile technologies in rural Africa contribute to the reasons for the adoption of the technology, nor just how the platforms contribute to any competitive advantage gained by users. Secondly, platforms have become an important area of research within the mobile technology field. The proliferation of studies on platforms has given rise to some degree of context specificity, having evolved from the engineering perspective to a more general application within management disciplines. However, the translation of the theoretical ideas from one discipline to another has not been clearly articulated.

For example, the interpretation and discussion of a platform in the engineering or manufacturing discipline is different from the perspective of management, and from areas of micro- and small businesses (Last, 2017). Thirdly, the discussion on platforms from the perspectives of the organisation encompasses products, the market and intermediary streams that form part of the business activities (Prahalad and Hamel, 1990). Notwithstanding this, the platform acts as a bridge between markets, helping the platform owner to profit from the value it creates. Having discussed mobile phone ecosystem, the next section looks specifically at Africa and the use of mobile phone technology.

2.3 Mobile Phone Technology in Africa

Africa is a continent that has more mobile phone users than fixed line subscribers. A report by the International Telecommunications Union in 2019, re-emphasised by Adusei *et al.* (2020), indicated that, by the end of the decade, the use of landlines in Africa is likely to fall to under 20 million individual users. This is because acquiring them is complex, since documentation must be provided, which in turn explains why individuals prefer mobile phones (ITU, 2019). Furthermore, Tobbin (2010) and Adusei *et al.* (2020) posited that in most developing economies, governments have regulations to help reform and support the development of this infrastructure. Using Ghana as an example, Tobbin (2010) went on to say that the lack of implementation and reform was due to political instability in the 1980s. However, from the 1990s onwards there was some stability and reform in this sector (Osei-Owusu, 2017; Ofosu-Boateng, 2020).

The reforms brought about a liberalisation of the sector, encouraging competition from other companies. Even with that, the cost and process of applying for landlines was still high and cumbersome (Dzidzah *et al.*, 2020, Haggarty *et al.*, 2002; Lewis, 2020). Nonetheless, the liberalisation of the telecommunication sector brought about the rebranding of Ghana Telecom as Vodafone Ghana while MTN and Airtel-Tigo also came on-board to provide mobile and network services (Osei-Owusu, 2017; Lewis, 2020). Makoza (2020) argued that reforms in developing countries like Ghana are not always a result of political stability. They may also be attributed to revolutions in the world of telecommunication technology.

Samarajiva (2000) also posited that those reforms, especially in developing economies, including Ghana, are a result of the influence of the World Bank and of experts from around the world with a strong knowledge of reforms in the technology sector (Cowhey and Richard, 2000; Thatcher, 1999).

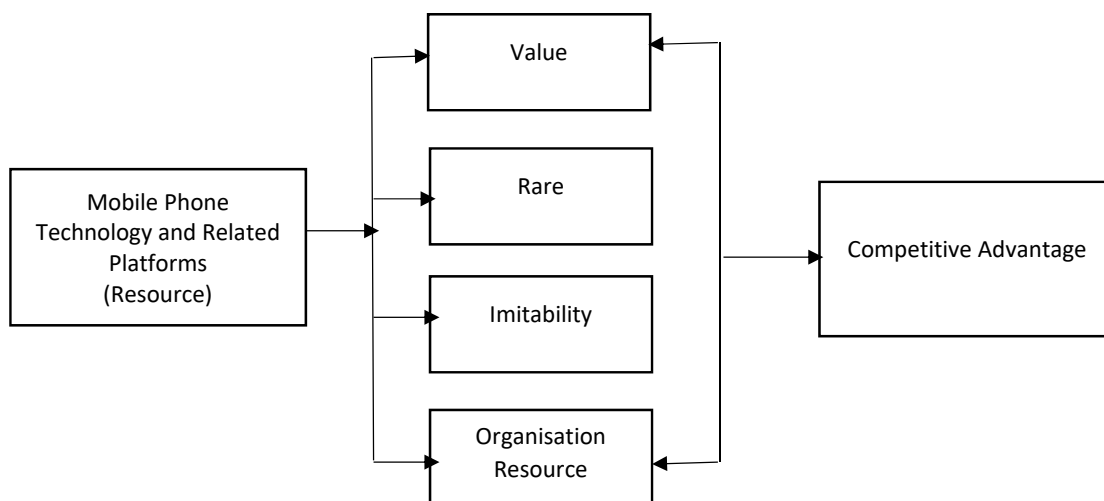
2.4 Mobile Phone Technology as a Resource for Competitive Advantage

The liberalisation of information communication technology (ICT) in the past two decades has been followed by a plethora of positive developments and outcomes in Africa (Asongu *et al.*, 2019). One of the development outcomes relates to the benefit that mobile phone technology and related platforms (part of ICT and ICT4D) can bring to the rural farmer in Ghana. Benefits include regular information updates on pricing, weather and banking services (Asongu, 2017; Asongu *et al.*, 2018; Efobi *et al.*, 2018; Tchamyu, 2018). In spite of these reported benefits, there is little available knowledge in the literature on whether users of the technology gain some form of competitive advantage through its use. Thus, the thesis seeks to explore this aspect using Barney's (1992) Resource-Based View theory. Barney's (1992) work focuses managerial attention on a firm's internal resources in an effort to identify assets, capabilities, and competences with the potential to deliver superior competitive advantage. This is supported by Amit and Schoemaker (1993), Corner and Harvey (1991), Conner and Prahalad (1996), Dierickx and Cool (1989), Helfat and Castanias (1991), Helfat and Lieberman (2002), Kogut and Zander (1992), Peteraf (1993), Rumelt (1984) and Teece *et al.* (1997). Since 1992, the Resource-Based View has been applied to a wide range of phenomena, such as information systems (Wade and Hulland, 2004) and organisational networks (Lavie, 2006). The theoretical and empirical development of the RBV has been analysed in a number of studies (for example, Acedo *et al.*, 2006; Armstrong and Shimizu, 2007; Lockett *et al.*, 2009; Newbert, 2007). Conner and Prahalad (1996), Helfat and Castanias (1991), Helfat and Lieberman (2002), and Kogut and Zander (1992) posit that competitive advantage comes from value created and or services offered. Barney (1992) goes further to say that firms create advantages based on the resources they have, and how they use them effectively and efficiently – for an organisation's resource to hold potential as a source of competitive advantage, the resource should be Valuable, Rare, difficult to imitate and the Organisation must be able to exploit the resource (generally known as VRIO criteria).

Value takes into consideration the specific benefits that an organisation's product or services provides and how that meets the needs and expectations of the customer or the user. In terms of rarity Barney (1992) indicates that organisations can create advantages if their resources are rare. This means the resources should be hard to come by. Rarity is important because a good recipe for success is created when it is mixed with value (Helfat and Lieberman 2002). These two criteria are mutually important because without rarity, it would be difficult to capitalise on the value that an organisation possesses. The resources should also be difficult to imitate according to Barney (1992). Imitability is like rarity but questions the ability of competitors to imitate their strategies. In thinking through this, competitors may want to know the cost associated with replicating these strategies. They may also want to look around to see if similar strategies exist which they can imitate without reinventing the wheel. If an organisation's resources can be replicated or imitated, then the competitiveness achieved may be only fleeting; the resource will offer only a shorter-term competitive advantage (Lavie, 2016). The 'O' in terms of the VRIO represents the organisation. Barney (1992) at this point indicated that for an organisation to achieve competitive advantage, it needs to consider the resources within itself. These resources include management, structures, systems, staff branding and strategy. Issues of workflows and technology use could also be considered. Barney's (1992) Resource-Based View is shown below.

Figure 2.1

Barney's (1992) resource-based view
Empirical Indicators (VRIO)



Source: Based on Barney (1992)

The Resource-Based View has been used to understand how different organisations gain competitive advantage using organisational resources such as staffing, technology, finance and service delivery. Empirical literature has indicated that organisations, be they large or small, have sought to achieve competitive advantage in areas of supply chain, manufacturing and customer service delivery using technology as a resource (Yang *et al.*, 2018). This has been supported by Tehseen *et al.* (2019) whose findings from a survey of 170 manufacturing SMEs in Malaysia indicated a positive significant impact of strategic competency on competitive advantage because of the use of ICT. Yet even though the Resource Based View has been successfully used in well-established organisations and developed economies to achieve competitive advantage, it has not been used to study rural small businesses in developing economies (Yang *et al.*, 2018). Notwithstanding the usefulness of the Resource-Based View the theory has met with sharp criticism. Most relevant to the Ghanaian context is that the resource-based view focuses on internal resources as being key to achieving competitive advantage. It does not sufficiently recognise external influences and factors as fundamental to achieving competitive advantage.

This aspect may be particularly important in the context of SMEs in Kwahu which rely on both formal and informal institutions and networks for creating, maintaining, and sustaining business. The limitation of the resource-based view lies in the fact that SMEs and other businesses supported with ICT4D in some parts of Africa do not operate within the confines of narrow 'neoclassical economic rationality' (Kraaijenbrink *et al.*, 2010; Heritier and Prakash, 2014). Kraaijenbrink *et al.* (2010) go further to say that: 'The RBV's core metaphor stands on the heterogeneity and immobility of competitive capability-producing and rent-earning resources. Firms are seen as entities aiming to gain above-normal profits in unmediated competition with other firms in a shared market. The resource-based view assumes firms are profit-maximising entities directed by bounded rational managers operating in distinctive markets that are, to a reasonable extent, predictable and moving toward equilibrium (Leiblein, 2003; Bromiley and Papenhausen, 2003). Fundamental to the resource-based view theory (Barney, 1992) are the concepts of competitive advantage and resources.

The term *competitive advantage* refers to the ability – through attributes and resources – to perform at a higher level than others in an industry or market (Porter, 1980; Christensen and Fahey, 1984; Kay, 1994). A firm is said to have a competitive advantage when it is implementing a value creation strategy – for example, using mobile phone technology to undertake an activity which competitors in the same business cannot do (Barney, 1992; Asamoah *et al.*, 2020). Competitive advantage is the leverage a business has over its competitors. This is gained by offering clients better quality services using the resources available.

Resources refer to activities that help accomplish an outcome. This could be a product or service that a business has, which can be drawn upon when needed. Resources are business assets that determine the firm's capabilities and competences and are embodied in the theory of the resource-based view by Barney (1992). In situations where an organisation has resources but lacks the skills to implement their use, those resources could be said to be redundant.

Skills could also be resources, and can be acquired through deliberate, systematic and sustained effort while carrying out complex activities. This implies that skills can be learned. Agbim and Eluka (2018) indicated that skills can be acquired through experience obtained while undertaking an activity. For businesses using mobile phones to facilitate business processes, skills and confidence increase as the device is used regularly.

Resources are also discussed from the perspective of their characteristics, which are tangible and intangible. Tangible resources include land, factories and the mobile phone. Intangible resources refer to anything without physical assets and include branding, reputation, software and platforms, all of which contribute to usage. Johnson *et al.* (2008) in exploring corporate strategy also indicated that resources, whether tangible or intangible, could be the organisation's strength. Resources are heterogeneous – that is to say, they differ from one company to another. The mobile phone is used for different purposes and is used differently by different small business owners. To offer three different examples: in Niger, it takes between 2 and 4 hours to undertake a 105-km (65-mile) round trip in search of information on prices, demand and other market-related statistics; however, with a mobile phone, it takes only two minutes to make a call to take or modify orders, or discuss prices, helping to save time and money (Aker, 2008; Mushi, 2020).

In Nigeria, small business owners have been found to use the mobile phone to build relationships with clients through regular calls and discussions on the business. And in Ghana, farmers use the mobile phone to check prices of agricultural products via Esoko, the agricultural profiling and messaging service (Esoko, 2015). In achieving competitive advantage, an organisation's resources should be difficult to move between companies (Porter, 1980). In context, how the mobile phone is used by an organisation or by an individual could provide competitive advantage based on how they use it. For example, a fishing business in Ghana (Agyapong, 2010; Atiso *et al.*, 2021) will use the mobile phone to check weather conditions, check prices of premix fuel and contact major suppliers, whereas a small business owner operating a traditional health and herbalist centre, for example, would use the mobile phone to check the quality and authenticity of the products received, and provide a diagnosis when the relevant software is available on the phone.

2.4.1 Acquiring Competences and Capabilities

The term *capability* means the power to do something, while *competence* means not just having the ability to undertake an activity but doing it efficiently (Mardikaningsih *et al.*, 2022; Ruben, 2019). Capabilities, according to Sawers *et al.* (2008) and Medio *et al.* (2020) are theoretically grounded in the resource-based view of organisations. Capabilities are either internal or external. Eisenhardt and Martin (2000) discuss internal dynamic capabilities as processes that use resources specifically to facilitate and integrate organisational activities. This is supported by Grant (1991), whose description of internal capabilities includes staff, whereas external capabilities include non-executive directors and the government. Eisenhardt and Martin (2000) posits further that a firm's capabilities and competences evolve as the business environment changes. Sawers *et al.* (2008) go further to say that to achieve a competitive advantage based on resources, firms must have the capabilities to integrate, build, and configure internal and external competences (Kruesi *et al.*, 2022; Hussain *et al.*, 2022).

This is further supported by Eisenhardt and Martin (2000), who also see dynamic capabilities as processes that use resources, specifically the process to integrate activities. An agribusiness that plants vegetables, for example, uses the mobile phone to facilitate business activities by coordinating meetings with suppliers, rescheduling staff, planning and checking prices. In doing so, the farmers acquire knowledge and experience. This helps provide a better way of doing these activities with the support of the technology, thereby enhancing their capabilities and their competences. This, in the longer term, gives them competitive advantage, as far as their business activities are concerned, over other farmers who do not achieve this (Adeniran and Johnston, 2012; Obeng *et al.*, 2014; Anadozie *et al.*, 2021). As indicated earlier, the knowledge required comes from ideas, values, insights and understandings as well as in the interpretation of data. Knowledge can be explicit or tacit.

Explicit knowledge is obtained from records or from technological devices including the use of mobile phones which can be accessible by all, as and when needed. Tacit knowledge is held within the individual and can be difficult to transfer to another person (Zain *et al.*, 2005; Anadozie *et al.*, 2021). Developing knowledge, as well as building it, involves experience, which has a psychological aspect and influences reactions towards the use of a particular product. This is supported by Davenport and Prusak (1998), who suggest that knowledge is simply a fluid mixture of experience embedded in the minds of people (see also Rootman and Krüger, 2020).

However, there may also be external factors that encourage businesses to build on knowledge through experience, from products or services acquired. For example, external factors like poor infrastructure and lack of landline telecommunication services encourage businesses in rural areas to acquire mobile phones. Knowledge and experience are acquired in the usage process, though business owners might not have used the technology before. The mobile phone is used to connect customers and to provide sales and supplier advice. For example, when customers in towns and cities want to know when products such as maize will be supplied, and at what price, they contact the farmers using their mobile phones (Alhassan and Kwakwa, 2012; Issahaku *et al.*, 2018; Folitse, 2018). In terms of paying workers, checking weather conditions and ordering seedlings, the mobile phone is the technology used because there is no alternative means of communication to facilitate these business activities.

And as noted previously, mobile phone technology also helps to reduce costs. Activities that would once have required rural business people to travel to cities are now done using mobile phone technology (Ofosu-Asare, 2011; Sey, 2011; Abdul-Rahaman, 2020; Parlasca, 2021). Referring to the benefits discussed above, the issue that arises is how users, especially those in rural Africa and Ghana learn to use the technology and how this helps to achieve competitive advantage? This is discussed in section 2.5 below.

2.5 Learning to Use Mobile Phone Technology

Gauvain (2020) posits that learning and development (L&D) is a systematic process that enhances an employee's skills, knowledge, and competency, resulting in better performance in a work setting. The goal of Learning and Development (L&D) is to align an employee's goals and performance with that of the organisation. In the setting of a small business, L&D is centred on the owner and the staff. Unlike a well-established organisation, where L&D is managed by the human resource department, the owner of a small business identifies the skills gap of the employees and encourages them to learn. From a resource-based perspective, L&D and knowledge are among the capabilities that businesses seek to acquire to establish themselves to compete. Barney *et al.* (2001) take a resource-based view and posit that for a firm to achieve sustainable competitive advantage, they must continuously and consistently develop and make use of the existing resources to develop new products and services. Addressing these issues calls for the need to review learning theories to understand how rural farmers learn to use the mobile phone technology as a resource, and how the capabilities acquired give the farmers competitive advantage.

Learning categories

The Greek philosopher Plato once asked how an individual learns a subject if it is new to them. Since Plato's days, many theories have emerged, all with different takes on how learning takes place (Ertmer and Newby, 1993; Richmond and Cummings, 2005; Ausubel, 2012). Learning theories are sets of principles that explain how learners can acquire, retain and recall new information (Chuang, 2021). They can be classified under categories: behaviourism, cognitivism and constructivism (Schunk, 2012; Idkhan and Idris, 2021). In addition, there are other learning theories, including social learning theory, Bandura (2018), Kolb's (2014) experiential learning (ExL) theory, and the double loop learning theory (Clark, 2018, 2021).

Behaviourism involves repeated actions, verbal reinforcement and incentives to take part. This theory emerged from the work of Skinner in 2019 in a study on behaviour and learning. It is helpful for establishing rules especially in managing behaviour. Behaviourism assumes that the learner's mind is a blank state and should be provided with information. In the process of making use of this information, new associations are made and thus learning takes place (Schunk, 2012; Idkhan and Idris, 2021). Cognitive theories can be traced back to the 1900s in Germany from Gestalt psychology (Schunk, 2012).

In contrast to behaviourism, cognitivism focuses on the idea that learner's process information they receive just after responding to an action (Schunk, 2012; Sudria *et al.*, 2018). Though there is still a behaviour change, cognitivism is in response to thinking and processing information. With cognitivism, learning occurs when learners recognise information through new explanations or by adapting to the old ones. The knowledge acquired through cognitivism is stored in the learner's memory.

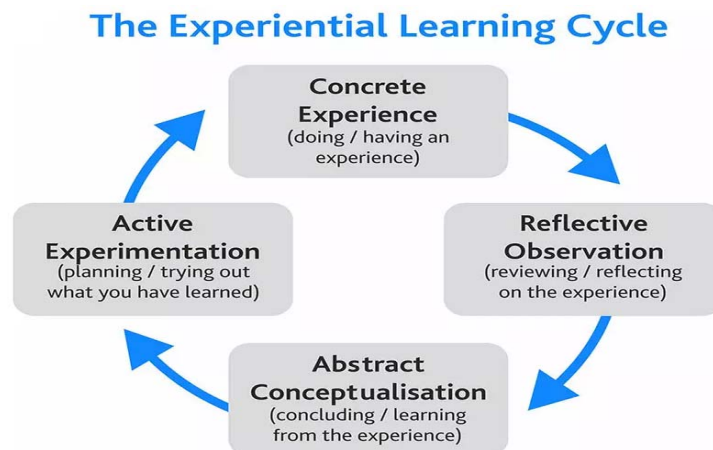
Constructivism, which emerged from the 1970s and the 1980s as a learning theory, indicates that learners are not passive recipients of information but achieve their knowledge through interaction with the environment (Bada and Olusegun, 2015). As they interact with the environment, they reorganise their mental structures. Learners are therefore viewed as sense makers, not simply recording information but interpreting it. This view of learning led to a paradigm shift of knowledge acquisition to knowledge construction (Charmaz, 2021). The growing evidence in support of the constructive nature of learning was also in line with, and backed by, the earlier work of influential theories such as Jean Piaget and Jerome Brunner (Grazzani and Brockmeier, 2019). There may be different versions of constructivism, but what is common among all the versions is the learner-centred approach whereby transmission of knowledge is centred on the learner. Bandura (1977), who worked with both cognitive and behavioural frameworks, developed the social learning theory. Bandura's (1977) theory suggests that learners learn within a social context and that learning is facilitated through the concepts such as modelling, observational learning and imitation (Sudria *et al.*, 2018; Chuang, 2021).

Bandura (1977) put forward 'reciprocal determinism', which holds the view that a person's behaviour, environment and personal qualities all reciprocally influence others. Bandura (1977) goes further to say that children learn from observing others as well as from a model, which are processes involving attention, retention, reproduction and motivation. Wang (2021) posits that the importance of positive role modelling on learning has been well documented. Ku *et al.* (2021) argue that the theory assumes that changes in the environment will automatically lead to changes in the learner. They further indicate that the theory is loosely organised and based solely on the interplay between the learner's behaviour and the environment.

2.5.1 Kolb's (2014) Learning Theory

Kolb's (2014) Experiential Learning Cycle (ExL) is the process through which learning is gained by undertaking an activity. Kolb (2014) focuses on learning by concrete experience, reflective observation, abstract conceptualisation and experimentation. This is shown in the diagram below:

Figure 2.2 Kolb's (2014) Experiential Learning Cycle



Source: Kolb (2014)

Concrete experience: Experiential learning cycle (ExL) starts with concrete experience. This learning method is concerned with more concrete issues related to the learner and the learning context. Examples of learning by doing include reading, completing a job, volunteering or even working in the office (Richmond and Cummings, 2005; Morris, 2020;

Idkhan and Idris, 2021). As the learner connects with the object of learning such as books or the mobile phone, experience is gained through the connectedness and, by this process, knowledge is acquired which helps in using the object better.

Reflective observation means reflecting on experiences gained in an action setting. The experience acquired – which includes using the mobile phone – could affect the way that the small business owner adopts the technology and appropriates benefits from it. Learners of a particular activity improve their knowledge and skills as they reflect on their experiences. Mansourian and Vallauri (2020) posited that in situations where mistakes were made in the learning process, but were overcome in the process, learners could reflect on how that problem was solved: in the process of looking back, learning takes place. Mansourian and Vallauri (2020) goes further to say that the main purpose of reflective learning is to generate new knowledge and skills for the future through experience.

This was supported by Gibbs (1998), who dwelled on the experience aspect of learning. Gibbs (1998) suggested that reflection is cyclical and lends itself particularly well to repeated experiences, allowing learners to plan from things that went well or did not go well. This is the process of making sense of what is happening. It involves interpreting events and understanding the relationship between them. Plotnikov (2019) indicated that at this stage, learners make comparisons between what they have done. In using mobile phone technology, for example, users might try to understand what the technology can do, apart from making calls. Some farmers may try to learn this themselves or seek advice from fellow users willing to help them (Lehane, 2020). At this point, users form new ideas about the technology and/or explore alternative uses as part of the learning process. Users who explore further get the chance to see whether the acquired ideas have practical value. These new developments are therefore likely to alter the way the user thinks about the technology. With active experimentation, the learner plans and tests a particular theory or an activity. For example, users of mobile phones may attempt to send messages and try to load credit onto the phone.

By experimentation, the learner interacts with the object, for an expected experience (Grady, 2017; Sudria *et al.*, 2018). Some users of mobile phones may attempt to receive calls, store numbers, create a diary or download applications. Successfully doing this for the first time increases confidence and accelerates the learning process (Caizzi *et al.*, 2018).

With abstract conceptualisation, learners think of experience as an abstract concept where learners form their ideas, opinions or concepts based on how they see learning. It is a process that follows a logical way of learning based on reflections on the current ideas they have. In terms of technology usage, abstract conceptualisation learners may logically follow the instructions and processes associated with the learning. They will then develop their ideas and approaches to doing things with the technology based on the existing knowledge they have acquired (Plotnikov et al, 2019).

Despite how influential Kolb's (2014) model has been in learning, there have been some criticisms. Notable is the graphical design of the model itself. Harald and Gordon (2010) posited that model aid scientific understanding and progress, as well as helping to develop theories. However, Kolb's (2014) model reveals fundamental errors of syntax and therefore fails to meet the modellers' sufficiency in relation to learning activities. On concrete experience, for example, Engeström (1999) critiques that Kolb's (2014) discourse on learning through experience needs more clarity and should acknowledge the importance of practice as part of experience. Engeström (1999) discusses this under the activity theory (AT).

Broadly explained, activity theory (AT) (Engeström, 1999) is a philosophical framework that is used to study forms of human experience, practice and learning. The theory also examines how individual social processes influence learning (Illeris, 2018). There are two fundamental principles on which AT was established. These are understanding the unity connecting human minds (consciousness) and what people do (activity) (Engeström, 1999). AT thrives on the ideas of Vygotsky (1978) on mediation, based on the premise that humans are not passive but operate within a social environment in line with Banduras' (2018) theory of social learning. This means learners engage with the symbols and artefacts and make meaning from them. Hakkarainen (2004) critiqued Vygotsky's (1978) ideas on mediation, indicating that focusing on mediation at the individual level limits the concept. The word *mediation*, from the perspective of Hakkarainen (2004), became socially mediated based on the idea that consciousness and learning take place in communal activities (Karanasios, 2015; Pettersson, 2021). Likewise, with the use of mobile phone technology users learn through experience of using the technology.

As part of learning through experience and practice, users get support from stakeholders – for example, the community and network customer service representatives (Kamwesiga *et al.*, 2017). This was supported by Hakkarainen's (2004) theory on learning through community activities. However, Hardman (2015) critiqued Hakkarainen's view, indicating that learning with community support when it comes with using technology defeats the experience purpose of Kolb's (2014) theory because it is the community the support the learner with little involvement of the learner through practice. This led to an updating of the theory, which considers that motivation is fundamental when it comes to learning through practice in using technology (Kuutti, 1996; Pettersson, 2021) – which could include mobile phones.

Kutti suggested that in learning through practice, based on AT, motivation is fundamental but depends on: the subject (adoption) – for example, why users want to adopt the technology; the object (the mobile phone technology); the community – the environment of the user; the rules – the laws and regulations supporting the use of the technology; and instruments – the technological and telecommunication infrastructure that supports use of the technology. Once all these factors work well together, learning by practice in using a particular technology becomes easier (Lee *et al.*, 2021). Kolb's (2014) model is described as eclectic.

Also, the phases of the learning cycle need coherence as suggested by (Miettinen, 2000; Sundria *et al.*, 2018). Miettinen's (2000) view was supported by Seaman *et al.* (2017) who indicated that Kolb's (2014) model in its current form is a barrier to a clearer understanding of the experiential model and a successful facilitation of experiential learning.

As part of the review of the learning theories, Jaaron *et al.* (2021) posited that in some situations, learners should be taught to think deeply about their situations and how solutions can be developed from within the existing problem. This is what Argyris (2004) called double loop learning, adding that this type of learning is useful for organisational learning because it drives creativity and innovation. Considering the usefulness of the learning methods and categories, Kolawole *et al.* (2021) suggest that every learner's approach to learning is different. Further, not all learners are motivated to think outside the box and be creative in the jobs they do.

For example, if learners are within a particular environment for the purpose of satisfying their 'physiological' needs, then using a double loop approach may not benefit this type of learners. Secondly experiential learning has some limitations. Thus it may result in false conclusions and may not help learners to understand changes in new experiences (Kempen, and Kruger, 2019, Kolawole *et al.*, 2021). However, Kolb's (2014) theory have been selected for this study because it encompasses most of the learning theories and sums up the main methods of learners. Secondly Kolb's (2014) theory seemed appropriate considering the farming group being explored for the study. Next in the discourse is on the acquisition of skills and knowledge acquired through learning.

2.6 Skills and Knowledge acquisition

Rao (2010) posited that skills are learned abilities and can be divided into *domain general* or *domain specific*, also supported by Gilmore and Cragg, (2018) and Oluwalola, (2020). Domain general skills are used to solve problems in any given area. They are normally based around skills acquired from solving previous related problems. For example, using mobile phones can help solve problems of transportation regarding delivery times. Acquiring customer data and access to it allow farmers to plan delivery and supply of farm produce to these customers. This also includes skills learned from problems they have had before in relation to using similar, related technology (Gilmore and Cragg, 2018).

Other examples of domain general skills are problem-solving, persistence, patience, resilience, courage and creativity (Grieff *et al.*, 2014; Oluwalola, 2020). For domain specific skills acquired during learning, Saka and Chan (2020) posited that the individual's cognition (mental action) is fundamental to helping to acquire specific skills including problem-solving and planning. Ruiz *et al.* (2020) contributed to the discourse indicating the importance of cognitive domain as fundamental to supporting skills improvement. With cognitive knowledge, users are able to engage with the technology through information exchange and interpretation. Despite the clarity of the theoretical underpinnings in relation to skills acquisition, little is provided by these concepts on whether sociocultural and educational factors play a role in influencing these skills and knowledge acquired when it comes to learning to use mobile phone technology and related platforms.

Technology not only offers new ways of learning and acquiring knowledge but also offers new ways for learners to do things using those technological devices (Layton, 1974). Also, the character of technological knowledge is defined by its use and efficiency (McGinn, 1978; Perrin, 1990; Parayil, 1991). Knowledge here is a strategic asset for business. It is the sum of skills, experiences, capabilities and expert insight, which has been collectively acquired by individuals and could be used for either personal or business support. For business organisations, knowledge is a shared resource that shapes and affects the business. Knowledge brings information and learning together and plays an important role in organisations, be they large or small. Krathwohl (2002) and Oloruntoyin (2020) posited that knowledge can be categorised into four types: factual, conceptual, procedural and metacognitive.

Factual knowledge is information that is learned through exposure, repetition and commitment to memory (Vukić *et al.*, 2020), or from referring online or to books, or even asking someone who already knows. In the context of acquiring knowledge from the use of mobile phone technology, information comes from the manuals that come with the phone, the network company's website, and the company's sales and customer service representatives.

Related to factual knowledge, *conceptual knowledge* can be understood as knowing the interrelationships and functions of the details and elements that make up a larger structure (Rahman *et al.*, 2020). This could be related to knowing information about principles and generalisations. It could also be about theories and models. Conceptual knowledge is about knowing the facts that can be organised in a meaningful way (Binney and Ramsey, 2020). The question for the current research is how this knowledge influences small business activities and the procedures involved in acquiring this type of knowledge through learning. Willingham *et al.* (1989) posited that *procedural knowledge* is critical for the success of goal attainment because it puts 'what' actions through 'how' processes. An example is loading credit or airtime to a mobile phone: when being taught, this may be easy, but until the learner practises, they will not grasp the process. Procedural knowledge can be understood as subject-specific knowledge of techniques or methods for deciding when the right procedures must be used (Banks and McCormick, 2005).

Gaining procedural knowledge is about practice and following the right procedures. In the use of mobile phone technology, continuity and constant practice enable users to gain the knowledge required. Once factual knowledge is gained (from books and other sources), it must be put into practice (Serbin *et al.*, 2020). To put it another way, once a learner knows cognitively how to use mobile phone technology for specific activities – for example, sending an SMS or recording a voice note – this knowledge has to be put into practice.

As for *metacognitive knowledge*, Simons *et al.* (2020) argued that this can be understood firstly as strategic knowledge – that is, knowledge acquired which allows a clear goal and purpose to be formulated for an activity. In the context of using mobile phone technology, it could be the formulation of policies by the telephony companies like MTN and Vodafone in Ghana to protect users against cybercrime. Metacognitive knowledge can also be understood as knowledge about cognitive tasks. This is where knowledge is acquired by processing new information mentally. Learners sometimes try to recall the information they have processed to see if they can retrieve the information from memory (Vukić *et al.*, 2020). Users of a new technology, after reading information about it, store the information in their mind and try to recall while attempting to use said technology. When users of mobile phones acquire a new handset, they read the manual and use the information it provides to set up the handset before use (Al-Emran and Teo, 2020; Mayanto *et al.*, 2020; Wolfe and Flewitt, 2010).

Metacognitive knowledge can also be understood as self-knowledge. Metacognitive knowledge helps learners develop contextual clues based on information around them and what they can recall from memory (Bannert, 2009; Al-Emran and Teo, 2020). This allows learners to develop their own personal ways of managing situations. Likewise, in the use of mobile phone technology, learners develop shortcuts which, in effect, enrich their knowledge and increase their capabilities. Although learners acquire knowledge – be it factual, conceptual, procedural or metacognitive – and apply it to their activities, there appears to be little information in the literature on the type of knowledge that users of mobile phone technology – especially small businesses – acquire, and how they integrate this into their business activities, and how the knowledge acquired impacts on the competences of these businesses. Next in the discussion in 2.7 below is how mobile phone platforms as part of the technology ecosystems influence the way users of the technology learn.

2.7 Chapter summary and gaps identified

This chapter discusses the mobile phone technology adoption in developing economies, within the broader content of information communication technology (ICT) and information communication technology for development (ICT4D). The chapter provided insights into the origins of ICT, and the investments that have to go into ICT to provide a platform and ecosystem for the mobile phone technology to work in Africa. Notwithstanding the investment's complexities, ICT4D seemed to have promoted the benefit that technology provides for developing economies like Ghana, highlighting the importance of mobile phone technology.

The chapter provided insights on the benefit associated with information communication technology, highlighting the ease of appropriation and its use as a resource and the learning associated with the technology. In attempting to explore further and deeper adoption of mobile phone technology by users in rural Africa, including Ghana, the review further draws on the theories of the Resource Based View (Barney, 1992) and Kolb's (2014) Experiential Learning Cycle. Though these theories have been reviewed in the extant literature, not much was found on first, how the resource-based view of the firm helps to frame an understanding of mobile phone technology use by farmers in rural areas in Ghana, and second, how Kolb's (2014) experiential learning provides understanding of the adoption and usage of mobile phone technology in rural Ghana. In line with the findings of the pilot study, Chapter 3 reviews how using the mobile phone technology influences user behaviour under the theoretical lenses of the Technology Acceptance Model (Davis, 1989) and the Boundary Object theory (Star and Griesemer, 1989).

CHAPTER 3 – LITERATURE REVIEW (2)

HOW MOBILE PHONE TECHNOLOGY ADOPTION INFLUENCES USER BEHAVIOUR

3.0 Introduction

Following on the discourse in Chapter 2 on mobile phone technology as a resource and how learning is gained through the technology, this chapter provides insights on how the adoption of mobile phone technology influences user behaviour. There has been increasing use of mobile phone technology in Africa due to inadequate telecommunication infrastructural facilities. The level of dependence on the technology is higher in the rural parts of Africa due to topographical problems and bad road networks. Thus, the continuous usage of the technology is likely to affect user intentions in terms of behaviour and attitudes towards its use. This chapter provides insights on factors that influence the behavioural intentions of the users in rural Africa and Ghana with reference to the Technology Acceptance Model by Davis (1989) and the Boundary Object Theory by Star and Griesemer (1989). The review of the literature on these two theories was necessitated by the findings of the pilot study which indicated that farmers adoption of mobile phone technology and the domestication of the technology could be explained better using the above two theories.

3.1 Mobile Phone Adoption and Technology Acceptance Model

The mobile phone technology is both good and bad, but mostly good because the user, be it an individual or a business, decides how to use it, and what to use it for (Komen, 2014).

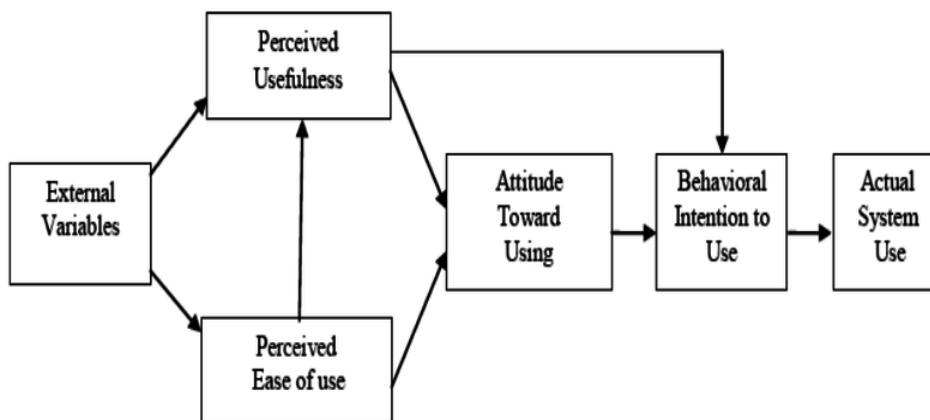
Komen's (2014) position above romanticises mobile technology as something that can influence businesses, but at the same time indicates that it can be manipulated or used negatively. Over-reliance can reduce face-to-face contact with stakeholders. In analysing the adoption of the technology and its success, it is imperative that the user's behaviour and attitude are understood in relation to the decisions they make (Chen *et al.*, 2014). The dimensions of human behaviour are *bounded rationality* and *opportunism*, according to Cheng *et al.* (2018). *Bounded rationality* describes the way humans makes decisions that departs from perfect economic rationality. This is because person's rationality is limited by their thinking capacity, available information to them and the time impacting on the choice they make.

On the other hand, *opportunism* is a practice whereby people take advantage of circumstances and situations. With opportunism, people take advantage of gains at the least cost (Peng, 2021). This could also apply to the use of the mobile phone technology. The limitations and complexities associated with applying for landline facilities in the rural areas of the developing economies impact on the user's access. This makes the mobile phone technology and its related platforms the preferred alternative technology, as might be expected by reference to the Technology Acceptance Model (TAM) (Davis *et al.*, 1989; Motamedi *et al.*, 2021).

Technology Acceptance Model

The Technology acceptance model theory by Davis (1989) posits that the speed and nature of the adoption of a technology depends on its perceived usefulness (PU) and the perceived ease of use (PEOU) (Davis *et al.*, 1989). The theory also goes further to explain other factors that determine the acceptance of technology. Notable among them is attitude, which is based on a user's trust in the technology and influences their attitude and behaviour (Ajzen, 2012). Agarwal and Prasad (1999) also found that user attitudes and intentions were fully mediated by PU and PEOU. The theory as shown in the diagram below is further discussed.

Figure 3.1 The Technology Acceptance Model (Davis, 1989)



The TAM indicates five important factors in relation to mobile phone and platform technology adoption and acceptance. These are: external variables, perceived usefulness, perceived ease of use, attitude toward using, and behavioural intention to use. Determinants of the TAM are seen in the framework above and explained further below.

External Variables

The TAM framework also indicates that external variables influence the perceived ease of use (PEOU) and perceived usefulness (PU) of mobile technology and related platforms (Al-Gahtani *et al.*, 2007). This was further confirmed in a research study conducted by Scherer *et al.* (2019) on the role of external variables in the TAM and indicated a positive relationship with the PEOU. However, Legris *et al.* (2003), in a review of 22 articles in 6 journals on the external variables of the TAM, found that only 60% of them talk about PEOU. What is more, there was no clear pattern with respect to the choice of the external variables considered, even though these are important drivers of decisions of whether to adopt a particular technology. The framework further assumes that the external variables only predict usage through PEOU and PU for mobile phone technology users. While this assumption has been tested and found to predict usage, the question that was not answered was whether PEOU and PU further mediate the external variables on usage (Ajibade, 2018).

Perceived Usefulness (PU)

On perceived usefulness, users are likely to accept technology if they perceive that it will benefit them. Ogara *et al.* (2014) indicated that users of mobile phones in Africa are likely to accept the use of mobile phone technology due to the lack of telecommunications infrastructure for landline facilities. Therefore, a product or a service classified as enabling communication will be accepted, and lead to a positive user relationship (Yang, 2005) — hence its success in Ghana. However, Clements and Boyle (2018) indicated that the perception of usefulness is a more robust predictor when it comes to reusing the same technology for repeated business activities.

Perceived Ease of Use (PEOU)

How easy a technology is to use is an important factor that can influence the way it is adopted (Lee and Coughlin, 2015). Liébana-Cabanillas *et al.* (2018) and Motamedi *et al.* (2021) indicated that to design and implement an easy-to-use application, the characteristics of the system and the interface need to be understood. In addition, the perspectives of the users and their needs should be taken into consideration, not forgetting the attention to navigation, display, size and login issues (Amberg *et al.*, 2004). With this guidance, developers have designed applications that successfully ensure that the technology is easy to use.

Attitude toward Using

Lah *et al.* (2020) and Ajibade (2018) posited that having access to a particular technology and being able to acquire it does not influence its use or adoption but rather stressed on the importance of the user's attitude. (Motamedi *et al.*, 2021). If the attitude is more positive about the technology, the actual usage will be higher. It is important to note that there may be several factors that shape attitudes toward the use of a particular technology, in the case of the mobile phone (Ogara *et al.*, 2014). For the users of mobile phone technology in Africa, influences from peers, family and the community are said to be factors that influenced the users' attitude.

Secondly external forces like transportation and telecommunication problems could shape users' attitude in a positive way because there are no alternatives to the use of the mobile phone technology due to lack of supporting infrastructure to facilitate land line usage. The attitudinal influence, be it positive or negative could also influence the behavioural intention to use the technology.

Behavioural Intention to Use

Behavioural intention to use a particular technology is a predictor of the user's behaviour to use it (Clements and Boyle, 2018; Ajzen, 2012). Intention to use a particular technology has a close link to the actual behaviour. It is a factor that shows the user's willingness to perform an action or a behaviour (Ajzen, 2019). According to Liébana-Cabanillas *et al.* (2018), finding out about a user's intention is about asking on the actual usage. The use of the word *intention* makes it easier to find out the user's intention indirectly. This is something the user may not have been comfortable with, especially if by they do not have the knowledge, or does not know how to use a particular technology. For users of mobile phone technology in Africa, finding out about their intention to use the technology is clearly asking about how they use the technology. Davis (1989) further posited that behavioural intention is influenced by perceived ease of use and perceived usefulness, and these factors results in the actual system or technology use.

Actual System Use

User acceptance is a critical factor that influences technology usage, and mobile phone technology is no exception. User acceptance does impact on the reason that mobile phones are used by small businesses. Developed by Venkatesh *et al.* (2003), the Unified Theory of Acceptance Use of Technology (UTAUT) is underpinned by key constructs. These are performance expectancy, effort expectancy, social influence and facilitating conditions.

The theory applies to the acceptance of technology by either an individual or a business (Alfadda and Mahdi, 2021). A particular technology must exhibit the characteristics outlined in the previous paragraph to influence intentions to accept or use it. Performance expectancy takes into consideration the degree of benefit associated with a particular technology. Benefits associated with the technology also influence adoption (Asongu and Boateng, 2018). When a particular technology is available and is innovative, a small business or an individual will look for information about how it would benefit them, a key factor in the diffusion process (Rogers, 1995). For businesses in Africa, including Ghana, issues of improved communication, transportation cost savings (enabled by using a phone to avoid a journey), and bringing customers together are some of the benefits that have contributed to the acceptance of mobile phones.

For the adoption of mobile technology usage, reasons for adoption may include social factors in a broader model (Orlikowski and Hofman, 1997). Venkatesh *et al.* (2012) investigated how a particular technology is accepted and noted that families and friends are taken into consideration. The experience of a family member with a particular technology may influence decisions by other members of the family to accept that technology. This observation seems to connect well with the African user's attitude towards technology, explaining why the technology is a success in terms of its adoption. For mobile phones, family influence is an important aspect when it comes to the selection of brands (Pew Research Centre, 2015; Atlas *et al.*, 2020). Obviously, Technology Acceptance Model (TAM) is one of the most used information systems frameworks (Bagozzi, 2007). The strength of the TAM as a framework is the intention to use technology to influence behaviour with reference to perceived usefulness and ease of use. Despite its usefulness, the TAM has drawn many criticisms from scholars.

Though the TAM has been widely used in information systems studies, it is not reasonable, according to the literature, that a framework like the TAM is the only model to explain behaviour across a wide range of technologies, including different reasons for adoption, different situations, and differences in decision-making. Arguably, the TAM has seemingly seduced researchers into overlooking the fallacy of simplicity. That is, in favouring a simple model, researchers have overlooked the essential determinants of decisions and actions and have therefore ignored the limitations of the TAM. Some researchers have suggested that the TAM is relatively speculative regarding PEOU (Dahlberg *et al.*, 2015; Tarhini *et al.*, 2017) and should therefore be used with caution. In an information society, end users take advantage of technology and will use it to their advantage if it is the best alternative to help improve their lives and businesses. This has implications for the TAM because it means that the usage of mobile phone technology is less dependent on the behaviour of individuals (Hwang *et al.*, 2016). Rather, it suggests that a new technology is likely to be adopted and used following its introduction. This becomes obvious if the users do not have alternative communication mechanisms to facilitate their business activities other than the introduced technology. This is exactly the case for mobile phone technology in Africa. Adoption at this point does not reflect the TAM, which relies on PEOU and PU (Vahdat *et al.*, 2021; Barnett *et al.*, 2015).

Furthermore, Legris *et al.* (2003) indicated that the TAM views information systems as an independent issue in organisational dynamics. In situations where a research study involves the subject of innovation, Legris *et al.* (2013) again suggested that organisational implementation also takes into consideration organisational dynamics (Orlikowski and Barley, 2001). Legris *et al.* (2013) further discuss that the TAM does not measure the usage of the technological systems including mobile technology; what it does is to measure the variance in self-reported use, making it an inaccurate measurement of a technology's ease of use. Particularly so because the issue of behaviour of users is evaluated through subjective means such as behavioural intentions (BI) and interpersonal influence (Renaud *et al.*, 2008). Interpersonal influence such as *subjective norm* is what happens when a person is influenced by the word of mouth.

For example, potential buyers of mobile phone in rural Ghana are likely to be influenced by friends and colleagues who have used the same technology and can recommend it because of the benefits associated with it. Not only that, experts or salespeople could also influence

buyer behaviour. Furthermore, behaviour cannot be quantified taking into consideration some factors which are subjective such as norms, values and social perceptions, as well as personality traits and the educational background. Hence the argument about the influence on behaviour as a key factor in influencing technology adoption as fundamental to TAMs is relative (Ramayah *et al.*, 2015 Shan and King, 2015).

Additionally, the theory makes mention of external variables as fundamental to technology adoption but does not clearly indicate what those external variables are, and in which environment – be it the Western world or the developing world. The external variables influencing adopters in the Western world, where the theory seemed to have been widely popular because of the advancement and the usage of technology, is different from a developing economy environment.

Benbasat and Barki (2007) argue further that TAM has outlived its purpose because the factors or the reasons for adoption of a particular technology can never be the same as they were when the theory was developed years ago. As technology transcends across borders, with the mobile phone and the internet being one of the most usable technologies, the reasons of adoption may not always be the PEOU and PU. Whether the user is an individual or a business – will determine the factors that would influence the adoption, which will in turn influence the behaviour of the adopter. Thus the theory seems to provide little or no information on (AlQudah, 2021; Chuttur; 2009). In spite of the aforementioned limitations influencing behaviour, which is central to the TAM, the question that needs asking is: Are there other factors influencing behaviour through mobile phone technology adoption, especially in rural Ghana. Next in the discussion is the Mobile phone as a boundary object and how that influences behaviour (Star and Griesemer, 1989).

3.2 Mobile Phone Technology as a Boundary Object

Chang and Kuo (2021) posited that a boundary is any object that is part of multiple social worlds and facilitates communication between them. In the numerous social worlds that it inhabits, it has different identities. This makes a boundary object simultaneously concrete, fluid and well defined. Wenger-Trayner *et al.* (2019) highlight that the term boundary object was coined by Star and Griesemer (1989) to describe how zoological specimens serve as a reference point in coordinating the perspectives of the scientists who analysed them and the

amateurs who collected them from the wild. This was affirmed by Fischer *et al.* (2007) and Dar (2018) who noted that boundary objects allow different groups to work together with actual use worked out via user cooperation. Star and Griesemer (1989) went further to add that boundary objects are highly portable and can be understood by members of different social worlds. They are sufficiently plastic to adapt to changing user needs. The boundary object is not imposed by one community or stakeholder but appeals positively to different stakeholders based on its expected use. This theory is important because it gives users knowledge and control over the object as they adapt it to suit their circumstances. Secondly, boundary objects are said to allow localisation of the object. Nimrod and Edan (2021) also indicated that boundary objects allow coordination without consensus because they can allow the users local understanding of the object to be reframed in the context of the wider collective activity. This influences the behaviour of the users, allowing them to do different activities through the skills and capabilities they acquire (Star and Griesemer, 1989; Chang and Kuo, 2021, Cattaneo *et al.*, 2021).

Boundary object in the world of technology and sociology could be termed as information such as maps, field notes and specimens. These are used in different ways and by different communities for collaborative work (Cattaneo *et al.*, 2021). Boundary objects could be objects that enhance capacities and facilitate usage of certain technological objects and help disseminate information across boundaries – for example, between communities of knowledge and practice. The object (mobile phone technology) performs a brokering role involving translations, coordination, communication and other activities, based on how users want to use it. Hence, mobile phone technology is a boundary object that can be used to address multiple issues.

The technology can be adjusted as needed to suit different situations (Fischer and Ostwald, 2005; Aprea and Cattaneo, 2019; Reyes, 2020). The boundary object allows different groups to work together, and the actual use is worked out through the cooperation of their users (Fischer *et al.*, 2007). The technology remains the same but the way that it is used by different users is fundamental to the theory. Gajek's (2016) view on mobile phone technology as a boundary object is also supported by Carlisle (2002) and Haddon (2007). There have also been suggestions by Star and Griesemer (1989) and Carlisle (2002) for categorising boundary objects due to domestication characteristics. Star and Griesemer (1989) further argued that

successfully managing the technology as a boundary object could also strengthen the reasons for adoption because of three levels. These are the information processing level, the interpretive level, and the pragmatic level.

The information processing level is where the object is used to store, process and retrieve knowledge. Consistent with the literature on farming small businesses, mobile phone technology is used by business owners to store information or knowledge of customers and their families, such as names, contacts and other relevant information needed to build and maintain relationships (Gajek, 2016; Nimrod and Edan, 2021).

The interpretive level focuses on learning. The learner, after interpreting the information, then determines the way to use the object, considering the purpose for which it is needed. The pragmatic level, or upper level, is where actors with different interests access the knowledge acquired using the object for businesses. The actors that access the knowledge include communities, government, mobile telephony companies and non-governmental organisations (Reyes, 2020; Nimrod and Edan, 2022). Thus, these actors are said to domesticate the mobile phone technology to meet their interests, line with the views of Haddon 2007.

The domestication of technology theory is an approach that was first developed in the UK and originated, in part, from anthropology (Douglas and Isherwood, 1979; Uwamariya *et al.*, 2021) and from consumption studies (McCracken, 1990). Both these disciplines asked how goods and possessions enter our lives and what symbolic meaning they have (Bourdieu, 1986). Norwegian researchers (Sørensen, 1994; Lie and Sørensen, 1996) helped to develop the concept. Their work was concerned with why and how technology emerges in the form it does through behavioural changes.

Sørensen (2016) was also interested in understanding how technology shapes behaviour and lives as technology is consumed, hence the development of the domestication framework at the start of the 1990s (Nimrod and Edan, 2022). The framework that emerged considered the process of shaping the adoption and use of technologies.

In doing so, the researchers explored how and what technologies and services mean to people, how they experience technology and the roles that technology plays in their lives. The term *domestication* itself evoked a sense of ‘taming the wild’. Many domestication studies

indicate that households encountering technology including mobile phone technology, work out how it can be used to fit into their lives and their everyday routines – otherwise known as the micro level of domestication (Sørensen, 2005; Haddon, 2007; Uwamariya *et al.*, 2021). In attempting to work around the technology to fit their daily lives, users are said to ‘appropriate’ the technology by domesticating it (Bar *et al.*, 2016; Nimrod and Edan, 2022). Haddon (2017) and Uzuegbunam (2022) posited that user of the technology are said to be able to adapt the technology if they can suit it to what they need it for. Successful adaptation of the technology provides confidence and learning opportunities for the user, and in the process, it brings about changes in behaviour (Søraa *et al.*, 2021).

Berker *et al.* (2005) posited that the positive relationship between the domestication and the boundary object theory is what has supported the growth of mobile phone technology in developing economies including Ghana. This is because being able to adapt the technology makes it easier to do different things and be in two places at the same time. This is supported by Asongu *et al.* (2021) who indicated that mobile phone technology lets the user do banking and work at the same time. Studies on technology domestication (Nimrod *et al.*, 2022) show how technology is implemented and changes users, and how users change the technology in return. Thus, the technology is adapted in three dimensions: practical domestication, symbolic domestication and cognitive domestication. Practical domestication refers to the physical, observable interactions that users have with the technology. For an example, how a user buys a mobile phone and uses it, learning to use the buttons, pushing them, touching the screen and trying to do different things with it for different purposes (Susan, 2021).

The process of doing this and learning from it is what influences behaviour and makes the phone be seen as a boundary object because no matter the location, they can use it. Secondly, symbolic domestication is the unobserved consequences of adapting the technology. What that means is that the users have the mobile phone technology as part of their lives, cognitive domestication refers to how users learn from or through the mobile phone.

Star and Griesemer’s (1989) boundary object theory has contributed to academic studies including information systems, but the theory has its criticisms. Kimble *et al.* (2010) describe the boundary object in the empirical literature as too mechanistic and ignoring intergroup politics. Kimble *et al.* (2010) further argue that having access to the product or the service (mobile phone technology and platforms) does not make it a boundary object. But the object

needs to be seen in the context of the motivations of the users and what they use it for. Huvila (2014) also argues that the creation of the boundary object is always to some degree an expression of hegemony and, as such, it cannot be viewed as neutral. Huvila (2016) also indicates that although Boundary Object theory (Star and Griesemer, 1989) facilitates sharing of knowledge among different actors in different social worlds, it does not take into consideration internal and external factors that influence the actors as well as the object.

Likewise, in respect of the use of mobile phone technology and related platforms, the theory does not take into consideration any internal or external factors that influence the technology as an 'object'. Star and Griesemer (1989) describes the boundary object as plastic, being both abstract and concrete and thereby sounding physical and tangible. However, the theory provides little information on managing internal and external factors (personal and institutional) that facilitate the standardisation of the interface (object) – here defined in context as mobile phone technology. In addition, there is no information in the empirical literature on whether intangible objects like language have been fundamental in facilitating the standardisation and/or adaptation of mobile phone technology as a boundary object in rural areas of less developed economies like Ghana which lack advanced telecommunications systems. Next in the discussion is the theory of technology domestication which also supports the boundary object theory.

Though the mobile phone can be adapted to suit various purposes (domestication), the theory seems to focus more on an individual household's use of ICTs (the micro level). However, home is not the only place where ICT is used. The domestication theory (Haddon, 2007) does not consider macro-level usage of the technology in the developing world or in rural farming. It is more Westernised and used to understand adoption of technologies in sectors like health, banking, and education, but could be applied to the rural farming sector in developing economies. The domestication theory (Sørensen, 2005; Haddon, 2007) assumes that the levels of technological and telecommunication infrastructure in all households are broadly the same.

This may be true in Western countries, but it is not the case in many African countries, including Ghana, particularly not in rural areas. This is because rural Ghana lacks the needed infrastructure to support telecommunications in the first place. Secondly, the geographical locations and the land topography are also contributing factors inhibiting telecommunication

infrastructure in rural household in Ghana. There is little discussion of the importance of social networks, family, and culture in helping users to domesticate ICT technology. This is important because, from the research described above, being able to domesticate mobile phone technology at the micro level has been fundamental to its successful adoption (Nimrod and Edan, 2021).

3.3 Chapter Summary

The chapter reviewed how adopting mobile phone technology influences user behaviour. The chapter does so with reference to the Technology Acceptance Model by Davis (1989) and the Boundary Object Theory by Star and Griesemer (1989). Referring to the TAM framework, the review indicated that users of technology adopt because of the perceived ease of use, thus there is the belief that the mobile phone technology is not complex and simple to use (AlQudah, 2021). The theory also indicated that when it comes to adopting a particular technology, users consider the benefits too. For mobile phone technology, the benefits it presents includes access to calls no matter the location, simplicity of the technology and the ease of acquisition (Renaud, 2008). The TAM theory identified external variables as fundamental to adoption but did not clearly identify which specific external variables influences adoption of the technology.

On the boundary object, it was clear in the review that the mobile phone technology allows different activities to be connected, using communication as the link in coordinating these. The technology allows many activities to be done at the same time, no matter the user's location. As users adapt the technology for multiple activities, it influences their behaviour through skills and knowledge acquired. The chapter also indicated that the mobile phone could serve these multiple purposes because the technology can be tamed or domesticated reference to the views of Haddon (2007) and Uwamariya *et al.* (2021). In the process of the domestication or appropriation, user's behaviour is influenced. The review indicated that domestication is a process, and that it can be symbolic, practical or cognitive, indicating why users adopt the mobile phone technology and how it influences their behaviour. Despite the insights provided by the Technology Acceptance Model (TAM; Davis, 1989) and Boundary Object (Star and Griesemer, 1989), linked with Haddon's (2007) explanation of the influence of domestication on user behaviour, there appears to be little information on whether these

theories are applicable in rural farming businesses in developing economies like Ghana. Hence this study investigated how these theories apply to how farmers in rural Ghana adopt mobile phone technology and learn to integrate it into farming business activities in rural Ghana.

Secondly, there is little material to be found in the extant literature on whether users, including farmers in developing economies and in rural Ghana, adopt the mobile phone technology because it influences their behaviour, with reference to the TAM and the Boundary Object theory. In attempting to address these questions that are identified as gaps in the extant literature in Chapter 2 and this chapter, Chapter 4 discusses the conceptual framework that brings the questions together to help prepare for the fieldwork.

CHAPTER 4 – TOWARDS A CONCEPTUAL MODEL

4.0 Introduction

This chapter aims to develop a framework consistent with the research questions and provide a guide for the fieldwork of the study. Hughes *et al.* (2019) posited that a good research framework helps to clearly understand the relationships between the research issues. From another perspective, the framework helps to understand the connections between the research questions and the attempt to answer them. A conceptual framework is an analytical tool used to make decisions and organise ideas (Tracy, 2019). Whether the conceptual framework takes a narrative or a graphic form, it is fundamental in providing a guide to the analysis of the fieldwork (Papargyropoulou *et al.*, 2016). For the study, both narrative and a graphical form was employed develop the conceptual framework. The conceptual model integrated the concepts in the questions, which were fundamental to understanding the adoption of mobile phone technology by small business (SBs), as detailed in this chapter.

This chapter has 6 subsections resulting from the review of the extant literature and the research questions identified as gaps. Section 4.0 discusses the introduction, 4.1 provides insights on conceptual framing and development and 4.3 discusses components of the framework. Section 4.2.1 discusses mobile phone technology adoption in Africa. Section 4.2.2 provides insights on the reasons of adoption from the RBV perspective (Barney, 1992). Section 4.2.3 looks at the learning and development processes relating to mobile phone technology adoption using Kolb's (2014) model. 4.2.4 Discusses the mobile phone as a boundary object. 4.3.5 Provides insights on the Technology Acceptance Model. The chapter concludes with a summary and the way forward for the thesis with subsection 4.2.6.

4.1 Conceptual Framework Development

It emerges clearly from review of the adoption of ICTs and ICT4D that the use of the mobile phone in the African and Ghanaian contexts occurs largely in response to the limitation that the communication infrastructure does not support landline telecommunications. This implies that how and why farmers in rural Ghana adopt the technology, as well as the knowledge they acquire using it, are worth looking into, to identify the opportunities for rural farmers to improve farming practices and their farming business processes.

Studies on adoption have focused on the mobile phone being a resource and how it influences user's behaviour (Davis *et al.*, 1989; Venkatesh *et al.*, 2012). On how farmers learn to use the technology, the existing literature review indicated that the users of technology, including farmers, learn experientially, through reflective means; they learn by doing (practice), observations and abstract conceptualisation (Engeström, 1991; Ozias-Akins *et al.*, 2003; Kolb, 2014; Plotnikov and Plotnikova, 2019). In learning through these methods, users of the technology acquire skills of communication, problem-solving and planning that allows them to use the technology by different ways to and to connect with different communities. Gilmore and Cragg (2018) posited that these skills are known as domain general skills. Chikwe and Biriowu (2020) go further by saying that based on these skills, and in line with the experience that the learners acquire, they can develop capabilities which influence their behaviour in the use of the technology. The above reviews draw attention to the fact that businesses, including farming, adopt mobile phone technology based on the benefits that the technology presents. However, some questions remain unanswered as indicated below.

1. In what ways does the adoption of mobile phone technology influence the farming business activities of rural farmers in Ghana?

- a. How can the Resource-Based View of the firm help to frame an understanding of mobile phone technology use by Farming Small Business Entrepreneurship in Rural Ghana?
- b. How can the Technology Acceptance Model explain the behaviour of farmers in rural Ghana when adopting mobile phone technology as part of their farming business activities?

2. How do rural farmers in Ghana learn to adopt the technology and integrate it into their farming business activities?

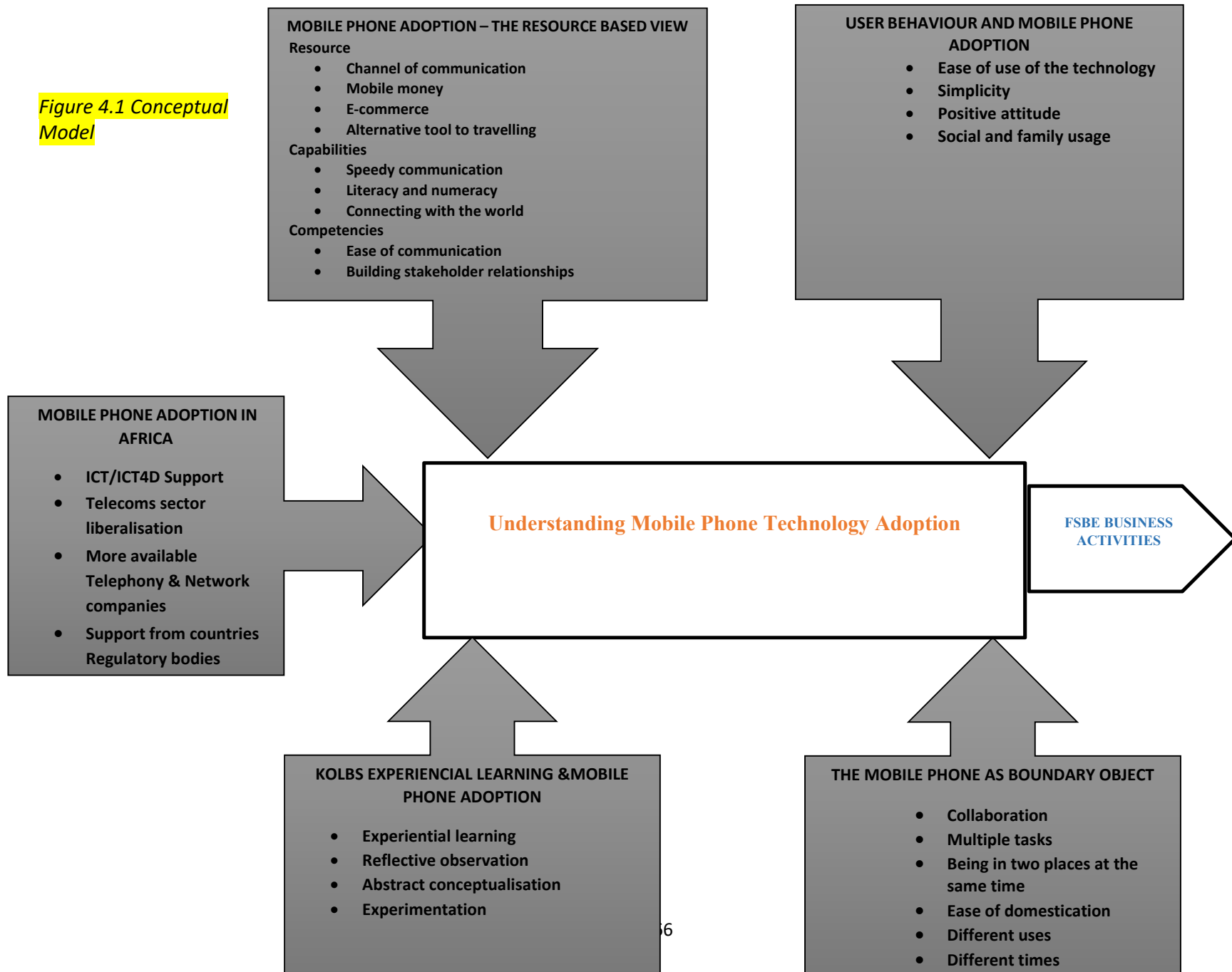
- c. In what ways does mobile phone technology become a boundary object in influencing farming activities and relationships in rural Ghana?
- d. How can Kolb's Learning Cycle help to explain the process of mobile phone adoption by Farming Small Business Entrepreneurship in rural Ghana?

This thesis therefore proposes a framework to answer the above questions to understand why and how rural farmers adopt mobile phone technology and learn to integrate it into the farming business. The study uses the theoretical frameworks of the Resource Based View (Barney, 1992), Kolb's (2014) Learning Theory, the Technology Acceptance Model (Davis 1989) and the Boundary Object Theory (Star and Griesemer, 1989). This is shown in the Figure 4.1 below.

4.2 Components of the Framework

An extensive literature review on technology adoption and how users learn to use the technology is discussed below, with reference to the framework above. Ejemeyovwi and Osabuohien (2018), Aker *et al.* (2020) and Asongu *et al.* (2021) indicate that users of the technology adopted it because it is simple to use and helps to connect customers, family, and friends. In addition, those using it for business indicated that the technology reduced the cost of transportation between them and their business stakeholders. Using the technology makes the world available at the press of a button. Not only that, but the technology is also domesticated – that is, can be adapted to do different things, from making calls and sending messages to taking pictures and storing the data of friends, family and customers. In developed countries, the research addresses the benefits of technology through availability and use of applications (Kabbiri *et al.*, 2018). Phone apps also allow users to buy, sell and undertake financial transactions. The technology has facilitated online shopping, making irrelevant the location of the customers. Despite these benefits, the literature does little to go beyond the basic assumption that rural farmers in Ghana, who are also users of the technology, adopt it because of this simple instrumental logic. The current research seeks to go beyond this to provide a richer account of the processes involved in mobile adoption. In doing this, the thesis also seeks to address the research questions above which the literature is absent on.

Figure 4.1 Conceptual Model



4.2.1 ICT/ICT4D and Mobile Phone Technology Adoption

In Africa, ICT has been crucial in helping to solve some of the development changes of the prominent issues impacting on the Africa (Tobbin 2010). These includes access to health and education. However, one of the areas that has received little support but which is the backbone of Africa and most importantly Ghana is agriculture. Development of ICT infrastructure is investment-based, and not many African countries have the resources to deepen these investments. Most developing economies, including Ghana, cannot afford them. Even if most of the countries are supported by development partners like the World Bank, International Telecommunications Union (ITU) and the European Union.

Despite these problems, ICT4D has been fundamental in helping to promote the growth of ICT using mobile phone technology in Africa. Mobile phone usage in Ghana has, for example, opened new channels of communication, connecting regions, districts and rural areas and ensuring the regular flow of information from one place to another. It has also improved financial activities. This has been possible because of the reforms in the telecommunication sector since the year 2000 (Nstiful *et al.*, 2019; Karakara and Osabuohien, 2019; Mustapha, 2021; Agyei *et al.*, 2020).

In the reforms, the then government in Ghana, through the private public partnership agreements and with the support of the World Bank restructured the sector, reduced investments in landline communications but improved investments in supporting the growth of mobile phone telecommunications usage (Williams *et al.*, 2022) Secondly, through trade liberalisation programs, the government opened up that sector to mobile telephony companies and networks to invest, and at the same time offered tax incentives. The National Communication Authority (NCA) and the Ministry of Information and Technology have also developed good relationships with these telephony companies, providing the support they need, especially in the providing and building of telephone masts which support the transfer of networks to the districts, towns and villages (Ayarkwa et al, 2021).

4.2.2 Mobile Phone Adoption and the Resource-Based View

Barney's RBV (1992) theory focuses managerial attention on a firm's internal resources to identify capabilities and competences with the potential to deliver superior competitive advantage, supported by Amit and Schoemaker (1993), Corner (1991), Teece *et al.* (1997),

Chatterjee, *et al.* (2021). Different studies have reviewed the empirical development of the RBV theory. Cennamo (2021) posited that competitive advantage comes from value created and/or services offered. Barney (1992) goes further to say that firms create advantages based on the resources they have, and how they effectively and efficiently use them – for an organisation's resource to hold potential as a source of competitive advantage it should be Valuable, Rare, Inimitable and of Organisational value (VRIO). Thus, achieving competitive advantage in using a resource should be based on the VRIO criteria.

Different reviews have been done by Tehseen *et al.* (2019) and Yang *et al.* (2019) in trying to understand how organisations gain competitive advantage using ICT resources to influence business areas such as financial, service delivery and marketing activities. This was done in a survey of 170 SME manufacturing industries (Tehseen *et al.*, 2019). The results indicated that using ICT as resource offered a positive impact on strategic and operational advantages through improved competency and capabilities. Capabilities are abilities — abilities to do something. These are the valuable functions to which individuals have access; as such, they are related to but separate from resources in that they are the unique set of skills and abilities that users acquire over time. Bisimwa *et al.* (2018) suggest capabilities which are achieved individually include literacy and numeracy.

In the use of technology, Argote and Hora (2017) noted that organisations are likely to acquire speed and customer connectivity capabilities by using some technologies. As the capabilities develop over time, they provide individuals and organisations with competitive advantage over other businesses or individuals who do not have them. Although competitive advantage gained through capabilities can be traced back to, among others, Aristotle, Adam Smith and Karl Marx (see Nussbaum, 1988, 1992; Sen, 1993, 1999; Walsh and Godfrey, 2000), it is the economist Amartya Sen who is credited with the idea. Moreover, Kiwala *et al.* (2021) argued that what matters is the advantage that capabilities bring. On the development outcomes relating to the use of mobile phone technology as part of ICT/ICT4D, Efobi *et al.* (2018) posited that business using mobile phone technology are able to access regular information and undertake other business activities, including financial transactions and supply of products or services (Abdul-Rahaman and Abdulai, 2022).

Using the technological benefits of the phone because of the associated platforms including social media platforms, manufacturing, learning and crowdsourcing platforms allow businesses and the customers to interact more frequently (Bonina *et al.*, 2021; Owusu *et al.*, 2021; Ayarkwa *et al.*, 2021; Cusumano *et al.*, 2020; Asongu *et al.*, 2018). In spite of these insights in the extant literature, very little is known about how rural farmers in Ghana use the mobile as a resource and how that enable the development of capabilities and competencies that enhances competitive advantage.

4.2.3 Learning and Development using the Mobile Phone Technology

The literature indicated that users of mobile phone technology and related platforms go through a cycle of learning in the process of adopting the technology. That is, they acquire knowledge, some of which involves abstract concepts, and apply it in different situations, in line with Kolb's (2014) theory on learning. Kolb further states that in the learning process, knowledge is created through the transformation of experience (Kolb, 1984). Kolb's learning theory identified four methods: experimentation, abstract conceptualisation, reflective observation and concrete experience (see Chapter 2 for a detailed discussion). Looking more specifically at learning with technology, Engeström's (1991) Activity Theory posited that in the learning process, the user's interaction with the technology is influenced by mediating objects; these could be the technology itself or stakeholders supporting the use of the technology, including telephony companies, mobile phone repairers and independent retailers of mobile phone accessories. As learning progresses, skills and knowledge are acquired, which impact the experience that users of the technology acquire (Aker *et al.*, 2012). However, the literature gives little insight into how users of mobile phone technology in rural areas learn, including farmers in Ghana, nor could much be found on the skills and experience these rural farmers acquire through using the technology.

4.2.4 Technology Acceptance Model and User Behaviour

Various models and theories have been developed to help understand user's acceptance of new technologies. However, the most widely researched model that investigates why a user chooses to use or not use technology is the Technology Acceptance Model (TAM) (Mohamad *et al.*, 2021; Tarhini *et al.*, 2015; Davis, 1993; 1989). TAM posits that there are five factors that determine whether technology will be accepted by potential users. These are: (i) external factors; (ii) perceived ease of use PEOU; (iii) Perceived Use (PU); (iv) Behavioural intentions (BI); and (v) the actual system use (AU). It is important to note that the key feature of the model is the emphasis on the perceptions of the user. Perceived usefulness Mariano *et al.*, (2022) is determined by the belief that the technology will do the job for which it is assigned for.

The core function of the mobile phone technology is communication and information exchange, and it can be seen to perform that function (Chocarro *et al.*, 2021). On PEOU, research has indicated that users of a technology are likely to accept it if they perceive the technology as easy to use. In the context of the mobile technology, the extant literature has shown that the technology is not complex but is designed in such a way that the user does not need to learn deeply about how to use it (Mariano *et al.*, 2022; Mohamad *et al.*, 2021; Kwateng, 2015). As indicated in the extant literature, some of the mobile phones have interfaces or features that allow the user to learn on the go, and it is the self-taught approach and experience in using the technology that influences the user behaviour (Kwateng, 2018). Though there is a steady growth in the use of the technology in developing countries, including Ghana, as shown in the extant literature, not much can be found in the extant literature on whether farmers in rural Ghana adopt the technology because of perceived usefulness (PU) or perceived ease of use (PEOU) being the reasons for the adoption for the technology. In addition, not much could also be found on the Technology Acceptance Model explain the behaviour in the adoption process.

4.2.5 The Mobile Phone as Boundary Object

The Boundary Object Theory has been used in different academic studies. Del Chiappa, Bregoli and Kim (2019) used the theory to show it brings into the frame the role of partnerships and stakeholders in helping to undertake activities no matter their location. In another study by Ten Oever (2019) on the Internet and Corporate Governing Society, the mobile phone technology was used as a boundary object to lead the negotiations and provide enough flexibility to translate the social realities of the various stakeholder groups, including government and industry. The mobile phone technology seems to appeal to users as a boundary object because it could be used for multiple tasks. In intersecting the social, cultural and other worlds of the user, the mobile phone technology as a boundary object tears down the time boundary (Islind *et al.*, 2022) because the technology can be used for the purpose the user chooses no matter the time. Users of the boundary object technology can be in two places at the same, performing different functions using the same technology. This is because the technology can be appropriated (Kummitha, 2020; Bar, 2012).

For users of mobile technology in developing economies, it is the characteristics that have been fundamental to the increase in the adoption of the technology. However, despite the benefits which the technology provides as indicated in the literature, Ejemeyovwi and Osabuohien (2020), intimate that there appears to be little or no information on ways the rural farmer sees the mobile phone technology as a boundary object and how it influences farming activities and relationships.

4.2.6 Chapter Summary

In summary, this chapter explained the rationale behind the research questions and the framework developed from the gaps identified in the literature on mobile phone technology adoption. These are addressed with theoretical lenses based on the Barney's (2014) Resource-Based View (RBV), Kolb's (2014) Learning Theory, the Boundary Object Theory (Star and Griesemer, 1989) and the Technology Acceptance Model (Davis, 1989). The framework indicated that adoption of mobile phone technology in developing economies, especially Africa and Ghana, is underpinned by processes of learning, development and experiences associated with its usage. In the process of the adoption, knowledge, skills, capabilities and

competences are acquired which allow the users to exploit other benefits giving them competitive advantage (Tanle and Abane, 2018; Folitse *et al.*, 2018; Owusu *et al.*, 2021). The framework also shows how users translate the perceived benefits of the technology into business opportunities, and at the same time improve relationships with the user's social, economic, and business worlds. Despite the reasons for adoption as indicated in Figure 4.1 drawn from the extant literature, not much could be found on how the Resource-Based View (RBV) of the firm helps to frame an understanding of mobile phone technology adoption by farmers in developing economies, especially farmers in rural Ghana. As part of the learning and development process of the users of mobile phone technology, the theory does not provide much insight on the applicability of the Kolb's (2014) experiential learning cycles to the rural farmers. How the technology bridges the social, economic and other worlds of farmers in rural Ghana referring to the boundary object theory (Star and Griesemer, 1989) could also not be highlighted much on in the extant literature. Referring to the Technology Acceptance Model by Davis (1992) on user acceptance of technology, not much could also be found on how farmers in rural Ghana's behaviour is influenced in the technology adoption process. This study therefore set out to draw on the above conceptual framework to explore and answer these questions by using in-depth and in-depth interviews and participant observation as main research approaches for the two main farming groups in the Kwahu district of rural Ghana. These are the Ministry of Agriculture (MOFA) and Esoko farmers. The next chapter discusses the research philosophy, strategies, design and ethics.

CHAPTER 5 – RESEARCH METHODOLOGY

5.0 Introduction

The aim of this chapter is to clarify the rationale behind the choice of the methodology and the methods used in the research. The chapter starts with insights on the district that was selected for the study and then goes on to discuss the research philosophy and the approaches adopted. It also outlines the sampling strategy, the data collection processes, and analysis methods used. Ethics and quality issues are also discussed. The research reflexivity report follows, and the chapter then concludes, with a summary of the whole methodological process for the study.

5.1 Why Farmers in the Kwahu District Were Selected

The Kwahu district is made up of four areas, namely Kwahu South, Kwahu North, Kwahu East and Kwahu West. The estimated population of the district is 875,887 based on an average growth rate of 4%, according to Ghana National Statistics – GSS (2016) and the population council of Ghana in 2018. This is an agrarian district with approximately 450,000 of the population being in agriculture of either crop or animal production (Antwi, 2018). It is also a fast-growing district with the younger population going into agriculture as a form of employment. The area was also selected because the author comes from the district and knows the terrain.

5.2 Research Philosophy and Approaches

The purpose of the study is to understand mobile phone technology adoption and its influence on the rural farmer's business activities. The research purpose informed the choice of the research philosophy and the strategy chosen. Philosophies about the development of knowledge and the nature of knowledge all define how data should be gathered and used (Al-Ababneh, 2020). Masuwa-Morgan and Burrell (2004) argue that different ontologies, epistemologies and models of human nature are likely to incline social scientists towards different methodologies (see also Roslender, 2016; Jinadasa, 2020). Based on the view that reality is socially constructed, interpretivism was chosen for the research in this thesis, rather than positivism or pragmatism.

Table 5.1: Demographics of the Kwahu District

Area	Estimated 2019 Population Size	Type of Farming	Crops Farmed	Animals Farmed	Markets	Men and Women
Kwahu North	132,535	Subsistence and Commercial	Maize, Yam, Cassava, Pepper, Groundnuts, Cowpea, Plantain, Cashew, Palm Oil, and Cyprus	Cattle, Sheep, Goats, Local Fowls, and Pigs	4 major market locations – Maame Krobo, Ekye Amanfrom, Donkokrom Tease	Male 45,433 Female 45,832
Kwahu South	104,960	Subsistence and Commercial	Cocoa, Palm Oil, Citrus, Yam, Cassava and Coco Yam, Banana, Plantain, Pineapple	Cattle, Sheep, Goats, Local Fowls, and Pigs	7 major market locations – Mpraeso, Bepong, Ntomem, Nketepa, Osubeng, Asikam, Kwahu Praso	40,238 Male 32,922 Female
Kwahu East	99,800	Subsistence and Commercial	Cocoa, Palm Oil, Potatoes, Ground Nuts, Cola, Citrus, Yam, Cassava and Coco yam, Banana, Plantain, Pineapple, Okra and Shallots	Cattle, Sheep, Goats, Local Fowls, Pigs, Rabbits, and Grass Cutter	9 Major market locations – Abetifi, Kotoso, Miaso, Hweehwee, Simpoa, Onyimso, Oframoase,	25,948 Male 23,952 Female
Kwahu West	338,590	Subsistence and Commercial	Cocoa, Palm Oil, Potatoes, Ground Nuts, Kola, Citrus, Yam, Banana, Plantain, Pineapple, Okra	Cattle, Sheep, Goats, Local Fowls, Pigs, Rabbits	6 Major market locations – Ekowso, Asubone rails, Nkawkaw,	84,918 Male 91,995 Female

Created by the author

5.2.1 Positivism

Positivism holds the view that the scientific method is the only way to establish truth and objective reality, and that science is the foundation for knowledge. Auguste Comte coined the word *positivism* to reflect an empirical approach in which claims of knowledge are based on experience (Bogdan and Biklen, 1997). In order to distinguish between empirical knowledge and knowledge derived from metaphysics or theology, Comte indicated that scientific knowledge was nearer to the truth than knowledge derived from metaphysical speculation (Schwandt, 2001). Positivistic research uses scientific methods to analyse variables. The results are then typically presented using statistical outputs (Collis and Hussey, 2009). Though positivism can look at the context of an issue and make links with causes and effects, it tends to be more reductionist (Guba and Lincoln, 1994). The purpose of the current study is to understand a social phenomenon – mobile phone usage by farmers in rural Ghana. This investigation also probed deeper regarding the ‘why and how’ of its usage. Pragmatism, on the other hand, sidesteps the contentious issues of truth and reality, and focuses on what works (Masuwa-Morgan and Burell, 2004). As a research paradigm, it is based on the proposition that researchers should use the best research method that answers the research question. Pragmatism, as Maxy (2003) notes, embraces the plurality of methods. It is therefore often associated with mixed or multiple methods (Johnson and Onwegbuzie, 2004; Tashakkori and Teddlie, 2009; Biesta, 2010; Klassen *et al.*, 2012; Morgan, 2014). Pragmatism as a research philosophy was not ideal for the current research because the study intended to understand in-depth how and why the rural farmers adopt and use mobile phone technology. Such in-depth understanding would be difficult to be achieved using mixed methods.

5.2.2 Interpretivism

Using an interpretivist approach, Jungie *et al.* (2022) respond to calls from researchers on the use of qualitative oriented methods in trying to understand reasons for the adoption of mobile phone technology and usage by the rural farmer as research on mobile phone adoption is evident (Krell, 2021). Cope (2005) and Coviello and Jones (2004) had, in their earlier research, found that positivism has dominated entrepreneurship methodologies in over 50 published studies. Very few studies into technology adoption by rural farmers were

found that used the interpretivist approach, hence the need for this thesis to use this approach to fill the gap in the literature. With the interpretivist approach, the researcher seeks to understand the interpretations that the FSBE owner-managers bring to bear on the adoption and use of mobile phone technology, and how that supports farming business activities. It allows for data collection during interviews to be done in an unstructured way, compared to the positivist researcher who uses a predefined set of questions in categories to extract the information they are looking for. Within interpretivism, participants or respondents can express their own views, share experiences and sometimes support their discussions with images, which all make it possible to understand their world (Easterby-Smith *et al.*, 2008). Interpretivist research is based on the belief of relativist ontology. This means that reality is subjective, and changes from one situation to another. Therefore interpretivism, as a research paradigm, seems the most suited for this study because the researcher wanted to gain an in-depth knowledge of how the owner-managers of farms perceive opportunities and constraints associated with mobile technology, and to understand how the adoption of the mobile technology influences farming business activities.

5.2.3 Research Paradigm

5.2.3.1 Ontology

The study adopts an ontological view of critical realism. Masuwa-Morgan and Burrell (2004) posit that ontology is a system of beliefs that reflects the way an individual interprets facts. Ontological assumptions are the views of the researcher on how the world operates and the commitment they have to views (Lucas, 2014). Ontology describes the researcher's view on reality, be it objective or subjective (Dietrich *et al.*, 2020). Objective reality looks at the existence of the issues – that is, whether the issues exist – whereas subjective reality considers how the issues are created in our minds (Guba and Lincoln, 1994). Saunders *et al.* (2007) posited that interpretivism uses a relative ontology and claims that knowledge is built based on social construction and that, therefore, knowledge is personal and subjective. Social constructivism helps to explain events and outcomes pertaining to questions about why and how events occur. It is subjective and allows the researcher to explore the reasons why certain actions took place – for example, why the rural farmer would adopt the mobile phone technology (Mukumbang, 2021).

On that basis, the study adopts a social constructionist approach in order to explore and understand the how and why of the adoption of mobile phone technology by farmers in rural Ghana (Feilzer, 2010).

5.2.3.2 Epistemology

Epistemology helps to unravel the relationship between inquirers or the potential inquirer and what can be known when it comes to the use of mobile phone technology. Interpretivists argue that by trying to find out how the inquirer knows and what it is possible to know, there is also the need to reflect on methods and standards through which reliable and verifiable knowledge is produced. Tsoukas and Chia (2011) also take into consideration how knowledge is generated. This therefore made interpretivism the appropriate approach for the research, as it argues that social reality is not objective but rather subjective and shaped by perceptions (Yang, 2005). Thus, in understanding how farming businesses adopt mobile phone technology and learn to use it, how they interpret and handle perceived constraints associated with it, this study gave their beliefs and practices respect.

5.2.3.3 Axiology

Hammersley (2015) describes how values can affect the various stages of the research process – the research question stage, the choice of the frameworks, paradigm issues, data collection, and analysis – and determine whether the researcher is a positivist (knowledge is gained through measurable facts) or an interpretivist (reality is socially constructed; there is no truth in reality) (Raja, 2019). Axiology explains the aims of the research but at the same time determines the researcher's stance, whether they are trying to predict, to explain or to understand what is happening in the world (Gericke, 2012). The Kwahu people, who were the main participants in this study, are by nature conscious of their cultural values, as well as their personal and family issues, and are unwilling to open or give information to anyone they do not trust. Therefore, there was the need to be mindful of ethics at every stage of the project. Furthermore, information systems research is socio-technical, involving social actors and their use of technology. Guidelines for appropriate research are defined in various reports,

including the Menlo Report which defines ethical principles for research involving ICT (Dmitritch and Kenneally, 2012).

5.2.3.4 The Menlo Report

The Menlo Report outlines the key principles and norms that provide the axiological basis of Research (Bailey *et al.*, 2012).

Respect for persons – The farmers were given the respect they deserve by having the right to decide whether to take part in the research or not. They were also assured that their information would not be used without first informing them or getting their consent.

Beneficence – The two general rules of beneficence are: do not harm respondents and maximise the benefits that the research will provide. Farmers were informed about the benefits that the research would bring to them and that there are no risks associated with the research.

Justice – The farmers were given equal considerations in terms of treatment. The benefits of the research in terms of information were shared fairly with all.

Respect for law and public interest – There was the need to engage in legal due diligence. The researcher was transparent in his relationship with the farmers and made it clear that he would be accountable with regards to the information they provided. From the principles above, important issues such as informed consent, confidentiality, and anonymity arose, which have been discussed in detail in this in line with ethics report, at Section 5.7.

5.3 Research Approach

The approaches to be discussed here connect with the philosophies outlined earlier. The deductive approach is used to test theories, whereas the inductive approach is used to help generate new theories (Saunders, 2012). The pilot study used a deductive approach while for the main study the researcher adopted an inductive perspective because it helped to explain the experience of the farmers in using the technology, which cannot be measured using scientific principles (Marton, 1986).

5.3.1 Phase 1 - Deductive

Saunders (2012) notes that the deductive approach concerns the development of a hypothesis based on an existing theory. A research strategy is then designed to test the theory. The deductive approach develops by means of a hypothesis, which is typically derived from theoretical propositions. In other words, the deductive approach or reasoning deduces conclusions from premises or propositions. The deduction begins with an expected pattern tested against observations. For the study, a deductive approach was initially used during a pilot study and that was followed on with the main data collection (inductive) in line with the views of Creswell (2019) and Bryman and Bell (2015). The pilot study was informed by the Resource-Based View (Barney, 1992) and Kolb's (2014) Experiential Learning Theory after a review of the literature, see Chapter 2. The deductive approach was based on using existing theoretical arguments to capture the phenomenon to enable producing more generalized knowledge about the empirical phenomenon (Saunders 2012; Rajin, 1987). However, the findings showed that the above theories could not fully explain the adoption of the mobile phone technology and how rural farmers learn during the process. See Appendix 1 (Table 5.0) on the thematic analysis of the pilot study and Section 5.7.2 for the analysis of the pilot study.

5.3.2 Phase 2 - Inductive

An inductive approach was adopted for the main study, as it fits with the overall qualitative and interpretivist approach to the research. Creswell (2019) posited that an inductive reasoning is a logical process in which multiple premises, all believed to be true or found to be true most of the time, are combined to obtain a specific conclusion. This is also a more flexible approach, as it supports changes in terms of the direction of the research (Creswell, 2009). Bryman and Bell (2015) posited that adoption of a particular approach depends on the nature of the research, objectives and the approach. For example, in research situations where the objective is to elicit detailed and in-depth information on a particular subject involving consumer behaviour, the inductive approach can use small samples of subjects or respondents to conduct the research (Randall and Mello, 2012). Easterby-Smith *et al.* (2008), in discussing the inductive approach, indicated the reasons why it is well placed to support

qualitative research, especially in understanding humans and the way they interpret issues in the world.

These reasons are as follows: firstly, the approach allows the researcher to configure the research and make an informed decision with the research question in mind; secondly, it supports the researcher in understanding why something is happening, and the reasons for a respondent's behaviour. The inductive approach also helps researchers to undertake a study even without prior knowledge. As such, inductive approaches start with data collection and end with the descriptions of the patterns that have emerged from the data. The inductive approach was based on the premise that the researcher engages with the objects of the study with an open mind (see also Saunders, 2012). The aim of the research was to understand how farmers in rural Ghana adopt mobile phone technology and platforms and how this influences farming business activities. Since there is little prior knowledge on the topic the inductive approach was more suitable than the deductive approach. The use of a deductive and inductive approach in the study enabled different theories to offer alternative explanations while enabling the emergence of concepts and theories to enable the extension of existing theories. However, the researcher was mindful of the risks as social phenomenon stemming from different intellectual traditions may have different meanings (Cairney, 2013).

5.3.3 Sampling Strategy

Lewis *et al.* (2003) posited that it is necessary to select people out of the population to be participants in both qualitative and quantitative research projects. This is because the entire population cannot be used. In qualitative research it is rare for the sample to allow generalisability due to it not being statistically representative (Elmusharaf, 2012). It is important to note that the units are selected to reflect the features of the sampled population (Saunders, 2012). The target population for this study was farming small businesses in the Kwahu district. These were selected due to the role that they play in the Kwahu district in the areas of employment and revenue generation and their immense potential for boosting the export performance of Ghana (Frimpong and Adams, 2010; World Bank, 2019). For the study, 24 farming businesses were selected, 12 from MOFA farming groups and 12 from Esoko farming groups. To enhance a broader representation of the farming community, the respondents were diverse with regards to gender and age. see Table 6.1 for more details. The selection of the 24 farming businesses was in accordance with the research questions, the

theoretical framework discussed above, and the potential reach of saturation once 12 from each group are interviewed (Njoroge and Kaluyu, 2020). A purposive sampling strategy was adopted. Purposive sampling occurs where a sample group is selected because they have the features of the wider population. This sampling method enables the researcher not only to collect the data but also to save time while giving a good insight into the specific farming groups involved in the study. Some writers, including Sharma (2017), have argued that purposive sampling may be prone to researcher bias and is sometimes unrepresentative.

This is because it is based on the judgement of the researcher. Secondly, there could be vulnerability to errors in the judgement by the researcher. Nonetheless, this research was not meant to be generalised or biased, but rather sought to collect data from a specific target group, hence the use of the purposive sampling method. The sample units (rural farmers in Kwahu district) were selected to enable the author to gain an understanding of the central themes in relation to mobile phone adoption, platforms, and learning and development, which are fundamental to this study. The features or characteristics that constitute the selection criteria are chosen due to them being expected or known to have salience to the subject matter under study. The farming businesses selected were consistent with the definition of a small businesses, as discussed by Asare *et al.* (2015), who define Micro Small Medium Enterprises (MSMEs) in Ghana using the indicators in the Bolton Committee Report (Bolton, 1971).

Micro-businesses are classified as those that employ up to 5 people with little or few fixed assets. Small Businesses (SBs) employ between 6 and 29 people with fixed assets of less than \$100,000, whereas medium-scale enterprises employ between 30 and 99 people with fixed assets of up to \$1 million (Kusi *et al.*, 2015). These classifications are also supported by the Independent Evaluation Group of the World Bank (2014). The 24 farming groups were selected with adherence to research requirements for qualitative studies. According to the requirements, if a researcher aims 'to understand common perceptions and experiences among a group of relatively homogeneous individuals, twelve people should suffice' (Guest *et al.*, 2006; Easterby-Smith *et al.*, 2008).

5.4 Time Horizons

This thesis was cross-sectional, and the data planning and design were executed in 2018. But prior to that, there was a pilot work done in July 2018 to see how practical and understanding the research questions are. The actual data collection started in September 2018 and was completed in September 2019. Prior to that, clearance was sought from MOFA and Esoko in May early 2018. This was followed by a visit to the MOFA extension officers in the Kwahu District and Esoko farmers in mid-May 2018. In addition, consent forms, information sheets and introduction letters were made available to the extension officers. By July 2018, once all respondents had agreed to take part, the data collection followed, as planned, in September 2018. This is summarised in the table below.

Table 5.2: Data Collection Plan in Ghana

Activity	Date
Introduction letters from Oxford Brookes to Esoko and MOFA Ghana	March 2018
A visit to the offices of Esoko and MOFA Kwahu District	May 2018
Meeting with the four area extension officers of MOFA and Esoko, on data collection planning	May 2018
Extension Officers and Esoko officials to submit introduction letters, consent forms, and participant information sheets to the farmers selected to participate in the project	July 2018
Pilot studies	July 2018
First visit	Sept 2018
Second visit	Sept 2019

5.5 Research Strategies

The research strategy defines the general plan of how the researcher goes about answering the research question based on the data that has been collected (Creswell, 2009; Saunders, 2012). The two strategies adopted for the purpose of the research were in-depth interviews and participant observation (Jorgensen, 1989), which was dubbed 'A Day in the Life of the Farmer'. Saunders (2012) posited that in-depth interview are open-ended and a discovery-oriented method which helps elicit detailed information from an interviewer. This method allows the researcher to gain a deeper knowledge and understanding of the interviewee and to explore their perspectives and experience their feelings. The researcher can monitor changes in the interviewee's tone, voice and body language, further enabling an understanding of interviewee's opinions (Dworkin, 2012). In collecting the data, two farming groups – MOFA and Esoko – were used. MOFA acted as one of two gatekeepers in this study by providing access to 12 farming businesses.

The second gatekeeper in the study was Esoko, which provided access or contact with a further 12 farmers. The study was conducted in two stages. Stage one was a pilot study with 6 farmers selected from both Esoko and MOFA. 3 from each group, respectively. These were not part of the main 24 farmers who were interviewed in the main study. These farming entrepreneurs were interviewed using the semi-structured approach to probe and gain a deeper understanding (in-depth) of mobile phone use, adoption, learning skills, and knowledge in terms of how the technology had helped influenced farming business. All the farmers interviewed were from the Kwahu District (see Appendix 4.)

5.6 Data Collection

5.6.1 Unit of Analysis

The unit of analysis is the main entity being analysed for the study. For this study, the units of analysis are the 24 farmers selected from the MOFA and Esoko farming groups. These groups were chosen as part of the steps in gaining access to a farming group that does not want public access to their farming activities. The literature review reveals that mobile technology adoption is a multi-level process that involves the owner-managers, firms, telephony companies, the government, MOFA and Esoko, families, farming cooperatives and communities. In this regard, the 24 FSBEs were appropriate for selection in the study where decisions regarding technology adoption rested on the owner-managers but needed the

support of the groups to improve the farming business processes. The data collection was carried out in two phases. The first was the pilot study and the second phase was the main data collection. Section 5.6.2 and Section 5.6.3 discusses this below.

5.6.2 Phase 1 Pilot Interview Study

A Pilot study was carried out in July 2018 when the researcher was in Ghana to work on the documentation with the Esoko and MOFA officers who would support the recruitment of the respondents for the main study. With the help of both farming experts from MOFA, who advise farmers on farming practices, and the community leaders in the Kwahu traditional area, access was given to six farmers for the pilot study. These farmers were not among the 24 farmers selected for the main data collection. These farmers each were interviewed for 45 minutes to 1 hour. The pilot research of 10 questions revolved around the Resource-Based View (Barney, 1992) and Kolb's (2014) learning theories. The interviews – apart from eliciting information on mobile technology adoption, platforms, and learning and development – also sought feedback from the respondents about the clarity of the questions and the duration of the interview. The pilot study focused on two research questions based on the Resource-Based View, RBV (Barney, 1992) and Kolb's (2014) Experiential Learning Cycle. The research questions were on (i) how the Resource Based View of the firm help to frame an understanding of mobile phone technology farming small businesses in rural Ghana and (ii) how Kolb's (2014) Learning Cycle help to explain the process of mobile phone by farmers in rural Ghana. The first 10 research questions related to the RBV theory and the Kolb's Learning Cycle. The responses from the farmers showed that the interview was fully understandable, and that the duration was appropriate for them. The pilot study was used to test and refine the research questions, providing insights on the respondents' behaviours and expectations, especially for the main data interview. From the data, it could be seen that the mobile phone enabled farmers to do things at home even when they are in their farms, connect with extension officers, fellow farmers, suppliers and family members. Similarly, the data showed that using the phone as a resource enabled learning which in turn made farmers to feel like a businessman, feel confident and a businessman using the phone with the mobile phone becoming everything for one farmer. These findings indicated that the mobile phone is not just a communication tool to connect with the outside world. Rather, the technology allows them to work from anywhere, and helped connect them well socially and culturally with the

family. Farmers showed an emotional connection with the mobile phone, and changes in their attitude towards farming using the technology. Based on these findings from the pilot study the literature was reviewed further, and two more research questions were developed based on the Technology Acceptance Model (TAM) by Davis (1989) and the Boundary Object Theory by Star and Griesemer (1989). Overall, the researcher achieved an insight into the life of the Kwahu farmer, which helped to plan for the main study in September 2018. Please see appendix 1 table 5.4 for the thematic analysis of the sample quotations on both the Resource-Based View (Barney, 1992) and the Kolb's (2014) learning theory.

5.7.0 Phase 2 - Main Data Collection

The main data collection focused on the 24 farmers who were outside the domain of the respondents from the pilot study. Experience from the pilot study helped establish rapport with the respondents, coupled with the fact that the researcher is a native who speaks their language and understands the culture. The interviews took place on the farmer's farms and were recorded with the permission of the participants (Creswell, 2014 Saunders, 2012). Most of the farms were situated across the Afram River, which required travelling with the farmers in canoes to the farms to conduct the interviews. Farmers were asked additional 39 questions in relation to the theories underpinning the study. Before the interviews, the purpose of the interview was explained to farmers.

See Appendix 17 for the questions and how they relate to the four theories. Once they were clear about what to do, they were given the consent forms to sign. In addition, farmers were given the assurance that their data would be kept safe and would be destroyed once the research is completed (Miles and Huberman, 2014; Yin, 2009). The interviews were conducted informally. Although there were multiple questions to ask, the interview was organised in a conversational manner and farmers never felt it took much of their time. The interviews began with the respondent introducing himself and the farmers doing same. Farmers were asked about their age, the farm size, and whether the land used for farming belongs to the family or is leased from the community. This was done in an informal way, thus putting the farmers at ease. Farmers were also asked about the number of mobile phones they have as well as SIM cards and the reasons for having them, if any. At the same time, making jokes, as well as mixing the discussions with the native language, helped put the farmers at ease.

Farmers were then advised that the interview would last between 45 minutes and 1 hour but that this would be done informally and in such a way that they would not even know that the time has elapsed. Farmers were also given assurance that should they want to stop at any time, they were free to do so. This was conducted against the backdrop of the gaps identified in the literature upon which the research questions were developed, and the conceptual framework developed in Chapter 4. During the interview, the critical incident technique was used to extract deeper insights from the farmers relating to experiences and incidents upon which the mobile phone was used to help facilitate their farming business. Creswell (2014) posited that a critical incident technique is a research technique where participants being interviewed are made to recall or describe a time when a particular incident or a behaviour occurred. Farmers were made to describe these incidents and experiences and how they used the mobile phone technology to help address these. The critical incident technique helped to capture important understandings that are fundamental to the reasons why and how farmers in rural Ghana adopt the mobile phone technology. More information was requested on issues relating to how the mobile phone influence the farmers business as a resource, how the rural farmers learn to use the mobile phone technology and integrate that into the farming businesses, what the mobile phone technology does to be perceived as a boundary object and how it influences the farmer's behaviour.

In the interviews it was ensured that misinterpretations were minimised. This was done by seeking clarifications on issues deemed important. Even though the researcher is a native of the district, he was apprehensive about the number of times he would need to cross the Afram river to these farms in the hinterlands, especially given the treatment of officials coming to the area in previous years. But these fears were overcome once a rapport had been established with the farmers, who learned that the researcher was based in England and a lecturer who might in the future provide lessons for their children. Once the interviews were completed, they were transcribed, and data analysed first using open coding (Saldana, 2014) see section 5.11 for more details.

5.8.0 PARTICIPANT OBSERVATION – A Day in the Life of the Farmer

As part of the methodology in trying to understand the ways in which farmers in rural Ghana adopt and learn to use mobile phone technology, the study adopted participant observation to complement the in-depth interviews. Two farmers were selected from the MOFA and ESOKO farming groups, respectively. In terms of selection of these farmers, they were simply asked during the interviews. Two farmers, one from each group, volunteered.

Farmer #22 is 58 years and belongs to the MOFA farming group. His educational level is secondary and he plants maize peanuts and onions in Adawso and Ekye Amanfrom. He seemed to be introvert but organised in relation to his operational activities. On my visit, the farmer welcomed me and provided insights into the day's activities, both at home and on the farm. He was in control of managing and directing what needs to be done, with the mobile phone playing a significant role, until he received a call about a bereavement. Even with that, he was organised and again was focused when we arrived back home in the evening.

Farmer #7 belongs to the ESOKO farming group and is 70 years old. He is from the Akan community and based in Maame Krobo on one of the Dwarf Islands. He is also educated to secondary level and is an ex-army officer. He plants maize and oranges and raises cattle. This farmer is more of an extrovert and seemed to believe in himself.

He had a positive attitude towards farming. On Dwarf Island, and in the Maame Krobo area, he was the spokesperson for the Esoko farmers. He seemed to be respected in the area and as such receives any Esoko dignitaries that comes to the area for visit. He seemed a firm manager and organised in terms of how he works. Observing these farmers took into consideration the views of Jorgensen (1989), Spradley (2016) and Harvey (2021). (Please see also Bougie and Sekaran, 2019; Burgess, 2002; Denzin 2001.) These are views on establishing rapport and getting to know the participants, immersing oneself in the field, recording the data and consolidating the information gathered. The information below provides insights into the lives of the two farmers observed beyond farming using mobile phone technology. The observation part of the data collection was to better understand the life of the rural farmer, and to help establish the veracity of the findings from the in-depth interviews (Bougie, and Sekaran, 2019).

This was not just in terms of farming but also their daily lives – understanding not just why but how they used mobile phone technology. Because the study was cross-sectional, spending a day with two farmers, one from the MOFA farming group and one from the Esoko group, was deemed the best way to get some insights into the impact of technology on their lives (Jorgensen, 1989). The interview process allowed the researcher to establish a rapport, which made it easy for the observation to continue. The farmers were comfortable to be observed on the farms and in their homes, going about their activities without feeling intimidated by the process. (Denzin, 1989). Building rapport with respondents before observation is an accepted practice (Butcher, 2013; Wachi *et al.*, 2018) and is also essential for interviews (Creswell, 2009; Saunders, 2012). The rapport enabled relaxed communication between the researcher and the respondents. In doing so, the observer had four overarching research questions as guide. These questions were underpinned by the theories which runs through the study:

1. How can the Resource-Based View of the firm help to frame an understanding of mobile phone technology use by Farming Small Business Entrepreneurship in Rural Ghana?
2. How can Kolb's Learning Cycle help to explain the process of mobile phone adoption by Farming Small Business Entrepreneurship in rural Ghana?
3. In what ways does mobile phone technology become a boundary object in influencing farming activities and relationships in rural Ghana?
4. How can the Technology Acceptance Model explain the behaviour of farmers in rural Ghana when adopting mobile phone technology as part of their farming business activities?

5.8.1 Protocols and Ethical Issues Considered during Observation

Shaw *et al.* (2020) posited that studies based on observations in natural settings must respect the privacy and the wellbeing of the participants. Therefore, in observations, the observer must adhere to ethics or protocols which protect not only the privacy and the wellbeing of the participants but their data and any activity that could harm them. Participants should also be given the opportunity to opt out if they want to do so. For this study, in line with the views of Burgess (1984), the observer made use of the Tri-council Policy Statement on Ethical Conduct for Research Involving Humans (TCPS) (Stockleigh and Wright, 2022). This involved the following protocol measures below:

1. *Farmer's privacy* – Though the observation was overt, farmers were advised that there would be no intrusion in their daily activities.
2. *Data recording* – Farmers were informed in advance that there will be video recordings and that a report of the observations or field notes will be kept but destroyed after a report has been developed from that reference to the General Data Protection Regulation (GDPR).
3. *Potential Harm* – How the observation will be carried out was explained to the farmers, and the fact that the observational method would cause no harm.
4. *Personal Space* – It was discussed and agreed with the farmers that the observer will find a space within the field of observation to occupy and make notes.
5. *Informed Consent* – These two farmers volunteered to partake in the observation. Even so, before the actual observation took place, the researcher recapped and explained to them the purpose of the research, the topic, why this observation was being done, and how the data being collected in the form of field notes and videos would be used (Burgess, 2002). How the information would be disposed of after the observation was also explained. They were given time to ask questions before the observation started.

5.8.2 Observational Method Used

Harvey (2021) posited that in participant observation, the level of involvement can be discussed in four levels. These are passive participation, moderate participation, active participation and complete participation. For this study, the research was overt, and the participants were observed passively. Though the observer had less control over noise because of the environment and the technologies being used, not being active in the activities of the farmers was an advantage because the observation was in its natural setting of the farmer's homes and the farms (Denzin, 2001). The behaviour of the farmers did not seem to have been impacted. The tables 5.0 and 6.0 are the observational checklists and field notes for the two farmers observed.

5.8.2.1 Observation Checklist and Notes (Farmer #22 MOFA)

Table 5.3 Farmer #22 MOFA

Participant Observation Farmer #22 MOFA			
	Date 10 September 2018	Start time 7 a.m.	Stop time 6.20 p.m.
Areas of Observation Check lists			
The Mobile Phone Technology as a Resource to the Rural Farmer	- Farmer was overheard saying he has received the mobile money sent (MoMo) - On the farm, the farmer was overhead shouting to someone to return the 20 bags of fertilisers he borrowed before the close of day - Farmer was always watching the phone to check messages and weather conditions. He would occasionally look into the skies too - As one of the farmer's phones was being used as a radio, he could be seen sometimes speaking to himself following the news from the radio picked up from the phone		
Learning to use the Technology	- Farmer called two of his assistants, wanting them to help him check something on the phone, and later sending a message to someone - At one point when the phone rang, he was overhead asking someone how he should check the balances and the information sent - During the time spent with him, the phone rang several times. He knew where to tap and receive the call even without looking on the phone		
The Mobile Phone as a Boundary Object	- In one of the calls that came through to the farmer, he was overheard saying to someone that he could not travel over as he was in the farm, but advised the person to take some cassava leaves and boil them, then blend with fresh tomatoes and drink, explaining that this would make him vomit and relieve him of the snake bite - Farmer was overhead calling someone believed to be a nurse and explained to the person that one of the staff has been bitten by a snake, but that he could not travel there as he is in a different farm. The person was overhead providing advice - He was overhead chatting happily to the farming assistants that he cannot physically be in two places at the same time, but the mobile phone has solved the problem		
	- Farmer was overhead speaking to someone on how simple it is to use WhatsApp - He occasionally fidgeted with the phone and smiled		

TAM Influencing Farmer's Personal and Physical Behaviour	• At one point he was overheard having a conversation assumed to be family-related and his body language was tensed. He looked serious. His mood changed as he got deeper and deeper into the conversation but remained calm and advised the caller. He was overheard telling his wife that traveling to the scene of the family incident would cost more money and time, and that he would prefer using the phone to coordinate the meetings • Farmer was overheard speaking to someone believed to be a chief from the way he used the word 'Nana', which in English means 'king', about community support activities • Farmer started speaking to himself angrily about how the network is not letting him do his calls. He was complaining of network problems and the lack of clarity of calls
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Table 5.4 Farmer #7 ESOKO

Participant Observation Farmer #7			
	Date 14 September 2019	Start time 8 a.m.	Stop time 5 p.m.
Areas of Observation Checklist			
The Mobile Phone Technology as a Resource to the Rural Farmer	• Farmer was overheard saying on the phone that he could not afford to pay that price unless the item was on credit • A call came through to the farmer's phone and he was overheard saying 50 bags of maize has been supplied • Farmer was overheard speaking to someone to provide him with five additional farming assistants to help harvest the following week. • Farmer got a call from someone about electricity problems back at home while he was on the farm. He was seen throwing tantrums and speaking loudly about how weak the government is in supporting the rural farmers with electricity to power electrical appliances and charging their phones		
Learning to use the Phone	• Farmer was overheard asking one of the sons around how he should go to the Internet to check prices, as he had been advised to do by one of the Esoko agronomist who had earlier on visited • At one point the farmer could be seen trying to send a message. The way he was tapping the keyboard one by one, it felt like he needed help but did not want to ask • He was overheard speaking to someone on the other phone on how to use the *123# to check his call credit		
The Mobile Phone as a Boundary Object	• The farmer used the phone for different activities and different purposes • Throughout the visit of the GIZ officials, the phone was being used to talk to people assumed to be families and business partners • There was a time that farmer was overheard sending money and receiving sales, indicating how multipurpose the phone was		
TAM Influencing Farmer's Personal and Physical Behaviour	• Farmer seemed strongly connected to the mobile phone that he was always looking at it if it was not ringing • Occasionally he flipped the smart phone over to see if he had received a message or otherwise • Any time a light seemed to flash on the phone, or it beeped, he was quick to check and see if there is something happening on the phone • Farmer got a call from someone believed to be a family member asking for support. He was overheard saying he would send them money after going home		

These tables provide insights into the participant observation as undertaken to complement the in-depth interviews in understanding the life of the rural farmer in using the mobile phone technology and beyond. The findings and detailed reflections are provided in Chapter 6. The activity notes are attached as appendices.

5.8.3 Field Journal for the Participant Observation

Gephardt (2004) posited that a field journal is a diary of activities kept to support field research. Kellehear (2020) goes further to say that field journals could include sketches, diagrams, sketches, notes with times as to which the activities being observed in the field happened. These information helps the researcher to remember the activities that happened when the action on the field was taking place. Field journals and notes are recorded in languages that best describes the action without dilution of the action. This can be English and or in local languages (Allan, 2020). Field journals are written taking into consideration details of time, activities, observations, and behaviour in the field. As part of the participant's observation, a journal and daily activities with time were kept for the two participants that were observed. The observational notes start from the times Farmer #7 and Farmer # 22 were visited (*see Appendix 16*). These notes helped the author to visually picture and remember the activities that happened in real time and to document accurately in line with the views of Kellehear (2020). The notes contain the activities that went on during the observations all through to the time that the observation finished as indicated in Field Diary in Appendix 16 page 274.

5.9 Data and Respondents' Access

Savard and Kilpatrick (2022) posited that successful results in qualitative interviews with hard-to-reach respondents depend on being able to understand and connecting with them for who they are. This was also supported by Abrams (2010), who indicated that for access to the hard-to-reach population there is the need to engage with them through their community settings to be able to understand them. Before the actual data collection, consultations took place with the community leaders and the farmers who had voluntarily agreed to participate in the research study. This took place in the Chief's palace at Ekye Amanfrom, on the market day for

these farmers. The Kwahu farmers are a group who never open up to the public. They are secretive and hold information close to their chest. Indeed, in times past, any government official approaching them to discuss government issues, particularly in relation to the payment of taxes, would be lured onto the farms to be harmed. Gaining access was made possible because the researcher's parents are natives and farmers working with the community in the district. Even so, it was difficult to establish a rapport and to get the farmers to agree to volunteer for the project (Abram, 2010). Twenty-four farmers agreed once the purpose of the study had been explained and they understood that the researcher was not a government official wanting to find out more about their earnings. Even then, the farmers were sensitive in interviews when asked about their annual income:

‘I can’t tell you how much I earn because I move money between my farming businesses. Why do you want to know? Have they sent you to come and investigate us?’ (Farmer #2)

5.10 The Researcher as an Instrument for Negotiating Access to the Field

In qualitative research, negotiating access and recruiting respondents successfully depends on establishing good relationships with the potential respondents. Chughtai and Myers (2017) even go further to say that through the establishment of the rapport, and a connection between the author and the respondents, the author can understand, interpret and describe the respondent's culture and lived experiences – an aspect the researcher fulfilled in the current study.

The researcher is a Ghanaian male from the Kwahu district but does acknowledge that having studied and worked abroad for the past 22 years means that, although he has insight into some of his respondents' values and ways of interacting in the world, there may be instances and situations he cannot understand. He considers himself as Kwahu, not just by birth but also through compliance with the traditions of the Akan tribe, which is the dominant tribe in the district of the eastern region of Ghana. Though he has lived outside of the district and abroad, he has regularly visited home throughout this time because his parents and siblings still reside in the district. This has enabled him to keep abreast with the changes taking place in the district, meaning that he therefore considers himself as knowledgeable about Ghanaian culture and about the lifestyle of the respondents in the district.

Prior tribal knowledge about the district and the dynamics allowed for an intensely focused in-depth study, conducted in 2018 and in 2019, of the MOFA and Esoko farming groups without compromising rigour. The researcher spent a month in 2018 and a month in 2019 conducting the in-depth interviews. These could not be done continuously and concurrently, for two reasons: different planting seasons between the Esoko farming groups in the Kwahu North area and the MOFA farmers in the Kwahu South, East, and West area; and the fact that the Esoko farmers live on islands and on the banks of the Afram River. Between June and August, when the opening of the Akosombo Dam causes the water level to rise, it is difficult to access these farmers except by canoe. (Sometimes, the rising water levels may even destroy the farmer's crops.) However, the roads from Kwahu Tafo through to Adawso, where it is possible to hire a canoe or boat to cross the Afram River, are not suitable for vehicles. These factors, combined with the rainy season that takes place between June and August, make travel difficult and no farmer will be willing to grant an audience to anyone at this time. In September, when it was time to collect the data, the author had to hire a canoe to visit the Dwarf Islands; the commercial boats on the river seemed to have outboard motor problems, but the author managed to get to the island in a paddled canoe. The work of Amundsen *et al.* (2017) and Van Maanen (2011) might indicate that just two separate periods, each of one month (September 2018 and September 2019), were too short a timescale in collecting data which was aimed at understanding how farmers in rural Ghana adopt mobile phone technology and learn to use it. However, there are compelling arguments that the length of time a researcher spends in the physical field does not determine the strength of the studies. Instead, it is the quality of the data, the rigour of the research, the intensity of the work and the ability to get into the worlds of the respondents that matters (Jeffrey and Troman, 2004; Reid and Russell, 2017; Farias, 2019; Rao *et al.*, 2019). By accepting the primacy of the ability to grasp, record and describe in depth the accounts of the respondents in their natural contexts, it is possible to conclude that compelling insights can indeed be gained from just two months spent collecting the data.

5.11 Data Analysis and Tools Used

The interviews with the farmers were recorded with their consent. The data was transcribed into a Microsoft Word document before being uploaded onto NVivo 12 for analysis. Braun and Clarke (2006) posited that transcribing interviews provides an opportunity to become

immersed in the data, which helps to generate insights into emerging concepts and themes. Undertaking the interview transcriptions and reading of the 24 transcripts provided a good insight and knowledge of the farmers. This made it easier to remember the relevant comments in a broader context and helped in the analysis section. This helped to identify reoccurring words, including: regular communications, mobile money (MoMo), networks, social media, payments, belief, easy to use, travel, saves time, simple technology, '*megyina abonten na me kasayi*' ('can talk from anywhere'). These words were grouped to generate the first order codes. The farmer's descriptions, key terms and phrases were all put together to identify similar. A thematic analysis was adopted to analyse the data following the steps of Braun and Clark (2006). First, the researcher familiarised himself with the data by trying to gain an in-depth understanding of the farmers. This was carried out by reviewing repeatedly the videos, the audios and the pictures taken, aligning the review with the questions asked and thinking deeply through them. Next, was the generation of the initial codes. Next, coherent patterns were identified leading to the development of subcategories. Finally, five main themes were identified (Braun and Clarke, 2006; Saldaña, 2015). These themes were revised several times to ensure validity and clarity. Continuous and rigorous interrogation of the data provided four main themes which are fundamental in understanding how and why farmers in rural Ghana adopt mobile phone technology to facilitate their farming business activities. These were the mobile phone technology as a resource, learning and development in using the technology, the mobile phone as a boundary object, how usage of the technology influences farmer's behaviour, and finally, constraints associated with mobile phone technology use. Table 5.5 presents a summary of the codes, categories, and themes of the main empirical study in Appendix 2. As can be seen from the table 5.5 in appendix 2 the codes were derived by interrogating and revisiting the transcripts many times, and eventually the categories and themes emerged. The author links the analysis with that of the participant observation of two farmers, one from each farming group and the two forms of data revealed similar themes, codes, and subcategories. The next section provides insights into the ethical issues that were addressed.

5.12 Ethics

Research ethics govern the moral principles that researchers must follow in carrying out their work. They help define appropriate behaviour for the researcher in relation to the respondents or those who become the focus of the study (Traianou, 2020). In adhering to the guidelines from the University Research Ethics Committee (UREC) at Oxford Brookes Business School, the research was designed to ensure that confidentiality, data security and the rights of all the respondents are taken into consideration (Saunders, 2012). Even so, there were some challenges for the researcher in response to sensitive questions about farm sizes and income, as well as family set-up. As already described, the farmers in this area are hard to reach and keep to themselves and do not open easily (Savard et al, 2022). They avoid anyone they believe to be from the government. They do not want to talk to them at all, let alone answer sensitive questions connected to their job or their income.

To overcome these barriers and to encourage the interviewees to talk, the researcher worked hard to build rapport with them – through his parents, who are natives of the community, through the local community chief and the union committee chairmen, and through the tribal leaders. Communicating with them in the local language, and exchanging greetings before the interviews, also made it easier to overcome barriers (Abrams, 2010). As this research involved the recording of conversations and farming activities both by video and audio, it was explained to the farmers who were interviewed and observed what this would entail. They were also given consent forms to complete, which they did willingly. In the process, the farmers were assured of their privacy and confidentiality, and were given the guarantee that these would be respected, and that their anonymity would also be protected (Saunders, 2012).

5.13 Quality Issues

On collecting data, quality issues were considered based on the criteria suggested by Miles and Huberman (1994) and Yin (2009) (see also Lincoln and Guba, 1985 and Saunders *et al.*, 2007). These are internal validity, external validity and reliability. Validity refers to the methods used to study what is intended to be studied. In the case of this research, the in-

depth interviews and observations were appropriate to understand the farmer's adoption of mobile phone technology and how they learn to integrate the capabilities they acquire into the farming business activities. Validity is strengthened where there is a good fit between theory and model (Herman *et al.*, 2019).

In collecting the data, clarity was sought from the farmers to make sure that they did understand the research objectives and the research questions. This helped to minimise potential misunderstandings with words like *platforms*, and to minimise salient issues about the purpose of the research, its benefits to the farmers, how confidential the discussions would be and whether there would be any third-party interference (i.e., from government). Data that was collected and stored on recorders, including field notes and on computer tablets, and were then transferred onto a laptop, which was protected by password. This laptop was kept safe under lock and key by the researcher. In addition, quality was enhanced by using multiple sources to collect the data, specifically observations and semi-structured interviews. The table below thus provides further insight into the techniques for establishing validity and reliability in qualitative research developed by the researcher but adapted from Miles and Huberman (1994) and Yin (2009).

Table 5.6: Techniques for Establishing Validity and Reliability in Qualitative Research

	Qualitative Research Techniques	Phase of the Research in which the data Occurred
Construct Validity and Confirmability	Multiple Sources of Evidence – semi-structured interviews and observations	Data Collection and Report Writing
Internal Validity and Credibility	- Matching the analysis with patterns - Ensuring that the findings and the concepts are systematically related	Data Analysis Data Analysis
External Validity and Transferability	- Used Esoko and MOFA farming groups in both in-depth interviews and observations to understand how farmers in rural Ghana adopt mobile phone technology. - Defining the scope and boundaries of the research - Compared evidence with existing literature. Provision of full account of theories and ideas	Research Design and data Collection Research Design and Data Collection Data Analysis and Discussions
Reliability and Dependability	- Ensured connectivity between research issues and the research design - Recorded observations, interviews, and actions as concrete as possible	Research Design and Data Analysis Data Collection and Analysis

Source: Adapted from Miles and Huberman (1994) and Yin (2009)

5.14 Research Reflexivity

In research, the process by which the researcher shows self-awareness and is able to self-criticise while reflecting on the impact of the research, is called 'reflexivity' (Palaganas *et al.*, 2017). On reflection, the researcher examined the impact that building relationships and interacting with the farmers in the field had on the data collection (Dodgson, 2019; Hogg and Maclaran, 2008). Reflexivity is an integral part of qualitative research and contributes to the validity, integrity, and trustworthiness of the research (Denzin and Lincoln, 2008; Whitaker and Atkinson, 2019). This influenced the researcher throughout the research process, not least during data collection – and especially in making observations while in the field.

A good qualitative research study requires trustworthiness, which Whitaker and Atkinson (2019) claim can be realised if the author of the research is able to demonstrate that the research is credible and dependable (Lincoln and Guba, 1985; Hogg and Maclaran, 2008; Dodgson, 2019; Whitaker and Atkinson, 2019). Good reflexivity was key to this.

The research should also acknowledge challenges and be able to show how these were mitigated. Hammell (2002) and Whitaker and Atkinson (2019) posited that criticality, authenticity and plausibility are essential in persuading the audiences of qualitative research of the merit of qualitative knowledge. Plausibility is achieved when claiming a fit between the data collected and the inferences made. In this study, plausibility was achieved as the author included information about and reflection on the research processes. Qualitative research is deemed authentic if the author can convince the audience that all interpretations emerged from the data collected, and that the author understood the world of the respondents who provided the data (Lincoln and Guba, 1985; Dodgson, 2019; Whitaker and Atkinson, 2019; Kapiszewski and Karcher, 2021). Secondly, the author of the research should also be able to demonstrate that they fully understand the respondents who provided the data for the research. The author of this study is a Ghanaian by birth and from the Kwahu District, which gave him knowledge of the tribal issues, cultures, tribal alliances, and the politics underlying the tribal issues in the district.

The author saw through the tribal dynamics of the district during the research processes and understood the nuances of subjectivity that risked influencing the findings. For example, during dinner time, the father is served first followed by the children and visitors. Mothers normally eat last. This helped to ensure that the interpretations made from the research data were grounded in the lives and worlds of the respondents – and that the use of a respondent’s quotations, as well as field notes, in the analysis section of the study accurately reflect the respondents’ views and meanings.

5.15 Chapter Summary

This chapter critically evaluated the research methodology deemed appropriate for addressing the aims of the study and answering its key research questions. The chapter began by discussing the research philosophy and the approaches taken, then addressed the philosophical assumptions of the study. The chapter also provided insights into the two-phase approach of the data collection. First was a pilot research of 10 questions which revolved around the Resource-Based View (Barney, 1992) and Kolb’s (2014) learning theories. The findings from the pilot study necessitated the introduction of two further theories to help further understand how adoption of the mobile phone technology influences rural farmers’ behaviour, allows them to be in two places at the same time, and also bridges the gap between time and space. These were under the lenses of the Technology Acceptance Model Davis (1989) and the Boundary Object theory (Star and Griesemer, 1989). Using the two main farming groups in the Kwahu Area of MOFA and ESOKO, 12 farmers each were purposively selected and interviewed in-depth between 45 minutes to 1 hour. The interview centred on the four main research questions developed from the theoretical lenses. This was further backed with participant observation Jorgensen (1985) to help understand the rural farmer’s adoption of the technology beyond farming. Braun and Clarke’s (2006) five-step approach to coding was adopted to finally arrive at the codes, categories, and themes. The ethical principles underpinning the research were also considered, followed by the researcher’s reflections – which align with generally accepted qualitative research principles – on ensuring credibility, trustworthiness, and the creation of valid knowledge (Palaganas *et al.*, 2017; Dodgson, 2019; Pousti *et al.*, 2021; Davis and DeWitt, 2021). The findings based on the data collected from the field are discussed in Chapter 6.

CHAPTER 6 – EMPIRICAL FINDINGS

6.0 Introduction

This chapter sets out the empirical findings of the thesis. It is divided into four sections. Section 6.1 discusses the demographic factors of farmers involved in the thesis. Section 6.2 seeks to answer two core research questions with their sub questions. Before answering the sub research questions, the findings provide insights on how Information Communication Technology for Development (ICT4D) influences the adoption of mobile phone technology. Research Question 1 explores the ways that the adoption of mobile phone technology influences the farming business activities of rural farmers in Ghana. Its sub questions are: (i) how the Resource-Based View of the firm frames the understanding of mobile phone technology use by farmers, and (ii) how the Technology Acceptance Model helps explain the behaviour of farmers in rural Ghana. For Research Question 2 on how rural farmers in Ghana learn to adopt the technology and integrate it into their farming business activities, the two sub questions are (i) the ways the mobile phone is seen as a Boundary Object, and (ii) how Kolb's Learning Cycle explains the process of mobile phone adoption. Section 6.3 discusses the constraints and problems farmers encounter using the mobile phone technology and how they manage them. Section 6.4 concludes the chapter with insights gleaned from the findings.

6.1 Demographic Factors of the Farmers

Appendix 2 provides demographic data for the 24 rural farmers who are the subjects of the thesis. This data helps to provide insight into their farming business activities, set within the context of what is defined as a small business in Ghana. Small Businesses (SBs) employ between 6 and 29 people with fixed assets of less than \$100,000 whereas medium-scale enterprises employ between 30 and 99 people with fixed assets of up to \$1 million (Kusi *et al.*, 2015). Please see Appendix 4 for table 6.1 on farmers' demographic profile.

6.1.1 Insights from the Farmers' Data

Table 6.1: Farmers' Data and Ethnicity

Age	Number of Farmers	%
31–40	6	25%
41–50	6	25%
51–60	6	25%
61–70	5	20%
71–80	1	5%
Total	24	100%

The above table describes the respondents in terms of age. The data shows that 25% of the farmers interviewed were 31–40 years old, 25% were 41–50 years old, and 25% were 51–60 years old. Interestingly, farmers who were above 60 years of age also represented 25% of the sample interviewed.

Table 6.2 Ethnicity vs. Farmers

Ethnicity	Number of Farmers	%
Akan	17	70.83%
Muslim Konkomba	7	29.10%
Total	24	99.93%

As regards ethnicity, the data shown above indicates that farming in Kwahu district is dominated by natives (Akan) at 70.83%, whereas the Muslim Konkomba (migrants) who have settled in the area form 29.1% of the total.

Table 6.3: Mobile Phone Ownership and Networks

Mobile Phone Ownership and Networks		
Number of Phone Handsets	Number of Farmers	%
1	6	25%
2	17	70%
3	1	5%
Total	24	100%

In terms of ownership of mobile phones, the primary data collected showed that 25% of farmers owned 1 handset, 70% owned 2 handsets, and 5% of the farmers owned 3 handsets, as indicated in the table above. Farmers who used more than one handset explained that

brands like Techno and Itel offered stronger and clearer reception for receiving calls. Additionally, these phones, which are mostly dual SIM, could connect to networks even in the remotest parts of the farms and were able to withstand adverse weather conditions.

‘You see this phone [Techno], it is stronger and can take two SIMs. This is always with me when I am on the farm, whether rain or shine. The other one I keep at home.’ Farmer #14

Farmers also cited a reluctance to rely on one service provider in case of problems. Finally, they noted that there was a sense of status involved: the more handsets a farmer had, and the more they rang, the more that farmer had the status of a business person.

6.2. How Mobile Phone Technology Adoption Influences Farming Business in Rural Ghana

6.2.1 ICT4D and the Adoption of Mobile Phone Technology

The findings indicated that on a micro level, the mobile phone technology supported the rural farmers operationally for their day-to-day activities. All the 24 farmers indicated that using the mobile phone technology helped them, and without it they would have been able to do less on the farm, especially in the planting season. It also helped with marketing and connecting with customers. As some farmers put it:

‘Everyone comes to Adawso and Ekye Amanfrom to buy my yams and maize on Tuesdays and Fridays. There are three main customers who come to load and send transport the food to Kumasi and Accra. We do business on the phones before they come’ (Farmer #6)

‘My money is always in my account on my phone. Why go to the bank and queue?’ (Farmer #18)

The above quotations from two of the farmers provided insights into the ways and different contexts in which the technology helped the farmers – for example, to gain access to markets and in managing their finances without having to go to the bank.

During the participant observation, Farmer #7 was overhead talking to someone of the dangers of carrying physical cash to markets rather than loading them into their wallet, reinforcing knowledge about the business and economic benefits associated with the adoption of the mobile phone technology by farmers. This highlights the importance of ICT4D

use in developing economies. However, it is of interest to note that none of the 24 farmers interviewed could explain how using the technology helped improve Ghana's Gross Domestic products, a macro influence of ICT4D. As a farmer indicated,

'Mobile Money is what everybody does here. How does this give the government money when they don't know I am using it and I don't talk to them?' (Farmer #20)

The next section addresses Research Question 1, 1a and 1b which sought to investigate why rural farmers adopt mobile phone technology and how they use it to support their farming business activities. The findings are presented below.

6.2.2 The RBV of the firm and Mobile Phone Technology use by Rural Farmers in Ghana

This section explores how the RBV helps to frame an understanding of how the mobile phone technology is used by the farmers in rural Ghana. The findings indicated that the technology acts as (i) a business resource, helping in areas of sales and marketing, health and business insurance, mobilising finance, access to agriculture inputs and weather information, and (ii) a resource that provides the farmers with technological capabilities using social media platforms, websites, and social networking. Farmers who acquired these capabilities went on to develop competences through content development and sharing, as discussed below. The findings also include information from the participant observations, which corroborated the interviews.

(i) The Mobile Phone as a Business Resource for the Rural Farmer

A technology for facilitating marketing and sales information

The mobile phone supported the marketing and sales of farmers produce according to 18 of 24 of the farmers. Customers called to check on the availability of produce, and farmers discussed the quantity of what needed to be supplied on the phone even before the market days. All the farmers, during the interviews complained that they had challenges of storage and transportation, which led to spoilages of most of their produce in cases when they could not sell it all.

Farmers have sometimes had to give away for free foodstuffs that could not be sold, including yams, plantains, maize and avocados, because they could not take them back to the villages.

However, the use of mobile phones helped them to avoid that problem as explained by Farmer #13 below.

‘There was an occasion where I had to give out 10 bunches of maize and avocados for free, as I could not take them back to the village. Those times are over. With the mobile phone, I arrange orders with customers before they come so I bring to the market what they request. I sell without excesses’ (Farmer #13)

This finding highlighted the importance of the mobile phone technology being a pivot in coordinating the marketing activities for the farmers, who had access to no other technology than the mobile phone:

‘With my phone I market before going to bag my cocoa’ (Farmer #17)

With the use of mobile phone technology, the process of connecting with regular customers before market days has improved. Customers provide specifications and quantities and even complete financial transactions through mobile phone technology. This gives the farmers some guarantee of sales:

‘Before coming to the market, I call my customers. I ask them the quantities that I should bring. Some of them do not allow me to bring them myself, but rather come with a truck or a lorry to load my plantain and the bananas. Do you think all this preparation ensuring smooth sales would have been possible without the phones? You tell me.’ (Farmer #20)

During the participant observation, Farmer #7 was overheard using the mobile phone to take sales orders, negotiating prices, and trying to agree on what was reasonable for the maize he had to supply. The observation data therefore confirmed how farmers use the mobile phone for marketing and sales.

Financial resource mobilisation

The 24 farmers had the option to register the SIM card in their phone for mobile money (MoMo) or banking services, depending upon the network. With keen subscriber competition between the three main networks (MTN, Vodafone, and Airtel-Tigo), mobile banking and savings services had become the strategy to win more customers. The data showed that half (12) of the rural farmers were unbanked – that is, they did not have bank accounts – and even the other half that had accounts, did not use them. The farmers also explained that the mobile

phone technology, and its access to the networks, enable them to get instant cash in a form of short-term loans for emergencies:

‘What is the point in having a bank account when I have to go and queue at the bank for money the whole day without being able to go to farm? What is the point when the banks are collapsing because the big men are siphoning off other people’s money? With mobile money and my mobile wallet, I have my money in my pocket! When I need a loan, I can call MTN and they can [put] up to 500 GHS in my wallet account immediately to pay my workers or do something. I don’t have to go to the bank to beg or waste time.’ (Farmer #17)’

‘I have been using MTN for over 20 years and have mobile money SIM and do mobile banking with them. Any time I need money they give it to me.’ (Farmer #6)

The farmers were able to speed up their business activities with the offer of short-term loans, their expected funds being used as collateral. One farmer indicated:

‘When I wanted a loan of GHS 1000 from MTN. They asked me if I am expecting money coming in. I told them I am expecting sales of about GHS 10,000 from the sale of maize. On the basis of that they immediately authorised GHS 800 into my wallet’ (Farmer #9)

In the observation, Farmer #22 emphasised how helpful the mobile phone has been in supporting his business. In a conversation with another person, he was overheard saying that he used the mobile phone to receive and send money from the bank, and for making payment for pesticides and weed killers. Some farmers also indicated that they used the mobile phone to access business and health insurance.

Facilitating the provision of insurance policies

In addition to supporting financial mobilisation, the mobile phone enabled the farmers, through its network providers, to access health insurance policies that allowed them to access medical advice outside the government National Health Insurance Scheme (NHIS).

The findings indicated that the technology also gave 10 out of the 24 farmer’s access to medical advice from doctors and nurses 24 hours a day, through an insurance policy designed for the rural farmer by a micro insurance company called BIMA Ghana. The farmers bought the policy with the support of BIMA officers and paid their premiums through their mobile wallet. Once the policy is in place, they receive medical advice, as well as health information from doctors via their mobile phones. By enabling a mobile health service (m-health), mobile

phone technology has created innovative ways for farmers to manage their health, and the health of their families (Hampshire *et al.*, 2015). Indeed, there are hundreds of thousands of farmers in Ghana whose location might otherwise deny them access to medical facilities.

‘The mobile phone is my saviour! One day I had a snake bite on the farm. With the phone, I called the insurance people, and they sent a motor rider with a nurse from Tafo to come and help. I would have died [without] the MTN BIMA insurance people!’ (Farmer #1)

Five of the 10 farmers also had some form of business insurance policies from the telephony companies to protect their business. These farmers indicated that the insurance brought a sense of relief because they no longer needed to rely on the government-run business insurance policy services.

‘This time I don’t fear thieves when sending the driver, going to the farm or feeling sick because I have insurance too’ (Farmer #3).

Facilitating access to agriculture inputs and weather information

Fundamental to a farmer’s success is information and access about the agricultural inputs required. The agriculture inputs ranged from machinery (combine harvesters, tractors, cocoa-spraying machines) to seedlings and fertilisers, insecticides and weedicides. These were either government-supplied through MOFA or sold by companies in the private sector.

As transportation infrastructural issues made it impossible for the MOFA and Esoko extension facilitators to deliver these inputs in person, mobile phone technology becomes the conduit that facilitates the quick transfer of information and access.

‘When I needed Oseltamivir (Tamiflu) or Zanamivir (Relenza) for my pigs, I spoke to RMG, an agricultural input agent in Accra, who had some in stock. I purchased them using my phone. “WO ye Guy”, the famous Accra-Nkawkaw driver, brought them to me in Nkawkaw’ (Farmer #2)

In the life of the rural farmer, being able to get access to regular weather information was fundamental to their business because it allowed them to prepare for the planting season. Five of the farmers indicated that the mobile phone technology helped them with access to weather information. The research showed that these farmers used mobile phone technology

to receive weather information from friends, extension officers and agronomists, and call centre staff.

‘With the phone I can check markets and weather in an around the area.
I call friends and other farmers when I am not sure of these’ (Farmer #11)

Table 5.5 in Appendix 2 below provides a summary on how the rural farmer saw the mobile phone technology as a resource. These were sales and marketing, provision of health and business insurance, financial resource mobilisation and a technology to facilitate access to agricultural inputs as well as monitoring weather conditions. Of these four perspectives, sales and marketing seemed to have the highest number of farmers, 18 out of 24 of them alluding to the benefit that this technology provides. The technology had another benefit: according to half (12) of the farmers who were unbanked, it enabled access to MoMo transfers and also helped to mobilise funds and short-terms loans with their expected funds being used as a collateral. These funds advanced to the farmers were forms of overdrafts payable once payments came into the mobile wallet. Having realised how important the MoMo and banking was to these rural farmers, the telephony companies also added insurance to protect and support some of the farmers according to the study, facilitating and managing these through the mobile phone. Furthermore, the mobile phone enabled nine farmers to access agricultural inputs and weather information, which were fundamental to the success of their businesses. The next section presents the findings on how the mobile phone technology offers capabilities in support of the rural farmers business.

(ii) Mobile Phone Technology Enhancing Farmer’s Capabilities

The study indicated that while farmers used the mobile phone technology, they developed skills and knowledge that allowed them to be able to do their farming activities better. As part of the interview, farmers were asked if they knew the use of mobile phone platforms as part of the capabilities they have acquired. The study showed that 17 out of the 24 farmers as seen in appendix 6 developed capabilities in the areas of (i) financial resource management, via the use of mobile money (MoMo), (ii) social media, through Facebook and WhatsApp, and (iii) research and communication capabilities.

Mobile Banking and Mobile Money (MoMo)

On financial management and access, half (12) of farmers indicated that they have a MoMo account, which serves as their main banking facility.

‘I have a WhatsApp and MoMo on my phone, this is my bank’ (Farmer #11)

These farmers developed capabilities in using MoMo and the mobile banking to support their farming activities. Despite the above capabilities that the technology provided, these farmers also indicated that they face constant threats from scammers pretending to call from the telephony companies. If they were not careful and gave out their mobile wallet PIN, believing that the call was genuine, the scammers stole the money in their wallet by transferring it into another account, which the farmer could not then trace:

‘Someone called me saying he had mistakenly sent money into my account, so I should resend it to him, so I went to the mobile money merchant to resend the money and the merchant realised that he was a fraudster’ (Farmer #3)

Social Media, WhatsApp and Platforms Usage

As part of the study, farmers were asked if they used any social media platforms. The most popular platform was the WhatsApp platform. As can be seen from in appendix 6, 17 farmers out of the 24 knew about WhatsApp and used it.

‘Recently I opened a WhatsApp account which I use to check information and what is happening in the world’ (Farmer #10)

Some of the farmers went further to explain during the interview how using the mobile phone technology has helped them to develop their skills, enabling them to explore how platforms can be used for marketing advantages through content sharing and development:

‘I don’t pay for any person to develop an advert for me, but I have a lot of customers through networking and sharing of pictures and videos of my farms with my customers’ (Farmer #18)

‘The display picture of my WhatsApp is the signboard you see near the road as you enter my farm. This is what everyone who wants to contact me through WhatsApp will see’ (Farmer #19)

‘Oh yes, I know about platforms. I have a YouTube account, I have developed video and put on my YouTube and Instagram account. I also have a Facebook account. So, these platforms (as I call it) helps me market my products because I get enquiries which some of them, the people, follow up to come and buy’ (Farmer #19)

Although the mobile phone technology facilitated knowledge exchange through social networking, there were two farmers who indicated that the social networking groups they joined offered them nothing more than noise and irrelevant information that often didn’t help. As one farmer puts it,

‘I am on many WhatsApp platforms for agriculture and farming. There are three of them. On two of them sometimes I don’t bother to check the messages as there is no need and it does not help at all. Sometimes nothing relating to agriculture’ (Farmer #5)

‘The social media platform for my WhatsApp is a waste. Sometimes they put messages and audios that does not help our farming business’ (Farmer #9)

Notwithstanding the negative experiences of the above two farmers, other farmers indicated that joining these social media platforms, especially the WhatsApp groups, provided them with access to social networks, which gave them access to local markets within Ghana and enabled the regular exchange of information on best farming practices. The findings indicated that some farmers who developed capabilities did not know what a platform is but seemed to have developed the knowledge of using them.

‘Oh yes, I have a WhatsApp. I think everyone nowadays use it. Is that a platform?’ (Farmer #8)

Nonetheless, three of the farmers were aware of the mobile phone as being itself a platform that they use. To these farmers, having knowledge of the word *platform* means having knowledge of the mobile phone. But Farmers #17 and 18 seemed to have full knowledge of platforms, and have made them fundamental to the core of the farming business:

‘I use platforms a lot. I use WhatsApp for messages. I belong to the farmers’ association and have family WhatsApp platforms. We get a lot of messages. On the farmers’ platforms this includes messages about sales, weather, and prices (Farmer #17)’

Research and Communication Capabilities

Using the mobile phone technology helped the farmers to develop research and communication capabilities. The study indicated that as farmers continued to use WhatsApp and other internet facilities, the phone allowed them to explore for information about the world and agriculture.

‘To me better communication and research has helped to know more about the piggery and what other farmers like me are doing around the world’
Farmer #19

‘For me the only things I do most on the phones are calling, sending WhatsApp and my MoMo which is registered on the phone. I am more confident in talking than before’ Farmer #5

The two farmers above indicated how using the mobile phone technology has helped them to develop skills of research and communication. Despite the security drawbacks, the use of MoMo, WhatsApp and other social media platforms for communication and research seemed to have been the most important capabilities that the rural farmers acquired through the adoption of mobile phone technology. This section is concluded with appendix 6 which sums up the capabilities achieved by the farmers.

(iii) Competences Achieved

Based on the capabilities achieved by the farmers, the analysis also identified that 17 of the 24 farmers achieved various competences. The specific competencies that farmers achieved were on (i) customer relationship management, (ii) social networking, (iii) researching, and (iv) content creation, development and sharing.

Customer relationship management

Farmers indicated that the mobile phone allowed them to communicate constantly and freely with their customers. Of the 17 farmers who achieved various competencies, 4 indicated that that they stored the customers’ details on their phones, and as a result were able to communicate with them. These details included names, location, and the products bought.

They also knew how to manage their relations with them in terms of the supply of products, credit facilities and payments. Two of the farmers indicated:

‘The mobile phone allows me to keep good relationships with customers at Nkawkaw. They don’t need to come here’ (Farmer #1)

‘I have given different songs to most of my customers, so I know who is calling. This is good because I have their information’ (Farmer #16)

These two quotations reveal the competences developed for customer relationship management and emphasise how these had been fundamental in helping to improve the rural farmers’ business. When farmers were asked how these data helped to improve their businesses and give them an upper hand over other farmers, the four farmers indicated that a successful long-term business relationship was based on the information they hold on their customers.

Social networking

Farmers developed the competences of social networking and that helped create opportunities for access to new markets and a new customer base. Out of the 17 farmers who were able to socially network using the technology, 12 of them indicated that using WhatsApp and other social media platforms enabled them to develop social network skills. These farmers indicated that they were connected to different social networks on the platforms. They made friends with customers and shared information about farming. And as a result, they were able to identify new markets – as two farmers put it:

‘Now I use the mobile phone to connect to customers, many friends and family members, making my connections with them easier’ (Farmer #3)

‘Using the mobile phone to do Facebook has allowed me to meet many friends, some of them are farmers’ (Farmer #13)

As shown above, the study indicated that farmers developed advantages through social networks. As farmers registered on various social platforms, they connected with other like-minded farmers. And through the exchange of information on best farming practices, using videos and advice from farming experts, they acquired a wealth of knowledge that could allow them to perform better than other farmers without these competencies.

Researching on best practices and access to local and international markets

The study indicated that of the 17 farmers who developed competences in using the mobile phone technology, 4 out of them were able to advance their skills further, exploring the benefits that using the internet brings in terms of research and access to information. These four farmers used the mobile to research agricultural practices, prices, and weather and agrochemicals.

‘The smart phone and the apps allow me to research more about best farming practices, prices and many more’ (Farmer #5)

Despite the benefits that the internet provides, it cost the farmers a lot in terms of data. Nonetheless, one farmer felt it was worthwhile because of the wealth of information that it brought to his farming business:

‘Though the internet always eats my bundle, I get different ideas on how people are farming on YouTube. It is good to see. The officers also send me videos sometimes’ (Farmer #20)

Of the 24 farmers interviewed, 9 indicated that using mobile phone technology with access to the internet could enable them to sell their produce in new markets locally and abroad, and that could bring them more money, since in some local markets they were priced down.

‘I hope to be able to export one day. The problems of storage and roads and transportation are too much for us. We produce more we sell less. It is a big problem’ (Farmer #1)

‘Who will help us sell abroad *eii* that will be a great opportunity where I can check everything on my phone? Selling here in Ghana is a problem, as we don’t get what we deserve’ (Farmer #4)

‘One day the light will shine for us to sell some of our yams and maize abroad. The time will come one day. We have been getting calls from people who claim to be from abroad, but I don’t know if they are real or wants to scam us’ (Farmer #3)

Content creation, development and sharing

On content creation, development and sharing, 5 of the 17 farmers supported their marketing activities by creating contents using pictures and videos of their farms. They pieced these pictures together in the form of a collage or developed them into a slideshow, with the addition of a voiceover or songs, and then sent this to customers:

‘I don’t pay for any person to develop an advert for me, but I have a lot of customers through networking and sharing of pictures and videos of my farms with my customers’ (Farmer #18)

‘The display picture of my WhatsApp is the signboard you see near the road as you enter my farm. This is what everyone who wants to contact me through WhatsApp will see’ (Farmer #19)

The above insights highlighted the farmer’s development of competences through creativity and learning from the use of mobile phone technology. It also demonstrated how the rural farmers’ competences helped them to facilitate their farming business activities. However, in spite of the opportunities provided by creating content, the findings showed that not every farmer was keen to try, for two reasons: a lack of skills and the cost of data. As one of the farmers put it:

‘Though I was not much interested in this because it will consume my credit and data, my son is teaching how to record my farm videos and put on the farming platforms I join. I enjoy doing this’ (Farmer #24)

Though not every farmer was keen to explore some of the advantages that the technology brings, the findings clearly indicated that the farmers who used the technology developed and enhanced their competences, which provided them with competitive advantage. Representative samples of the quotations on core competences are provided in Appendix 7, page 259-260.

6.2.3 How the Technology Acceptance Model Explains Rural Farmers' Behaviour in Mobile Phone Technology Adoption

The Technology Acceptance Model (TAM) (Davis, 1989) is an information system theory model that provides insights into how users come to accept and use technology. Davis (1989) posits that user acceptance of a technology is influenced by four factors, which results in the actual system usage or adoption. The factors are (i) external variables, (ii) perceived ease of use (PEOU), (iii) perceived usage (PU), and (iv) behavioural intention (BI). The findings of the study are presented in response to Research Question 1b in Chapter 1. Information from the participant observation has also been incorporated here too.

6.2.3.1 External variables and influences

Sociocultural Factors (Family, Friends and Community and Network Providers)

Mobile phone adoption aided communications beyond the farmers' environment, widening their links with families and other social networks. These interesting insights emerged from the findings: for 17 of the 24 farmers studied, social and cultural peer influences in the local farming environment, as well as from the farming managers, influenced the adoption of the mobile phone technology. For example, two of the farmers expressed their sense of pride in owning and using a mobile phone and explained how it raised their standing in the eyes of the local people, and indicated their belief in its wider benefits to their business and their community as indicated below:

'The Moslem and Konkomba community is strong here. We do most activities to support one another, and the mobile phone helps a lot. (Farmer #3).

'The mobile phone is my business and the business in my pocket. I feel more confident and a businessman! When my phone rings, and this one is also ringing, you see how busy I am. People are talking about business, money, and family. In fact, everything' (Farmer #11).

The phone also generated a feel-good factor, enhancing confidence and happiness. The busier the farmer's phone in terms of calls, the more he was perceived as an astute business person, rich in the eyes of the community and of other farmers.

Topography, Transportation Problems and Weather

Notable among the external factors influencing technology adoption in Kwahu district in rural Ghana are transportation, weather, and armed robbery problems according to 13 out of 24 of the farmers. It is impossible to connect with the rest of the world without the mobile phone. This is because Kwahu lies on top of the Odweanoma hills, stretching from Mpraeso all the way round the district, sharing borders with Akuapim and Ashanti Akim Agogo. The findings indicated that the topography of the land meant there was no access to landline telephone facilities, so the farmers had no alternative than to rely on the use of the mobile phone. As one farmer put it:

‘Had it not been for the mobile phone, I would not have had many contacts and connections with other farmers, as no one wants to come to this area and get their lorries or cars stuck in the mud during rainy seasons’ (Farmer #1)

6.2.3.2 Lack of confidence in traditional banks

The study provided the interesting insight that the adoption was also influenced by the lack of confidence in traditional banks. Overall, half of the farmers (12 of 24) were influenced by the banking services provided by the mobile phone companies. Out of those 12 farmers, 8 indicated that they didn't trust the banks due to corruption and bureaucracy. In addition to these 8, another 4 farmers who did not have access to traditional banks emphasised that they depended on the innovative financial services like MoMo. Furthermore, the findings revealed a recent state of instability in Ghana's financial sector: six banks had closed as well as many savings and loans companies. The customers of these banks lost all their money. Investigations have proved that the boards of these banks and the managers were corrupt, siphoning off customers' deposits into other investments (Kosiba *et al.*, 2020). This had been widely reported in the news, including on the radio, so the farmers were aware of the issue. As MoMo has been offered in Ghana for some time without any major problem, the farmers using these services had become more confident and trusted it more as a farmer indicated:

‘Have you not heard in the news about the closures of banks and Susu [micro finance] companies in Ghana? The directors of six banks have stolen people’s money. Now when you go there you cannot get your money. My money is in my mobile wallet’ (Farmer #20)

6.2.3.3 Trust and security associated with the use of mobile phone technology

The lack of confidence in the traditional banks and the heightened trust in MoMo also came with its own ramifications: some customers had encountered fraud and security issues. Notwithstanding, the analysis highlighted that trust in technology-based systems was founded not on the reputation of the organisations but on the services that the technology offers to the rural farmer, to meet their needs. Trust and security were also found to be fundamental in establishing business relationships with the customers, according to 12 of the 24 farmers interviewed. The findings indicated that trust in a business relationship depended not only on the longevity of the business but on community relations (how connected the owner managers are with the community) and how consistent the service delivery was. For the mobile phone companies, farmers trusted them based on the support and the consistent benefits they got from the technology all the time.

‘I have been using MTN since the Mobitel era and do not have problems with them. I can access calls in most of the locations, though the airtime is costly. I have not had problems, I trust them’ (Farmer #22)’

However, buying credit or airtime to keep the phone up and running seemed to be an issue that farmers grappled with. Even so, they maintained positive relationships with the technology providers. The farmers’ dependence on the use of mobile phone technology and platforms were clearly visible in the findings, resulting also in the actual system use. This seemed to have been based on the idea that the mobile phone technology was the only communication tool connecting them to the outside world – keeping them in close relationship with their families and, at the same time, helping them to work on their businesses. This made the farmers feel more attached to the technology, with some believing that they could lack information and lose customers without their phone:

‘The phone is very close to me. I don’t feel well when my phone is taken to repairers or develops a fault. The mobile phone is part of my business and me. That is why I bought it’ (Farmer #14)’

Despite the above, it was difficult to determine whether the farmers would have developed such a trust and confidence in this technology if there had been alternatives in the areas where their farms were located.

6.2.3.4 Support from telephony companies

The study indicated that some of the 24 farmers received support through education and advertising messages as well as from the telephony officers or assistants. These sometimes came in the local languages. The media houses have collaborated with the telephony companies to develop programmes that supported the adoption and use of mobile phones. Programmes like *Farmers' Hour* were popular among the farmers, the analysis of the interviews showed. They got to understand the technology better, which in turn influenced their use of the technology:

The messages and the news, which is provided to me, and the *Akuafomere nie* [*Farmers' Hour*], which I listen to via the phone, have opened my mind and I have learned a lot from it to do my farming business' (Farmer #12)

Other farmers felt differently, however:

'Vodafone keeps sending me messages like three to four times every two days. I don't know what they want me to do. When I check it, they take my credit. So, it is a waste. I don't bother about it anymore' (Farmer #8)

This shows that not every farmer felt that the support they got from these companies influenced them to use the technology. A summary of some of the farmers' responses from the interesting insights on the external variables is shown in appendix 8 under five subsections. These: are (i) sociocultural and community networks, (ii) topography, weather, and transportation issues, (iii) lack of trust and confidence in the traditional banks, (iv) trust and security, and (v) support from telephony companies. With some representative samples of the quotes from the farmers in appendix 8 table.

6.2.3.5 Perceived ease of use and usefulness (*Simplicity of the technology*)

The Technology Acceptance Model posits that the speed and nature of the adoption of a technology depends on perceived usefulness (PU) and perceived ease of use (PEOU) (Davis *et al.*, 1989; Venkatesh *et al.*, 2003; also Ajzen, 2015). Consistent with the literature on the reasons why the rural farmers adopt the technology, all the farmers in the study affirmed the PEOU of the technology:

‘The phone is not too complex to use’ (Farmer #16)

‘Once you know how to make calls, that is all. You learn from there’
(Farmer #9)

‘This is not like the normal telephone. It does the same work and even more than the big phone’ (Farmer #1)

6.2.3.6 Supporting gender and demographic change in farming

The ease of domestication of mobile technology has not just made different activities possible but has also attracted women and graduates into farming according to 5 of the 24 farmers. Of the 5 farmers, 3 were women and 2 were graduates. The available literature on farming in Ghana indicated that farming as a business was once an activity only for men, for people with no education or for the old (Danso *et al.*, 2004).

This is not the case now. The study shows that farming is beginning to evolve with technology playing an important role. The following interview excerpt draws out some of the issues here:

‘As a university graduate, one might ask why I am not working in the office but rearing pigs. It is a business I wanted to do, and the mobile phone technology is helping me in finding customers and [for] marketing purposes’ (Farmer #18)

Not only is technology attracting graduates into farming, it is also attracting women. In Ghana, most women are subsistence farmers, farming at a smaller scale to support the family; their main role is to support their husbands or male partners and to take care of the home and the children. Anything related to big business lies in the hands of the husband, who is traditionally the head of the family, the key decision maker, and the person in charge of the family finances.

Though 3 out of 24 (12.5%) of the sample were women who had taken on farming for business. They indicated that it was the mobile phone technology that helped them to do so. These women called the mobile phone their 'farm manager' because they used WhatsApp and other farming applications to recruit farming assistants during planting and harvesting, purchase agricultural inputs, make payments, and seek advice from extension officers:

'When I started the maize farm with just half an acre, my husband doubted if I could do more because our fourth child was young, and I could not go to the farms regularly. I used the mobile phone to manage every activity while I remained at home doing my household duties. Today I have five acres of maize here. My husband is happy because I also bring money to him' (Farmer #13)

The quotation above provides some insight into how mobile phone technology has helped women and graduates into farming. Women have been able to do more than generate extra income in support of the family; they have been able to break into a tradition and business that has previously been dominated by older men.

6.2.3.7 Behavioural intention

On the behavioural intention to use the mobile phone technology as indicated in the TAM framework, 12 of the 24 farmers indicated seeing the other farmers using the phone to manage their farming business, and the fact that sometimes they had to go and borrow or rent the technology to make calls or do business, encouraged them to get their own in order to facilitate their business and to enjoy the status enjoyed by other farmers using the smart technology, as two of the farmers indicated.

'I feel good and happy when I bought my own mobile phone to do my farming business and I have told friends to get it too (Farmer #2)

'Being confident, [I] have a high standing and feel good using the phone, I don't want to miss this' (Farmer #13)

The findings further indicated that mobile phone technology improved the farmers' self-sufficiency and their belief in themselves.

Being able to communicate with family and customers, as well as to buy agricultural materials, made five of the farmers feel independent and confident in their daily activities, knowing that they could rely on the mobile phone to support their farming work. There was also a sense of pride in owning more than one phone.

‘I have learned how to plan. You see on this phone, there is a calendar. I put my things to do every day there. I also put dates for meetings there as well. When I wake up every morning, I check that and plan my daily activities’ (Farmer #12).

6.2.3.8 Actual system use

Referring to the actual system use of the TAM model, all of the 24 farmers used the mobile phone technology to communicate, while other uses included managing sales, marketing, customer and supplier relationships management, financial transactions, developing sociocultural networks, research, monitoring weather and enhancing perceived security and trust. As seen from the data so far, the majority of farmers indicated that the mobile phone provided advantages due to the various uses of the technology. These farmers felt that their life, both on and off the farm, improved due to the use of mobile phone technology as they acquired extended capabilities that helped to improve their farming business. Some of the farmers also felt that the mobile phone technology improved their self-belief and the will to do things themselves, knowing that they could rely on the mobile phone to support their farming work. A farmer put it in this way:

‘Using the phone for some time now, I can now check my MoMo without having to call my wife or son to come and see how much I am paid from a customer, hahahaaaa! I think about the mobile well as the same as my children. When I wake up in the morning, it is the first thing I check’ (Farmer #3).

In the participant observation, Farmer #22 seemed confident and trusted the technology for conversations with the family and other people connected with his mobile network,. The farmer was gleeful about how the technology has helped to improve social and family

relationships despite the challenges related to transportation costs and bad weather conditions. This farmer seemed to have developed good relationships with the community and the Nananom (elders and chiefs of the community) because the mobile phone could be used for this, strengthening the belief and trust associated in using the technology. This was also due to the simplicity associated with the use of the technology and how easy to use it. Appendix 9 sums up some of the quotations from the farmers on the actual system usage.

6.3.0 How Rural Farmers in Ghana Learn to Adopt Mobile Phone Technology

Research Question 2 sought to understand how rural farmers in Ghana learn and integrate that into their farming activities. This research question takes into consideration two sub questions. These are: (i) In what ways does mobile phone technology become a boundary object in influencing farming activities and relationships in rural Ghana? (ii) How can Kolb's Learning Cycle help to explain the process of mobile phone adoption by Farming Small Business Entrepreneurship in rural Ghana? The findings are presented against the backdrop of the two theories relating to the sub questions: the Boundary Object Theory (Star and Griesemer, 1989) and Kolb's (2014) Learning Theory.

6.3.1 The Mobile Phone Technology as a Boundary Object for Farmers in Rural Ghana

Star and Griesemer (1989) posited that boundary objects are entities that enhance the capacity of an idea, theory and practice to translate across culturally defined boundaries. Boundary objects could be artefacts, documents or ideas that help people from different communities to build a shared understanding. Boundary objects could also be described as repositories, field notes and maps. This is because they can be used in different ways by different communities, and for collaborative work purposes.

The findings position the mobile phone technology as an artefact consistent with the literature but provide interesting insights into how farmers in rural Ghana use it as a boundary object. The way the technology is used by the rural farmer is put under three sections: (i) a bridging device, (ii) a relationship-building technology that improves time and space, and (iii) a technology that eliminates generational divides. These interesting insights are presented from 6.3.1.1 through to 6.3.1.3.

6.3.1.1 The mobile phone technology as a bridging device

The study indicated that 23 of 24 of the farmers studied believed using the mobile phone technology bridged the relationship between them and their world, and enabled them to sort out issues involving business, family, friends and community.

‘Sometimes I am on the farm but advising family to do things at the same time’ (Farmer #13)

The findings from the participant observation by Farmer #7 and Farmer #22 corroborated the results from the other farmers. In the observation, for example, Farmer #7 was on the farm but could be seen connecting to customers and families. Farmer #22 was on the farm, but at the same time he was calling other people to check prices and speaking to family members. This was possible because the mobile phone was at the centre of all the farmers’ activities. That is, the technology made it possible for them to connect with stakeholders and business partners including workers, customers and extension officers, as well as with family, friends and community members. With the use of the technology, farming issues could be resolved regarding, for example, work allocation as well as fertilisation activities. This is an interesting insight and new to the literature. Farmers felt like they were in two places at the same time – at home while also on the farm. From home while performing other duties, they could also advise farm assistants and request updates. With the advancement of technology through WhatsApp and video calling, farmers could connect with the activities on the farm as indicated below:

‘You are interviewing me here on the farm, but I can easily know what is happening at home. When I am at home, I can video call the farm to see the workers or explain things to them’ (Farmer #5)

‘Using the mobile phone is like having my customers with me. Time is not a problem doing business with them’ (Farmer #7)

Farmers were at times not on the farm site. In fact, some travelled out of the village but were able to work using the phone to facilitate their activities. Nonetheless, an overreliance on the technology and its associated benefits could take the farmer away from the reality of what was happening. For example, while video calling seemed to show what the workers were

doing on the farm, once the farmer hanged up the phone, did the actual activity differ? What's more, this was costly, as video calling and using WhatsApp consumed more data than regular telephone calls. A summary of some of the farmer's responses to seeing the mobile phone as a bridging device is seen in appendix 10

6.3.1.2 Shifting Context: Improving Time and Space through Relationship Building

Apart from enabling them to be in two places at the same time, most of the farmers indicated that mobile phone technology helped them to connect well and improve relationships with most of the stakeholders involved in helping to improve agriculture. These included NGOs, money providers, customers, suppliers of agrochemicals, extension officers, agronomists and sellers of fertilisers. Interestingly, and new to the literature, 23 of the 24 in the study farmers indicated that using the mobile phone technology made farming easier due to improved relationships with the above key stakeholders. According to the farmers, the mobile phone technology has brought close contact with NGOs including international organisations like *Deutsch Gesellschaft für Internationale Zusammenarbeit* (GIZ) from Germany which supported these farmers with technical advice. Getting access to these stakeholders had always been a challenge to these farmers due to location problems.

But with the use of the mobile phone technology, relationships improved through communication, advice and the supply of agro products. Farmer #22 corroborated this also during the participant observation.

'In Ghana, as you know, getting Veterinary Officers to travel all the way to this place is difficult; they claim these places are difficult to reach due to bad roads and are hilly, so their cars can't come. But with the mobile phone they can advise us on keeping the cattle safe. They advise us on medication when they are sick' (Farmer #7)

'Before the GIZ Germany officers came to see us here at Maame Krobo, we plan communication before they came' (Farmer #22).

The farmers indicated further that there is now a swift and constant flow of information – for example, about progress or the availability of farm produce. Secondly, the mobile phone saved time, which could be used more productively instead.

Farmers no longer had to travel to access information on agricultural inputs or receive advice from agronomists and veterinary officers. The empirical evidence indicated that the mobile phone technology facilitated and improved farmers', veterinary and extension officer relationships. When prices changed, for example, these farmers received the information quickly through the mobile phone without having to travel:

‘When there are changes in price, we get the information quick because of the phone’ (Farmer #2)

The study showed further that the technology allowed all the farmers to be in two places at the same time. The technology was seen as a platform allowing many farmers to work with it no matter their location. All the farmers were not in one location but were spread across the district. However, some were near to the townships, whereas others were in the remote villages that were accessible only by tricycles popularly known in the Ghanaian language as ‘Aboboyaa’. These farmers saw the mobile phone as a tool that solved the problem of regular travel and improved communication with the stakeholders in agriculture. With the mobile phone technology, farmers were connected to each other and shared information regularly. Appendix 10 presents some of the farmer’s responses to seeing the mobile phone as a device that improved time and space through bridging relationships.

6.3.1.3 A technology that eliminates gender and generational divides

The mobile phone technology was also seen to have eliminated gender and generational boundaries, allowing both women and university graduates to do the same male-dominated job of farming in the Kwahu district, according to 5 of the 24 in the study.

‘As a woman and a mother, I could not have done this farming as a business without the phone. This is because even when I am looking for workers, planting, spraying the farms, I use the phone to organise these activities while at home preparing things for my husband and the kids. I am not always on the farm’ (Farmer #9)

The effect is that the three women were gradually being liberated from their traditional role of housewife, doing the household chores, taking care of the children, and, if they were farming at all, doing so only for subsistence purposes.

Traditionally, the man is the main contributor of the household income and therefore makes the decisions, which every member of the household must accept.

‘When I started the maize farm with just half an acre, my husband doubted if I could do more because our fourth child was young, and I could not go to the farms regularly. I used the mobile phone to manage every activity while I remained at home doing my household duties. Today I have five acres of maize here. My husband is happy because I also bring money to him’ (Farmer #13)

Thanks to mobile phone technology the three women farmers who participated in the study have a voice, enabling them to share some of the best practices with their husbands and sometimes to contribute to the household budget from the proceeds of the farm. This gives wives a measure of financial freedom.

6.3.2 How Kolb’s learning Cycle Helps to Explain Mobile Phone Adoption by Farmers in Rural Ghana

The study draws on Kolb’s (2014) Learning Cycle to provide insights into how farmers in rural Ghana learn to use the mobile phone technology. Kolb’s (2014) Learning Cycle is a four-stage learning process based on concrete experience, reflective observation, abstract conceptualisation and experimentation. Kolb (2014) indicates that effective learning is achieved when a learner enters these stages. Kolb also said that a learner could enter any step of the cycle using a logical sequence. The findings are discussed under the four-stage Learning cycle but the responses of the farmers combined experience with experimentation. The other stages discussed are reflective observation and abstract conceptualisation. Under reflective observation and abstract conceptualisation are information that represents some of the quotations from some of the farmers that supports the interesting findings which Kolb’s model appears to be silent on. This section is concluded with skills that farmers acquired in the learning process.

6.3.2.1 Learning through concrete experience and experimentation

The findings showed that farmers generally learned in the process of experiencing and experimenting the use of the technology simultaneously. It was clear in the findings that all the farmers learned through practice but did not follow a conventional formal approach in learning to use the mobile phone technology. One farmer described his experience in this way:

‘Using the phone is like practice every day. I learn something like sending money or checking WhatsApp. Now I can load credit or load my phone with credit, I learn through experiencing using the phone. I learn something new every day’ (Farmer #5)

Even though the farmers had study manuals or guides accompanying the mobile phones they bought, they never followed the manuals to learn. Thus, all the 24 farmers relied mostly on their own understanding and abilities, making mistakes in the process.

‘Any time I get a new phone or want to do something on the phone like load credit, or fix a SIM card, I do it on my own. Sometimes I make mistakes. I keep doing and doing until I get it right’ (Farmer #2)

As some tried to fix their phone batteries, change SIM cards, upload credits or buy airtime they made mistakes. And in the process, according to the findings, learning took place. The 24 farmer’s explored opportunities associated with the use of the technology in areas like managing battery life span, not downloading so much music or things that they might not need and which slowed down the memory of the phones. As the farmers used their different approaches and methods, learning took place.

‘Like I said to you earlier, my learning to use the mobile phones [takes place] through trial and error. I don’t follow any book. I am a farmer’ (Farmer #1)

‘Me de3, me p3 mfekyere fekyere paa. This means I like experimenting [with] new things that the phone can do. I try these sometimes. In the process, I learn new things’ (Farmer #23)

Observing Farmer #7, it was clear that he too has learned to use the technology: how he was flipping the phones, sending, and responding to messages and multitasking all indicated the knowledge he had acquired having access to the phone over a longer period.

6.3.2.2 Reflective observation

Based on Kolb's Learning Cycle, the farmers studied would be expected to reflect, rethink and reorganise themselves, and then observe others as part of the learning stages for using the mobile phone technology – but the findings proved that farmers didn't always learn that way. Instead, 23 of the 24 farmers stated that they often relied on two groups of people to support them in their learning processes if they could not learn on their own. These groups were (i) their children and (ii) the community and staff of the telephony companies. How these farmers learned using these groups are explained further below.

Support from Children (Reverse Parenting)

The analysis of the data showed that farmers were often supported by their children in learning to use mobile phone technology. Out of the 24 farmers interviewed, 17 indicated that they asked their children for help, whether sending messages, accessing financial information or saving documents. These farmers acknowledged that their children shared ideas with them about new ways that the phone could be used, including for managing the farm – teaching them how to use WhatsApp, sending pictures/videos and creating a diary for customers.

'Me, I did not attend school because I was interested in farming from a young age. One day I needed to download something on my phone. I did not know how to do it. I called my son, who came and taught me how to download and save the app I was looking for. When it comes to preparing and sending messages to customers, I call my son' (Farmer #16)

Reverse parenting has the advantages of bringing children closer to the farming business and deepening the bonds between parents and children. However, it was also acknowledged by 3 of the 24 farmers that too much support from children took away the parents' ability to learn and to do things independently, increasing their reliance on their offspring.

Problems can then arise when children move away from home or go to school, as the farmers must look for external support when they were not educated sufficiently to use the technology by themselves. However, not all the farmers always involved their families, as one of the farmers described:

‘I try to use the phone myself. I have not gone to school. If I can’t do something on the phone, I ask my children or wife to help me but sometimes I don’t want to depend on them too much. When they are not here, what do I do?’ (Farmer #15).

Learning through Friends, Community Members and Mobile Phone Company Staff

The findings further show that 6 of the 23 farmers occasionally asked friends, community members, their fellow farmers and telephony company staff how to use some of the functions, like uploading credits to browse the internet or using apps to access content on agrochemicals, pricing information, even new networks – all examples of activities that would not have been possible without support.

‘There is a teacher friend in my house that helps me to set up or load data or credit when I need to. The same teacher helps me when I have a problem. If he travels, I go to MTN office in Abetifi to get these resolved’ (Farmer #24)

‘I learn from my friends and by myself. I also learn through social media and search engines. When I get information on prices, weather or agrochemicals, I share it on WhatsApp. I also use it if it helps or watch the videos. Nobody taught me to learn. I play with the phone, look for search engines, and type in this ... or that ... when I have data to do so. That’s how I get to use it.’ (Farmer #13).

The telephony company staff also helped these farmers to learn how to manage their call credits, keep their money safe in their wallets, reset their phones when needed, and even taught them some of the basic uses of the phones like making calls, sending messages, loading credits, and receiving and sending money:

‘When I bought this phone from ITTEL office, they asked me if I can set it myself and I told them no. The customer service person was

good to me. She taught me how I must insert the SIM and top up with credit. I learned something. If I have a problem, I take it to them, and they help me or the assembly man who lives next door to me in my community' (Farmer #10)

'[The] Konkomba community leader is very helpful when it comes [to] using the phone. Sometimes he gathers a few of us in his compound and educate us how we need [to] keep our password safe and change them if needs be. He went to school, some of us did not' (Farmer #3).

It was observed that when Farmer #22 could not find something he was checking on the phone, he called one of the workers for help. He was also heard asking someone on the phone how to load credit because he was running out of data. Appendix 11 provides samples of the quotations on how the rural farmers learn to use mobile phone technology reference to Kolb's Learning Cycle reference to concrete experience, experimentation and reflective observation.

6.3.3.3 Abstract Conceptualisation

No formal learning methods, Self-learning without a plan, Community support, Educational programmes

The findings contradicted Kolb's (2014) concept of abstract conceptualisation. All the 24 farmers did not have formal learning programmes to follow and there was also no logical approach to follow. The farmers did not rely on school educational programmes but learned as they go along using the mobile phone technology. There was nothing keeping formal documents or a scientific process in line with Kolb's (2014) Learning Cycle of abstract conceptualisation. As one farmer put it:

'I think the mobile phone teaches me as I use it. I don't need to read or follow any book I learn as I go use the phone every day at 62, I am too old, hahaaaa!!!'
(Farmer #21)

The participant observation findings from Farmers #7 and #22 corroborated the views of Farmer #21: neither of the two farmers was seen to be reading or using a handbook or notes when using the phone. The findings from the observation showed that these two farmers flipped through the phone when they were searching. During the observation Farmer #22 seemed to be searching for something on the phone, and when he could not find it after

several attempts, he resorted to help from one of the farming assistants. The study also showed that farmers learned through informal radio educational programmes, normally organised by governmental and non-governmental agencies. MOFA, for instance, has produced programmes on the radio about agriculture and sometimes sent extension officers to radio stations to discuss farming practices, fertiliser applications, planting for increased yield, and seasonality issues. The farmers received a wealth of information, as well as advice on problems they faced. It was interesting to note that the radio facility on the phone was what enabled the farmers to tune into these programmes no matter their locations:

‘On this phone, there is a radio. I listen to news; I always listen to Akuafo mere nie [Farmers’ Hour]. I am with Vodafone, and they send me messages about these. Some farmers help us to understand the program or get into it on our phones if I can do so’ (Farmer #16)

In addition to the programmes organised in collaboration with the radio stations, the 24 farmers also learned informally through regular updates and information from the telephony companies. Once the farmers registered with a particular company for their network services, they maintained relations through SMS, promotional messages and the occasional call to see how they were doing. Some farmers reported that they learned occasionally about food prices or agrochemical information via their phones, as well as about security issues – educating them on what to do should someone contact them purporting to be from the company’s head office, about winning the lottery or telling them to provide Personal Identification Numbers (PINs) to their mobile wallets. This level of information formed part of the process through which farmers learned how to use the technology effectively and safely. Interestingly, these messages and communications came in different local languages, which made the farmers feel that they were being addressed personally – as one farmer confirmed:

‘MTN sometimes sends me messages on discounts and credit packages as well as messages to warn us about scammers. The messages and the news which is provided to me using the phone has opened my mind and I have learned a lot from it that helps my farming business. Occasionally I get information about maize prices. When the messages come, I can listen to them in Twi.’ (Farmer #7)

Appendix 11 show samples of the quotations showing the informal approach through which majority of the farmers learned.

6.4. Constraints Associated with Rural Farmers' Mobile Phone Technology Adoption and Use

Despite the benefits associated with mobile phone technology use, the findings also show that the mobile phone technology presented farmers with problems, as the regulatory systems in Ghana are weak and do not check the institutions that manage these services (Issahaku and Nkegbe, 2018; Amoako, 2014). The analysis highlighted the following issues: (i) network problems, (ii) data breaches, and (iii) the high cost of credit or airtime as constraints associated with the technology. However, the study showed that farmers adopted the technology and managed these problems, though an overwhelming number emphasised these problems: 21 out of 24 of the farmers interviewed.

6.4.1 Network problems

Mobile phones were used in an increasing variety of development initiatives – for example, to educate and support farmers in planting processes and on the application of agrochemicals. However, 21 out of the 24 farmers indicated that there were constraints associated with its use. These farmers did not have access to the networks in all places. Of the 21 farmers, there were 18 who described these problems further, indicating that their problems to network access were due to their farms being located in mountainous and thickly forested areas, meaning it was more difficult to always get connectivity in those areas. Interestingly, they still adopted it because of the lack of alternatives:

‘Yes, I have a network problem; sometimes you see the sign on the phone, sometimes it is not there; even if you call, it keeps cutting out. But when I use the yam phone [from Tecno], I do get networks sometimes even if I am on the farm. We call it the “yam phone” because the design is not nice. It’s like a yam but it works well!’ (Farmer #13)

However, many farmers believed that the type and brand of the phone used counts as much as location. The Tecno analogue phone (or ‘yam phone’) seems sometimes to provide better access to the network. Yet, the design of the phones also brought its own problems. Describing a phone as a ‘yam phone’ indicated it is bulky and therefore difficult to always keep on your person; in Ghana, a yam tuber is bulky, no matter the size.

6.4.2 Data breaches

It was of interest to note that the spate of security and data breaches were a source of concern for the farmers. Even so, they adopted the technology because they needed it. The data breaches occurred where thieves were able to access farmers' PINs, SIM card details and their mobile wallets to commit fraudulent activities – something that was costing not just the farmers but also the telephone companies, according to 18 of 24 of the farmers. The first quotation below explains the farmer's experience:

'One day I got a call from MTN that I should give my PIN for my wallet. I did not. I called them back to ask what they needed the number for, and they said they had not called me. They told me that someone attempted to withdraw money from my wallet but could not do so because they changed the security settings. I was advised to go to the main branch office at Mpraeso for them to help me change the settings and be issued with a new PIN' (Farmer #4)

'We hear on radio and from MTN and Vodafone to keep our MoMo details safe from scammers' (Farmer #11)

6.4.3 High Cost of Airtime (Credit)

The cost of credit or airtime was also an issue. Despite the high levels of trust that many farmers felt in their phones and mobile providers, some felt they did not get their money's worth in terms of airtime. The 18 farmers believed that the companies either did not credit their phones in full for the amount purchased or used a technology that meant their credits were used up quickly, forcing them to buy more. This was because losing contact with their customers impacted on their business relationships and led to the problems of lack of storage associated with the local marketing of farm produce.

'You get too many messages from MTN and Vodafone. When you open them, they eat up your credit' (Farmer #10)

Farmers who always had access to credit and airtime were likely to be more competitive than those unable to ensure such continuity in the use of mobile phone technology. Details of farmers constraints associated with mobile phone use are in Appendix 13

6.5 Chapter Summary and Insights

The purpose of this chapter was to present the findings of the data collected on mobile phone technology adoption and learning by small farming business in rural Ghana. The findings showed the many ways through which mobile phone adoption enhanced the businesses of the rural farmers in the study and therefore highlighted the importance of ICT4D use in farming in rural Ghana – a developing economy. The findings were presented in line with the two main research questions, under which there were two sub questions each.

Research Question 1 was: *In what ways does the adoption of mobile phone technology influence the farming business activities of rural farmers in Ghana?* Under this, the two sub questions were: (i) how can the Resource-Based View of the firm help to frame an understanding of mobile phone technology use by Farming Small Businesses in Rural Ghana? (ii) How can the Technology Acceptance Model explain the behaviour of farmers in rural Ghana when adopting mobile phone technology as part of their farming business activities?

Research Question 2 was: *How do rural farmers in Ghana learn to adopt the technology and integrate it into their farming business activities?* This also had sub questions: (i) In what ways does mobile phone technology become a boundary object in influencing farming activities and relationships in rural Ghana and (ii) how can Kolb's Learning Cycle help to explain the process of mobile phone adoption by Farming Small Business Entrepreneurship in rural Ghana?

The presentation of the in-depth interview findings in this section were also backed with participant observation data from two of the farmers who had previously been interviewed.

6.5.1 The mobile phone as a resource for competitive advantage

Research Question 1a sought to understand how the Resource-Based View of the firm helped to frame an understanding of mobile phone technology use by Farming Small Businesses in Rural Ghana. The findings indicated that the farmers saw the mobile phone from three perspectives: (i) as a business resource, (ii) as a technology that enhances the farmer's capabilities, and (iii) as a technology that was helping farmers to improve their competences. To answer Research Question 1a, the findings clearly indicated that most of the farmers achieved competitive advantage through the use of the mobile phone as a resource and their

extended and enhanced capabilities and competencies. Most farmers stated that the mobile phone was a resource that enabled them to do several important activities in their farming businesses. The activities included: (i) facilitation of marketing and sales through communication with customers about the availability of produce, quantities and delivery, (ii) financial mobilisation and banking services wherever they were, (iii) accessing health and business insurance policies, which in turn allowed them to access medical advice and protect their produce from incidents such as theft, and (iv) accessing information on agricultural inputs and weather. By enabling the performance of these important farming activities, the mobile phone proved to be a very important resource to the farmers in this study.

The findings indicated further that the use of the mobile phone enabled the farmers to develop important skills and knowledge that enabled them to be able to do their farming activities better. Nearly two thirds (17) of the farmers developed capabilities related to (i) customer relationship management, (ii) mobile money (MoMo) and financial resource management, (iii) social media usage through Facebook and WhatsApp, and (iv) research capabilities. These capabilities enabled the farmers to successfully run their businesses. For example, in managing customer relationships.

Using the capabilities acquired enabled most of the farmers to develop competencies related to farming business. For example, some of the farmers developed competencies in areas of sales and marketing, managing customer data and accessing new markets. Others developed competencies in the creation of content, using videos and pictures to market their farm produce through social media particularly WhatsApp. Furthermore, some of the farmers who had access to mobile money (MoMo) were able to mobilise finance such as short-term loans using their mobile banking facilities. This enhanced their ability to manage their financial transactions without having to go to the bank. A few of the farmers also browsed the internet and regularly searched for market opportunities, information on agrochemicals and fertilisers as and when needed. This study therefore shows that the mobile phone provided competitive advantage to the farmers, not necessarily because the technology is variable, rare and inimitable as the Resource-Based View theory indicates (Barney, 1992) but because of the capabilities and competencies that they developed while using the phone.

6.5.2 TAM influencing farmers' personal and physical behaviour

To understand how the Technology Acceptance Model explains farmers' behaviour when adopting mobile phone technology in reference to Research Question 1b, the findings showed that the adoption of the technology influenced the farmers behaviour based on the following factors: (i) external variables, (ii) perceived ease of use (PEOU) and usage, (iii) behavioural intention to use the technology, and the (iv) the actual system use.

On the external variables, the findings showed that for the majority of the farmers, their behaviour towards the adoption of the mobile phone had been influenced by their ability to improve social and cultural relationships, bringing family and friends together. The mobile phone also facilitated and enhanced the farming business, helping them to manage their customers, organise well their farming activities while maintaining their family.

Apart from improving business and sociocultural relationships, the majority of the farmers cited additional factors influencing their adoption of the mobile phone, like the mountainous nature of the lands and the areas where the farms were, poor transportation networks, lack of access to landline telecommunications and weather conditions. These factors compelled the farmers to rely on the use of the mobile phone technology to stay connected to the rest of the world and to do their business activities. Perceived trust and security associated with using the mobile phone technology was also seen as fundamental to the adoption of the technology. The findings indicated that distrust in the high street and commercial banks due to corruption and the embezzlement of clients' deposits deterred some of the farmers from opening a bank account. On the other hand, farmers were being lured by the telephony companies to open a mobile banking account, and they were given assurances that their deposits and funds were safe. Thus, some of the farmers who were unbanked all had a MoMo account instead of a high street bank account. In addition, the need for technology to promote social and demographic changes and encourage women and university graduates to get into farming have also helped the adoption of mobile phones.

Regarding perceived ease of use (PEOU) and perceived usage of the technology, the findings indicate that the farmers were influenced to adopt the technology because of its simplicity in terms of the design and the interface. Some of the farmers indicated that the technology is simple and not complex to use. The simplicity of the technology influenced their behavioural intention to adopt, in addition to the fact that the technology influenced their status in the society. In addition, the majority of farmers stated that the mobile phone provided advantages by improving their lives both on and off the farm due to the extended capabilities that helped to improve their farming business.

6.5.3 The mobile phone as a boundary object

The farmers easily domesticated the technology and adapted it to suit their farming activities. The technology was seen as a bridging device that enhanced connections and relationships between the farmers, family and friends, and community members. For example, the mobile phone bridged and enhanced relationships with suppliers regarding the buying of agrochemicals and fertilisers. Moreover, the technology made farmers feel like they were in two places at the same time. Hence most of the farmers indicated that they did not always need to be on the farms to get the employees to work, neither did they always have to travel to see customers and suppliers but could transact business deals on the phone.

Furthermore, to the farmers, the mobile phone technology was seen as a device that shifted the context of time and space between them and stakeholders, which in turn supported their farming. The farmers felt that the use of the mobile phone technology enabled them to eliminate the barriers between them and extension officers, agronomists and non-governmental organisations, including GIZ, who have been supportive of agriculture in developing economies including Ghana. Interestingly, to a smaller number of respondents, the mobile phone seemed to be gradually eliminating generational barriers, encouraging women and university graduates to go into farming. Three women stated that using the mobile phone technology had given them the opportunity to expand their farming to become businesses while still maintaining their marital and family responsibilities at home. Two farmers who were university graduates also stated that they enjoyed farming because the mobile phone technology has facilitated the management and marketing of most of the farming activities.

6.5.4 How farmers learned to use the mobile phone technology

Regarding how farmers learned, the findings indicated that all the farmers did not follow a conventional formal approach in learning. They did not use a logical approach to learn to use the mobile phone. Instead, they learned through experiencing and experimenting with the use of the technology and that was consistent with Kolb's (2014) theory. Through mistakes they learned new things and became more proficient using the technology. However, they combined experience and experimentations simultaneously while learning. However, it was interesting to find that the farmers did not mostly learn through reflective observation as suggested by Kolb's (2014) Learning Cycle. Rather, the overwhelming majority of the farmers stated that they at times relied on the support of their children to learn otherwise known as reverse parenting. Interestingly, some of the farmers indicated that in addition to the support of their children, they got support from the community and telephony staff but did not give time to reflect on what they have learned. This contradicts Kolb's (2014) theory of reflective observation, which suggests learners watch others or develop their experience watching others.

The findings further contradicted Kolb's theory on abstract conceptualisation. The farmers did not use scientific processes such as school educational programmes but learn as they used the mobile phone technology. The farmers didn't also rely on documentation on paper and scientific processes as proposed by Kolb's (2014) learning theory on abstract conceptualisation. However, some of the farmers learn informally through radio educational programmes and by themselves without a plan. In addition to the radio stations, farmers learn from the regular SMS updates on food prices, agrochemical information and security issues sent by the telephony companies to their phones. Despite all the many benefits enjoyed by the farmers through using the mobile phone, most of the farmers' recounted instances when they encountered problems associated with the use of the technology.

6.5.5 Constraints associated with mobile phone technology use

The three main constraints that farmers encountered related to networks, data breaches and the high cost of airtime. Some of the farmers indicated that network problems were common and blamed that on poor quality systems of the telephony companies, quality of the phones and the location of the farms. Another problem recounted by the farmers was that on numerous times they were targeted by scammers who wanted to access their PIN and their mobile money wallet. The high cost of airtime was another major constraint faced by the farmers. Even though the farmers trusted the mobile phone providers, the majority felt that they did not get their money's worth in terms of airtime. Yet, given the importance of the phone to their businesses, when the credits were used up quickly, they were compelled to buy more. Notwithstanding these problems, farmers generally trusted both the technology and the telephony companies, due to lack of alternatives and the long-standing relationships that had developed. The implications of the findings in this chapter are discussed in Chapter 7.

CHAPTER 7 – DISCUSSION OF FINDINGS

7.0 Introduction

This chapter draws on the literature review in Chapters 2 and 3 on mobile phone technology adoption, and how it influences farming businesses activities in developing economies and in rural Ghana to discuss the findings of the study. The literature review highlighted the debates on ICT and ICT4D supporting developing economies to promote mobile phone technology adoption (Ojo, 2020; Heeks, 2017; Mbiti, 2010). In understanding how and why farming businesses in rural Ghana also adopt the technology, the review focused on two main research questions. The first question (1) asks: In what ways does the adoption of mobile phone technology influence the farming business activities of rural farmers in Ghana? Under this are two sub research questions: (1a) *how can the Resource-Based View of the firm help to frame an understanding of mobile phone technology use by Farming Small Business Entrepreneurship in Rural Ghana?* (1b) *how can the Technology Acceptance Model explain the behaviour of farmers in rural Ghana when adopting mobile phone technology as part of their farming business activities?* The second question (2) explores how rural farmers in Ghana learn to adopt the technology and integrate it into their farming business activities. There are also two sub questions: (2a) *In what ways does mobile phone technology become a boundary object in influencing farming activities and relationships in rural Ghana?* (2b) *how can Kolb's Learning Cycle help to explain the process of mobile phone adoption by Farming Small Business in rural Ghana?*

The study is distinct because it was conducted in rural Ghana and in the Kwahu traditional area, where getting access to information is difficult since participants do not open to people who are unfamiliar to them. In the Afram Plains area of Kwahu North, there are no proper transportation routes, so the islands are reached by fishing boats. In Ghana, the mobile phone was previously seen as a gadget used in the cities and by workers doing blue- and white-collar jobs (Frempong, 2009).

However, the demystification of mobile phone technology usage has been addressed by the marketing activities of the telecommunication companies in Ghana, as well as by the word of mouth of users, contributing to its acceptance and usage (Acheampong *et al.*, 2018). Using in-depth interviews and observation, the findings of the study in response to the research questions as outlined in the paragraphs above, have been discussed based on the extant literature on the Resource-Based View (Barney, 1992), Technology Adoption Model (Davis (1989), Boundary Object theory (Star and Griesemer 1989) and Kolb's (2014) Learning Cycle.

This chapter discusses the findings of the study in Chapter 6. The discussion is structured as follows:

- (7.1) The influence of ICT & ICT4D on mobile phone technology adoption
- (7.2) how the Resource-Based View of the firm helps to frame an understanding of mobile phone technology use
- (7.3) How the Technology Acceptance Model can explain the behaviour of farmers in rural Ghana
- (7.4) the ways mobile phone technology becomes a boundary object in influencing farming activities and relationships
- (7.5) How Kolb's learning Cycle helps to explain the process of mobile phone adoption by Farmers in rural Ghana
- (7.6) the constraints associated with the technology use
- (7.7) The Summary, which offers interesting insights from the discussions, sets the scene for the conclusion of the study and takes into consideration the contributions and limitations of the study.

7.1 How ICT4D Influences the Rural Farming Business through the Associated Technologies

In terms of ICT and ICT4D the study provides insights on the macro- and micro-level influences of the technology. On the macro level, the study indicated among others that investments made into the telecommunications infrastructure in Ghana, backed by policies of liberalisation of the sector, have attracted many telephony and network companies into the sector. This has helped to increase government revenue through taxes and to create employment, consistent with the views of Heeks (2010) and Olokonyo *et al.* (2021). At the micro level, ICT4D supports the day-to-day operations of businesses. This happens in the areas of communication, payment of sub-contractors, facilitating financial transactions, and daily planning of the business activities. ICT4D knowledge extends beyond social media platforms to cover organisational and external platforms (Gawer and Cusumano, 2014; Altman and Tushman, 2017).

But in the developing world and in places like rural Ghana, ICT4D is mainly the use of mobile phone technology to communicate, for social media and for mobile banking or mobile money. These are micro-level activities which the farmers feel contributes to their development. However, there is little knowledge on how the rural farmers adopt the mobile phone technology and how they learn and integrate the knowledge and skills acquired via the technology into their farming activities. The next sections discuss the findings of the empirical study in relation to the research questions.

7.2 The Resource-Based View of the Firm and Mobile Phone Technology use in Rural Ghana

Referring to Research Question 1a, Barney's (1992) Resource-Based View (RBV) theory focuses on managerial attention to a firm's internal resources to identify assets, capabilities and competences with the potential to deliver superior competitive advantage (Amit and Schoemaker, 1993; Corner and Harvey, 1991; Conner and Prahalad, 1996). The theoretical development of the RBV has been analysed in several studies such as Acedo *et al.* (2006), Armstrong and Shimizu (2007), Lockett *et al.* (2009) and Newbert (2007), who posit that competitive advantage comes from value created and/or services offered by an organisation.

Barney (1992) says that organisations create advantages based on the resources that should meet the VRIO criteria and how they effectively use these resources. The VRIO is an acronym that stands for Value, Rare, Costly to Imitate and Organised to capture value. Theoretically, one can argue that Barney's (1992) theory could apply to the adoption of mobile phone technology by any organisation if they see it as a resource. This is because the technology offers value to everyone. However, the mobile phone is not rare because every business can acquire it. The technology can be imitated; the features and the designs of the various mobile phones are the same. Changes that normally happen are added to the original designs and shape. As an organisational resource, it serves the purpose expected of it. For farming businesses in rural Ghana, the resources they have include mobile phone technology. The findings on the reasons why the rural farmer adopt the mobile phone technology is consistent with Barney's (1992) view on what a resource is, to a business. However, the findings from the study specifically explain how farmers in Kwahu district of rural Ghana use the technology as a resource, in the way that Barney's theory generalises. The next sections discuss the findings in more detail.

7.2.1 Mobile Phone Technology as a Resource

To the farmers in this study, the technology is a resource because it supports farming activities in four areas: (i) facilitation of marketing and sales, (ii) financial mobilisation and access to banking services, (iii) access to health and business insurance policies, and (iv) access to information on agricultural inputs and the weather. Given the critical importance of these activities to the rural farming businesses, the study shows that the use of the mobile phone enabled the farmers to do these activities effectively, which in turn created advantages (Barney, 1992) for their businesses. In terms of marketing and sales, the mobile phone technology supports these farmers to undertake marketing activities. In a study in South India, Jensen (2007) indicates that the use of mobile phones by fishermen enables them to identify available markets. However, this study provides more insights on the different marketing activities undertaken by rural farmers using the mobile phone. The rural farmers use the phone to contact customers, take orders from suppliers and send information on queries and sales. Pricing and credit information are all negotiated and discussed using the mobile phone.

This includes arranging for farmers to self-load and deliver the products if customers are not coming to the villages to buy directly or on market days. Interestingly, the findings further indicate that rigorous preparations and loading of farm products are evolving as customers order in advance and pay for it electronically using the mobile money systems. Farmers supply in advance too. If customers and farmers meet in the market, little sales or exchange activity takes place because the transaction will have been arranged on the mobile phone prior to the meeting. The mobile therefore gives farmers time to spend with their customers, allowing them to build relationships and grow their business. This confirms Asongu (2013) and Paas *et al.* (2021), who claim that mobile phone enables businesses to expand when it is used to sell through e-and m-commerce via the internet. The study also found that the mobile phone was used as a resource to access payments from customers through mobile money (MoMo), raise short-term loans, and mobilise finance using their mobile banking facilities and to receive pricing messages, sometimes in their own languages. Those farmers who do not have a bank account rely on the use of the mobile banking.

In that part of the world, mobile banking is associated with money where farmers are supported with the telephony companies to upload software that allows them to send and receive money from customers, friends and family and from their banks if they have bank accounts. The findings indicate that once farmers have this software on their account, it performs the same function as a retail bank, so farmers do not have to go through the processes of opening a bank account. This eliminates the issue of handling physical cash, which farmers and customers used to have to carry during business transactions and on market days, exposing them to armed robbers who targeted the farmers and customers to rob them on their journeys during market days. These findings extend the views of Essegbey and Frimpong (2011), Agyei Kwakwa (2012) and Folitse *et al.* (2018) on mobile phone usage by medium and small-scale businesses. The social media platforms associated with the technology support farmers in advertising the produce and the farms to the customers and the rest of the world. For example, the 'DP' – the display feature on WhatsApp platforms – allows farmers to use their farming pictures to show what they have. Some of the farmers who have developed capabilities and competencies using the technology go even further, using Facebook and YouTube to advertise their produce.

They can collate photos and videos taken with the phones to form collages and share using these social media platforms to help showcase their farms, poultry and livestock to the customers and the rest of the world, though they did acknowledge that these videos and social media activities consume a lot of their data and credit, which is expensive to buy.

As a resource the technology facilitated the acquisition of insurance policies to support the health of the farmers their family and their farmers. Accordingly, farmers who have access to mobile money (MoMo) services are encouraged by the telephony companies to register for health and farming insurance policies that comes connected to their mobile wallet. Farmers saw that getting the policy was helpful, and payments were all done using the phone. According to the farmers, the insurance policy enhanced access to medical advice and their security and protection from thefts. Interestingly also, the technology supported farmers to check weather conditions and receive weather and information on agricultural inputs and extension services.

For example, farmers communicated with extension officers and NGOs who supported them on the choice of inputs such as fertilisers and agrochemicals using their mobile phones. These findings extend the views of Barney (1992), Aker (2008) and Mushi (2020) on the concept and the characteristics of resources as discussed in Chapter 2 in the literature.

7.2.2 How the Mobile Phone Technology Enhances Farmers' Capabilities

Capabilities defines what a business does, and how well they do it (Medio *et al.*, 2020). Sawers *et al.* (2008) go further to say that capabilities are theoretically grounded in the Resource-Based View (RBV) of organisations – that is, how organisations use their resources to achieve competitive advantage. As discussed in the previous section, for farming businesses in rural Ghana, one of the most important resources they have is the mobile phone technology. The mobile phone enables farmers to enhance their skills and achieve capabilities in literacy and numeracy and business applications usage, particularly in (i) financial resource management (MoMo) usage, (ii) social media usage through Facebook and WhatsApp, and (iii) research and communication capabilities.

In West Africa financial markets – both insurance and credit markets – are underdeveloped and over 80% of the population is financially excluded (Adesina, 2012). However, this study shows how rural farmers use the mobile phone technology to access financial markets. The farmers' use of electronic transfers provides a form of banking to both the banked and unbanked farmers, as well as enabling them to keep financial records. Farmers did indicate that using MoMo helps develop relationships between themselves and the telephony companies which often leads to access of short-term loans. The access to these services demands that farmers understand the use of the technology and the features, which forms part of the capabilities (advanced skills) they develop while using the phone to enjoy these services. However, some farmers did express their concern about scammers who call them purporting to work with the telephony companies. If these farmers are not careful and hand over their PINs, the scammers withdraw money from the farmers' accounts. Furthermore, the farmers in the study stated that using the mobile phone gave them the opportunity to enhance their capabilities using social media, especially WhatsApp. Using the WhatsApp social media platform allowed farmers to socially network with family, farm workers, and other farmers through farming associations.

Farmers in the study viewed the WhatsApp platform as transformational because it not only helped them with sociocultural connections but also allowed them to advertise farm produce using the display picture (DP) feature on Facebook and YouTube. The social networking and exchange of information through messages, audios and videos enhance the farmers' skills and as well as giving them a voice to contribute to farming discussions using these platforms. These insights reveal how rural farmers achieve capabilities using mobile phone technology in Ghana. In terms of research and communications, farmers were able to access information via the internet on their phones. Types of information accessed include piggery gestation periods, prices of weed killers, and market prices for maize and weather conditions. The regular weather information allowed these farmers to make plans for planting, harvesting and fertiliser applications. Armed with this information, some of the farmers can plan farming activities like planting and make sales projections as well as find out where agro inputs are cheaper.

This study therefore shows that farmers who used the technology well were able to achieve capabilities, as indicated in the literature on users of the technology in developed economies and on larger firms or business organisations (Medio *et al.*, 2020; Sey, 2011; Eisenhardt and Martin, 2000). The study, however, contributes to the discourse on capabilities by suggesting that for farmers in rural Ghana, using the mobile phone technology enhanced skills and knowledge, offering financial resource mobilisation, social media usage through Facebook and WhatsApp, and research and communication capabilities. This study therefore provides specific examples of how the mobile phone is used to contribute to economic development by the rural farmers, and currently the literature provides little insights into these activities (see, for example, Abubakre and Mkansi, 2022).

7.2.3 Competences Acquired by Farmers in Rural Ghana using Mobile Phone Technology

(Extended Capabilities)

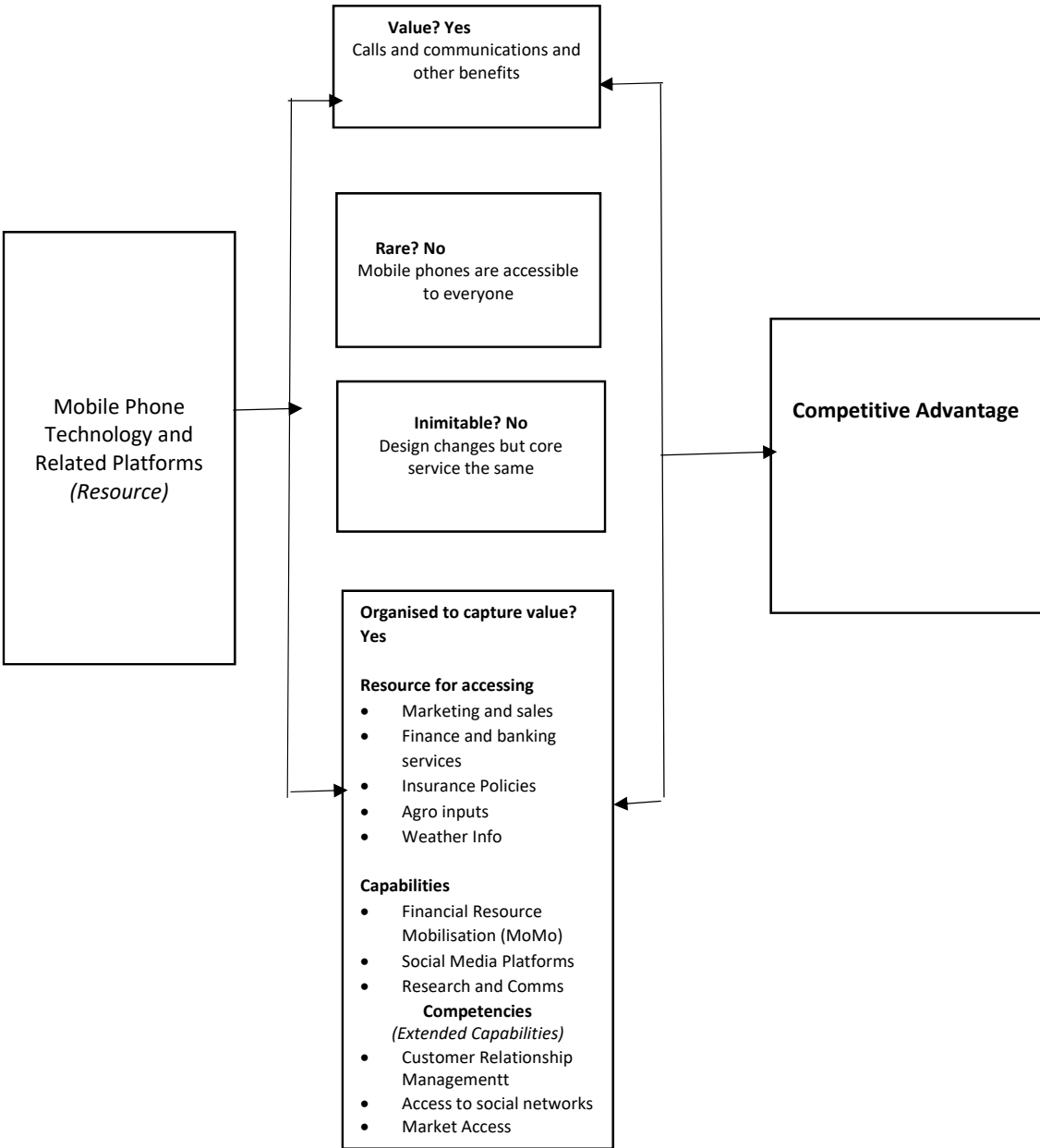
Mardikaningsih (2022) posited that business competencies are the defining sets of capabilities that give a business competitive advantage over others. They are the extended capabilities that businesses develop using their resources efficiently and effectively overtime. According to Reuben (2019), achieving these competencies, be it personal or organisational, depends on the knowledge and skills the businesses acquire and use through their operational staff and support from senior management. In other words, competencies, according to the RBV, are the advanced capabilities or competitive advantages that other businesses or competitors cannot offer or replicate even if they have the same resources. This is consistent with the views of Kruesi *et al.* (2022) and Hussain *et al.* (2022) on competencies and competitive advantage in developed economies and within large organisations. For small businesses and entrepreneurship in farming businesses in rural Ghana, the study contributes to our understanding by suggesting that farmers using mobile phone technology develop competencies that enable: (i) customer relationship management, (ii) social networking, (iii) researching on best practices and access to local and international markets, and (iv) content creation, development and sharing. On customer relationship management, using the mobile phone allowed the majority of the farmers to develop improved and regular communications with customers over time.

Through the data stored on their phones (names, addresses and supply orders), farmers in rural Ghana can plan how to manage these customers. Based on the data they hold, they can devote more time to some customers and supply them with information. Farmers are also able to develop credit and payment term relationships with these customers based on the orders they receive from them. Thus, farmers build relations based on custom and provide customised services, sometimes through identifying customers through specific ringing tones. These customer management practices enable farmers to build sustainable relationships with customers, and that results in competitive advantage. Interactive and swift information exchange with customers and suppliers helps farmers to identify marketing opportunities, such as when there are shortages of products in a market which they are not aware of until informed. An important competency gained by farmers in the process of relationship building is access to social networks using the mobile phone technology platforms. Farmers develop competencies of social networking on WhatsApp in particular, and that creates opportunities for access to new markets and new customers, connection with other farmers, farming associations, and the sharing and exchange of knowledge. In addition, the extended capabilities of being able to use the telephone for conference calls, developing collages and voice audios, enhances their social network relationships, which in turn creates business opportunities.

Furthermore, access to the social networks and social media platforms improves communications between the farmers and the agricultural stakeholders, including the MOFA extension officers and ESOKO agronomists. Furthermore, mobile phone technology enhances the farmers' knowledge and improves their competences regarding research and access to much needed education and extension services. In addition, farmers who have the skills to search for market information via using the social media platforms and the internet created potential marketing opportunities, both locally and internationally, though this activity costs the farmers a lot of money in terms of data. For smaller organisations like the farming businesses in rural Ghana, the study extends Barney's (1992) theory by suggesting competitive advantage, which is core to the Resource-Based View, is achieved by farmers using the technology as a resource. In the process of using the mobile phone, farmers develop capabilities from the advancement of their skills. Developing these enhanced skills through continuous usage of the technology results in competencies coined as extended capabilities

in areas of customer relationship management through building customer data base, social networking and researching best practices and how to access new local and international markets. Hence the thesis confirms Barney's (1992) Resource-Based View theory that firms create advantages based on the resources that they have and acquire, and on how they effectively use these as assets to enhance capabilities and competences. However, Barney (1992) argues that resources must meet the VRIO criteria. Theoretically, Barney's (1992) RBV theory can potentially be extended to apply to phone adoption by any organisations if they see it as a resource. The thesis, however, shows that the Value, Rare, Costly to Imitate and Organised to capture value (VRIO) criteria do not necessarily apply to mobile phone as a resource to the rural farmer in Ghana as shown in the – Figure 7.1 below.

Figure 7.1 The Resource Based View Extended (Author Compilation)



As indicated in the diagram above, the mobile phone is a resource because that is what the farmers rely on to create value. However, the technology is not rare (rarity). This is because every farmer or user can have access to it if needed. In terms of whether the technology is hard to imitate or otherwise (inimitability), the designs are different, but the core service is the same in terms of communications. On how the technology is organised to capture value (organised), some of the entrepreneurs used it effectively. Hence, from the above figure, and using the VRIO criteria, it can be said even though the technology doesn't meet all the VRIO criteria, the way that most of the rural farmers use the mobile phone technology as a resource, the capabilities developed and the competencies gained provide them with competitive advantage – and that enables the farmers to be successful in their farming businesses.

7.3 How the Technology Acceptance Model explains Rural Farmers' Behaviour in Mobile Phone Technology Adoption

The TAM model was based on the theory of reasoned action. Fischbein and Ajzen (1975) posit that the behaviour of a technology user is motivated by the attitude which is designed to predict the technology use. The Technology Acceptance Model (TAM) which was developed by Davis (1989) proposes that when users perceive that a type of technology is useful and easy to use, they will be willing to use it. Thus, if the users of the technology believe that using it will make their businesses worthwhile because they have no alternatives, as is the case for farmers in rural Ghana, there is a higher probability that they will use it (Ajzen, 2012). However, user attitudes and intentions were fully mediated by PU and PEOU (Agarwal and Prasad, 1999). This theory is widely used in different settings and sectors, though not much can be found in the extant literature on how mobile phone technology adoption influences the behaviour of farmers in rural Ghana. Not much is also found on the specific variables that influence behaviour within the variables set by the TAM. The discussion in this section provides insights on the adoption of mobile phone technology using the variables in the TAM model. These are: (i) external variables; (ii) perceived usefulness; (iii) perceived ease of use; (iv) attitude towards use; (v) behavioural intention (vi) actual system use.

7.3.1 External Variables

The study contributes on specific external variables that influence the adoption of mobile phone technology by rural farmers in Ghana. Previous studies, such as Legris *et al.* (2003), had no clear pattern with respect to the choice of the external variables studied, even though these are important drivers of the decisions on whether to adopt a particular technology. On the other hand, Dillion & Morris (1996) and Lin (2007) declare that an individual's attitude to adopt a technology is influenced by friends and colleagues. However, this study shows that the external factors that influence the rural farmers to adopt mobile phone technology and use are sociocultural factors – namely, families and friends as well as community and network providers; topography, transportation and weather conditions; a lack of confidence in the traditional banks; trust and security associated with the use of the technology; and, finally, support and education from the telephony companies.

On sociocultural factors, the findings indicates that social and cultural peer influences in the local farming environment as well as from the farming managers influence the adoption of the mobile phone technology. The farmers seem to rely on the tribal and community support in the adoption process. This is because according to the study, stronger community networks in the Afram Plains area, especially within the Konkomba community, enable the farmers to all be in a wider farming network. There was also the feel-good factor, a sense of belonging and confidence once farmers adopted the technology and connected well with the community, though a few did indicate that using the technology reduced face-to-face contact. To be able to stay connected with the rest of the farming community and with customers required access to the technology, no matter the location of the farmers. The study indicates that in most cases the location of the farms in mountainous areas and on islands across the Afram river mean that there is no access to landlines, and that this factor influenced the adoption and use of mobile phones. Hence the lack of alternative telecommunications infrastructure, as suggested by Ogara *et al.* (2014), also influenced the adoption of the technology. As farmers do their farming activities, the mobile phone allows them to connect with the rest of the world. Some farmers did indicate in the study that there are some types of phones like the TECNO and the ITEL which are rigorous and can withstand weather conditions no matter the topographical location of the farms, and those phones enable the reception of a call or listening to radio which is incorporated in the phone.

The lack of confidence in traditional banks was another external factor that influenced the adoption of the mobile phone technology. The collapse of some of the traditional banks, due to embezzlement, corruption and transparency issues, are factors which made farmers rely on the use of mobile banking and the MoMo services offered by the telephony companies. The farmers indicated that the instability in the financial sector, leading to the closure of some banks and the loss of most customers' deposits, was a factor that led to a lack of confidence, not also forgetting the bureaucratic systems customers had to go through to undertake financial transaction (Kosiba *et al.*, 2020). In contrast, farmers already associated with networks like MTN and Vodafone had access to MoMo in mobile wallets, which enabled them to do financial transactions on the phone. Seeing their bank in their pocket increased confidence in the mobile phone companies.

Some farmers did indicate that the security resulting from their mobile phone technology has also influenced them to access more networks, and now they prefer to do all their business activities if possible, using the mobile phone. This is because of the support they get from the staff of the telephony companies as well as the relationship they have established with them. The support given by the telephony companies in the process of acquiring the technology, setting up and maintaining the device and managing credits all influenced the adoption according to the study. However, the use of the technology is prone to problems, including issues around the security of personal identification numbers (PINs) for the mobile wallets. The mobile phone companies educated the farmers about these security issues, telling them not to give their PINs to scammers asking for access to their mobile wallets, and this made the farmers feel safe about their money, especially because for them the phone is their bank.

7.3.2 Perceived ease of use and usefulness

Davis (1989) posited that perceived ease of use is the degree to which a user of technology believes it is free of effort and could perform as recommended by other users. This is also supported by Liébana-Cabanillas *et al.* (2018) and Motamedi *et al.* (2021), who indicated that the design and the benefits associated with that technology use could influence its adoption. Davies (1986, 1989 and 2000) further corroborates the views of Liébana-Cabanillas *et al.* (2018), suggesting that perceived ease of use is the perception of how easy it will be to use a particular technology to do many things.

Part of the findings is consistent with the views: some farmers who have adopted the technology did indicate that the technology had easy-to-use application, and the interfaces are easy to understand (Amberg *et al.*, 2004). This set of farmers believed that the technology is simple to use. Interestingly, a section of the farmers, especially married women who adopted the technology, perceived that they could domesticate the technology to help them in their farming activities while maintaining their core responsibilities at home and in their marriage. Thus, perceived ease of use (PEOU) is revealed to have been influenced by gender and demographic factors, which TAM provides little or no information on. Perceived usefulness is associated with the belief that a user has in the technology to fulfil the needs and expectations (Davis, 1989). Thus, the user believes that the technology can fulfil their needs based on the information received. The study indicates that farmers adopted the technology because of the features and the benefits, which consistent with the literature. Amberg *et al.* (2004) suggest that once people get the phone, not only can they make calls, but they can also use it to do activities like mobile banking and social media and to help improve business, just as other farmers are doing.

7.3.3 Behavioural intention of use

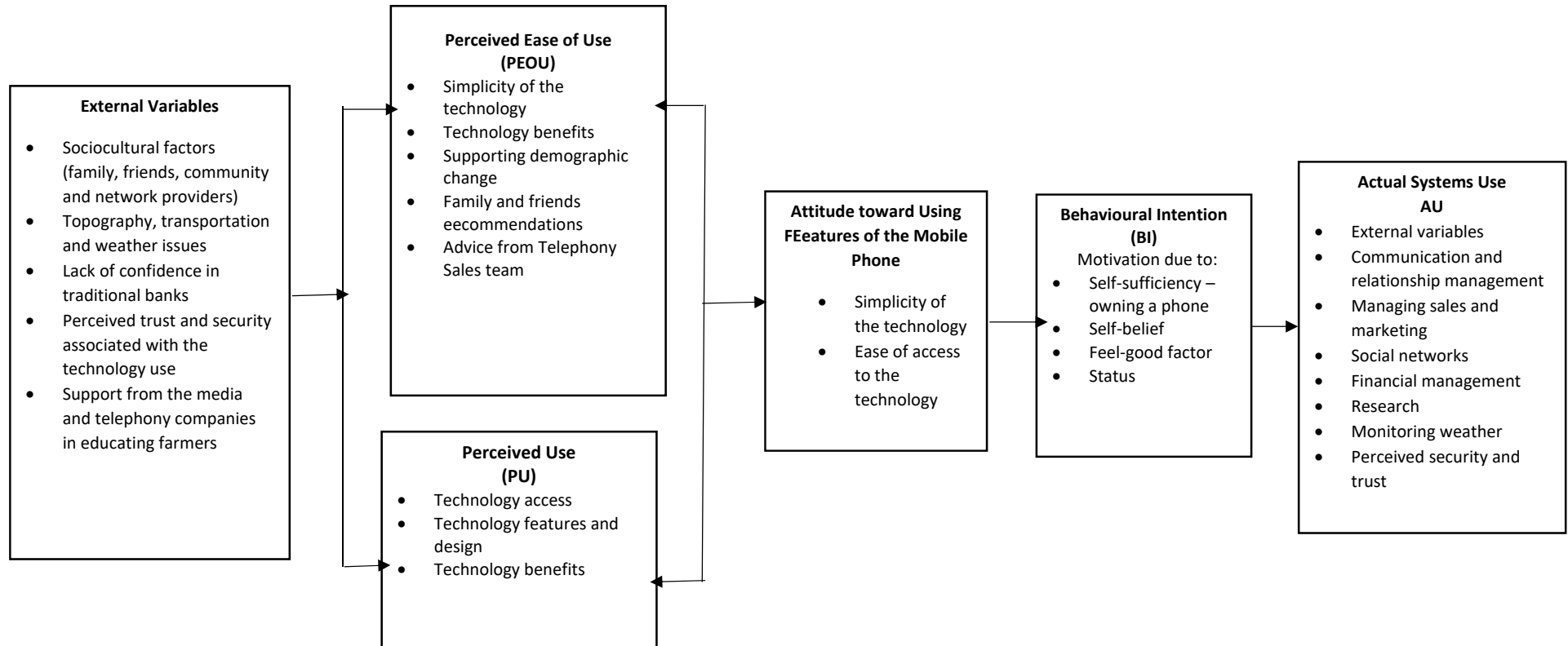
Perceived usefulness and perceived ease of use both influence behavioural intention to use a particular technology (Clements and Boyle, 2018; and Ajzen, 2012). Behavioural intention is based on the fact that the user of the technology has formed – or not formed – plans to use a particular technology believing that it will influence their behaviour (Davis, 1989). Interestingly, the study complements the views of Clements and Boyle as well as Davies suggesting that farmers' behaviour is influenced not by only the intentions to use the technology but also by seeing other farmers using the phone to do the farming business, and the fact that sometimes they had to go and borrow the technology to make calls or do business. The desire to enhance their status and business influences the adoption of the smart phone technology. Once farmers adopt the technology, they feel self-sufficient and believe in themselves now that they have their own phones like the other farmers. Nonetheless some farmers did indicate tha always using the phone for business reduces ace-to-face contact and encourages segregation.

7.3.4 Actual Systems Use

The actual system use is the end point at which users adopt a particular technology (Davies, 1989) and is influenced by performance expectancy, effort expectancy, social influence and facilitating conditions, otherwise known as the external variables (Venkatesh *et al.*, 2003; Alfadda and Mahdi, 2021). Farmers adopt the mobile phone to help them to perform activities like communication, marketing and sales, customer and supplier relationships management, financial transactions management, and weather monitoring. The study further provides the insight that farmers use the mobile phone to connect to friends and family, which improves the relationships between the farmers and their sociocultural networks. Figure 7.2 below shows how the study extends the TAM model on how the rural farmers adopted and use the mobile phone technology.

As can be seen from the extended TAM model below the study confirms that the adoption of mobile technology by farmers in rural Ghana is influenced by perceived ease of use of the technology and the perceived usefulness. However, the model further indicates that farmers' PEOU and PU are influenced by specific external factors namely sociocultural variable (family, friends, and community and network providers), topography, transportation challenges and weather issues. Other variables that influence adoption are a lack of confidence in traditional banks, perceived trust, perceived security associated with the technology use and support from the media and telephony companies in educating farmers. Furthermore, farmers' behavioural intention is influenced by a sense of pride that the ownership of the mobile phone technology gives them, in self-belief and self-sufficiency as well as social status. These factors also influence the farmers' behaviour. Finally, the actual system uses by the farmers involved communication, managing marketing and sales, customer and supplier relationships, financial transactions, developing sociocultural networks, research, monitoring weather as well as enhancing perceived security and trust.

Figure 7.2. How Mobile Phone Technology Adoption by Rural Farmers Extends the TAM Model



7.4 The Mobile Phone Technology as a Boundary Object for Farmers in Rural Ghana

The notion of mobile phone technology for development (M4D), part of ICT4D, has received a strong focus in the literature of information systems. This is because the use and domestication of mobile phone technology and related platforms is fundamental to the information technology revolution. Ghana has had its fair share of these benefits, with the mobile phone technology transforming the way people socialise and do business. Stemming from the work of Star and Griesemer (1989), Cattaneo *et al.* (2021), Chang and Kuo (2021), the concept of the boundary object has been widely used to help understand the ways in which knowledge is created, shared and integrated across boundaries of practice by stakeholders and groups.

Fischer *et al.* (2007) and Dar (2018) affirm that boundary objects allow different groups to work together with actual use worked out via user cooperation. Crucially, the defining characteristic of the boundary object is that it has interpretative flexibility or ‘plasticity’, which allows different groups engaged in distributed practices relating to farming business to interact with one another and engage in joint activities – in the process of sharing their knowledge and practices to support the farming business (Dar, 2018; Aprea and Cattaneo, 2019; Chang and Kuo, 2021). Although this theory has been used in different sectors including schools (Gajek, 2016), much cannot be found in the extant literature on how this theory relates to technology and its application to the agricultural sector particularly farming in rural Ghana. This study provides interesting insights on how farmers in rural Ghana uses mobile phone technology as a boundary object from the following perspectives: (i) the mobile phone technology as a bridging device, (ii) technology that eliminates gender and generational divides, and (iii) technology that shifts context, improving time and space.

7.4.1 Mobile phone technology as a bridging device

The study show that the mobile phone technology helps farmers to connect with customers, suppliers, farming assistants, family and friends. Farmers did not need to be at the farms or at home to be able to facilitate work.

They could coordinate their workflow from any location. Farmers could resolve issues regarding payment with customers, suppliers and farming assistants without having to travel. Thus, the mobile phone as a boundary object allows the farmer to work with different groups (Fischer *et al.*, 2007; Dar, 2018). The study further provides the interesting insight that for farmers to be able to use the technology in the different contexts as needed, they need to domesticate it (Sørensen, 2005; Haddon, 2007). For example, to be able to resolve family or farming problems if they are not at the scene of action, they need to have downloaded an application that can enable them to do conference calling or video calling if the mobile phone technology is a smart phone. The addition of the video application feature to the original handset is a form of appropriation whereby the farmer is said to have modified the existing handset to suit its use. The mobile phone as a boundary object influences the behaviour of the farmers as users, allowing them to do different activities through the skills, capabilities and competencies they acquire (Star and Griesemer, 1989; Chang and Kuo, 2021; Cattaneo *et al.*, 2021).

7.4.2 Technology that eliminates gender and generational divides

Interestingly the domestication of the mobile phone technology reduced gender, generational and demographic boundaries, allowing women and university graduates to join the farming business community. This is because being able to adapt the technology makes it easier to do different things and be in two places at the same time (Berker *et al.*, 2005; Asongu *et al.*, 2021). The technology has allowed social and farming networks to be formed according to the study, allowing women and university graduates who would previously not have considered doing farming as a business to make connections on various social and farming platforms. This enables them to try new activities and to be in different places at the same time. For example, the women farmers explained that the mobile phone (as a boundary object) has gradually liberated them from their traditional role of a housewife – doing household chores, taking care of the children, and, if they were farming at all, doing so only for subsistence purposes because traditionally the man is the main contributor of the household income and makes the decisions, which the woman must accept. The technology also helped to shape the social behaviour of the farmers as they learn from one another.

For example, the farming community, including this farming generation of women and graduates, used the WhatsApp platform as an information hub for the sharing and exchange of knowledge, including best practices such as farm management.

Thus, the study advances the work of Star and Griesemar (1989), Catteneo *et al.* (2021) and Chang and Kuo (2021), suggesting that the mobile phone eliminates the boundaries between the farming communities, which now includes university graduates and women.

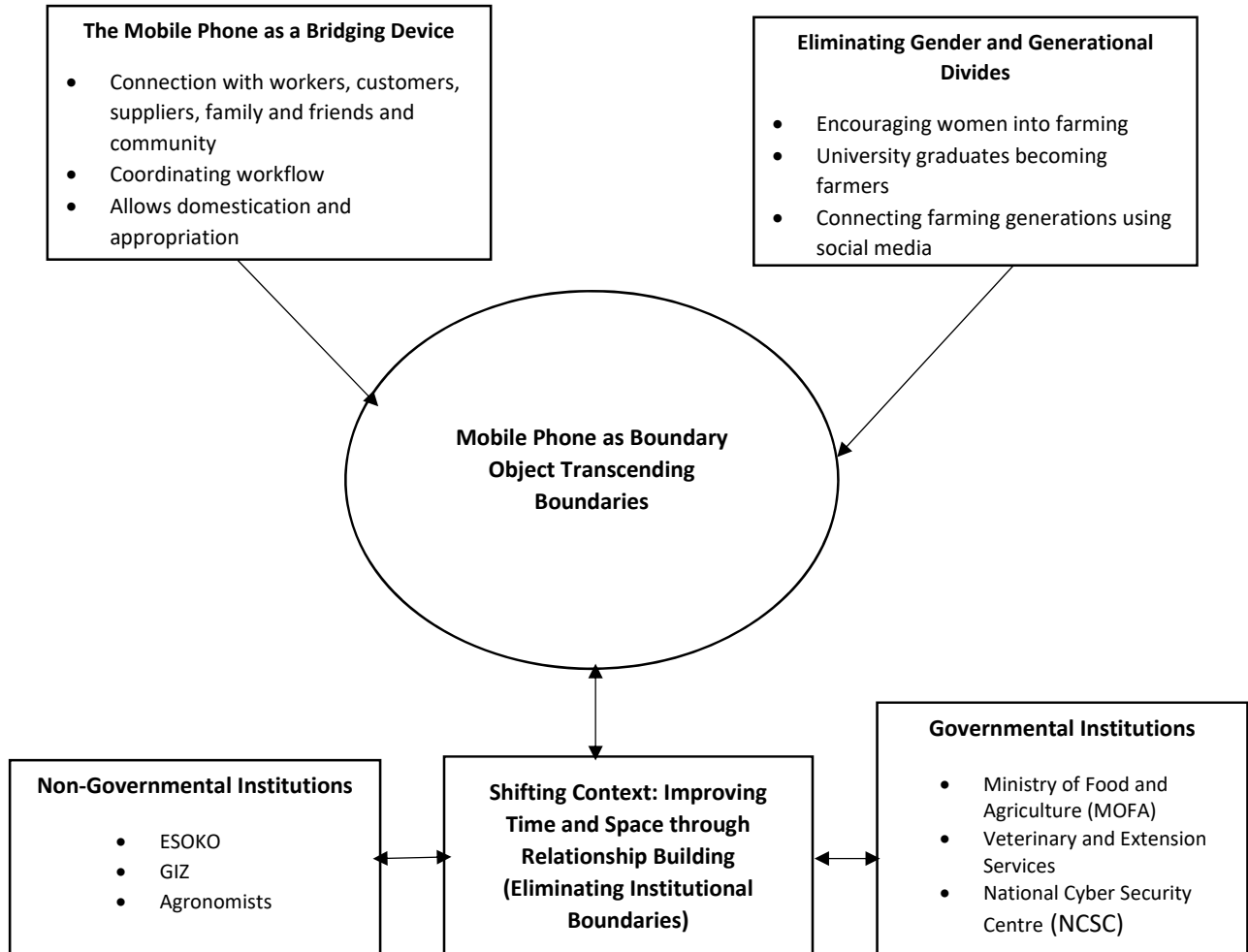
7.4.3 Shifting Context: Improving Time and Space through Relationship Building

The mobile phone as a boundary object allows different groups to work together, and the actual use is worked out through the cooperation of their users (Fischer *et al.*, 2007). The study shows that relationships between farmers and stakeholders improved as the technology became the business tool that facilitated the planning of supplies, transportation arrangement to the farms, access to markets, and banking facilities between the farmers and customers.

The mobile phone technology also transcended the major function of communication in the farming business and became a gadget that facilitated the mediation of family meetings and disputes. Farmers could be on the farms and address family issues without having to be at home or meeting relatives face to face. They felt there was no boundary between them preventing them from managing family and community relationships. Institutionally, the study contributed to the theory, suggesting that the technology eliminated the boundaries between the governmental, non-governmental and tribal hierarchy, allowing farmers to work with these concurrently, using the mobile phone technology as the mediating tool. For governmental institutions like the National Cyber Security Centre (NCSC), Ghana Extension and Veterinary services and the Ministry of Agriculture (MOFA), the mobile phone technology facilitates the sharing of information on cybersecurity, extension advice and veterinary advice between these institutions and the farmers. This reduces cybercrime and improves agricultural and poultry productivity in rural Ghana. Governmental policies through the aforementioned institutions were disseminated by the radio stations, which farmers could access on their phones. Some information was disseminated in the local languages, which the farmers listened to on their phones.

For non-governmental institutions – such as Esoko, the telephony companies, and the (GIZ) – which support agriculture and rural farming, the technology eliminated the boundaries that have caused problems in the past. Paper documentation such as training manuals had to be posted, and travelling to visit farmers was often difficult (and indeed still is), especially in areas that cannot be reached by motor vehicles. Training and farming support, advice and information could be shared with the Esoko farming community via their social media platforms and through direct calls, reducing transportation costs and travel risks for these agencies. Apart from information processing, the technology allows different institutions to work collaboratively, using the mobile phone as a centre point to support farmers. The agencies could all coordinate their support through joint meetings using the mobile phone technology. The banks, for example, use the technology to help provide financial support and insurance to the farmers, in the form of short-term loans or by ensuring interbank transfers. Access to finance and banking allows the sellers of agrochemicals, fertiliser distributors and tractor rental organisations to collaborate and work with rural farmers, knowing that whatever services provided would be paid for through mobile money transfers. For the farmers themselves, the added benefit is that they can receive information on their farms or in the comfort of their homes. The same technology facilitated the transfer of inputs and payments by farmers. The study therefore provides additional insights into the boundary object theory, suggesting the relevance of it for eliminating time and space between institutions that work closely with farmers in rural Ghana. Figure 7.3 below sums up the contributions to the discourse on how the mobile phone is used as boundary object from the perspectives of farmers in rural Ghana.

Figure 7.3: The Mobile Phone as a Boundary Object



7.5. How Kolb's Learning Cycle Helps to Explain Mobile Phone Adoption in Rural Ghana

Kolb's (2014) Learning Cycle is an important learning model because it highlights the stages learners go through in to acquire knowledge. The cycle involves concrete experience, reflective observation, abstract conceptualisation and active experimentation. Kolb (2014) further indicates that learners could join or exit at each stage of the learning cycle. Though the learning model has been used over decades in different learning settings (Kempen and Kruger, 2019), little can be found in the extant literature on how farmers learn, particularly in

rural Ghana, where farmers use mobile phone technology to facilitate their farming activities and learn in the process. The findings are discussed under Kolb's Learning Cycle but combine the categories of experience and experimentation as one because the responses provided by farmers combine both. The study therefore advances Kolb's (2014) Learning Cycle in all four areas: (i) concrete experience and experimentation, (ii) reflective observation, and (iii) abstract conceptualisation.

7.5.1 Concrete experience and experimentation

The study advances Kolb's (2014) concrete experience learning style, suggesting that although the farmers using mobile phone technology rely on experience, they depend on trial and error guided by their own experience. Those who learn by concrete experience want opportunities for direct, interpersonal interactions. Learners who follow this approach prefer to feel and experience the use of the technology rather than think about how to use it. Kolb (2014) describes these learners as intuitive decision makers, who take an intuitive approach to problem-solving rather than a scientific approach (Richmond and Cummings, 2005; Idkhan and Idris, 2021). Interestingly, these farmers experimented with the use of the technology even while learning through experience. Learners who experiment prefer to be involved in the learning activity and play an integral role in making the decisions. According to the study, farmers did not follow any manuals or documents that come with the phone on purchase.

The farmers practising every day and at times fidgeting with the phones and experimenting – including making calls, storing numbers or downloading applications – sometimes made mistakes along the way but learned through the process (Caizzi *et al.*, 2018). Nonetheless, some of the farmers in rural Ghana could be said to be active learners because some were assisted by their peers, the community and their children, consistent with the literature on active experimentation (Kolb, 2014; Sudria *et al.*, 2018; Idkhan and Idris, 2021). Farmers learned by experimenting with the mobile phones, which they saw as artefacts. They made meanings from the use of the technology with the support of the community. This is consistent with the views of Kamwesiga *et al.* (2017), who focused on stroke victims and their families in Uganda and demonstrated how through experimentation, mobile phone usage becomes not just an artefact but a symbol of hope because the knowledge acquired through experimentation helps to adapt the technology for different uses.

7.5.2 Reflective observation

Reflective observation focuses on the reflection of ideas and experience on a personal basis by learners. Learners with this learning style value objective judgement, impartiality and patience. They prefer abstract understanding rather than practical applications. They prefer to reflect and observe rather than act on the situation (Kolb, 2018). The study contradicts Kolb's (2014) reflective observation, suggesting that it was not relevant for farmers in rural Ghana using mobile phone technology. According to the study, farmers relied on other groups of people to support them in their farming. These were their children and the community as well as staff of the telephony companies. Farmers depended on their children to teach them how to use the technology, especially for the first time and even beyond. This method of learning is otherwise known as reverse parenting. Farmers stated that they get support from their children which brings them closer, but it takes away the parent's ability to do things on their own. Where children are not available, farmers then turn to staff community members and the telephony companies. In effect, there was little evidence of reflection by farmers in the learning process as they relied on support from children and community and telephony company staff.

7.5.3 Abstract Conceptualisation

Learners with this approach attend to tasks that involve logical investigation of ideas and concepts. They involve themselves with and tackle problems in an academic way, following formal processes and documentation if available. They prefer to manage issues in a way that helps them develop logical conclusions to issues. As part of the process, some learners end up building theories in order to come out with solutions. In addition, learners in this category value rigorous idea analysis and well-defined conceptual systems (Kolb, 1984; Sudria *et al.*, 2018). The study contradicts Kolb's (2014) abstract conceptualisation learning approach. Farmers in the study used unorganised learning methods or no formal learning approaches, relying on the support of community members, including teachers, pastors and assemblymen as well as fellow users (Lehane, 2020). Thus peer-to-peer learning was also fundamental in supporting farmers to learn how to use mobile phone technology. All these methods lacked documentation and had no formality. Farmers corrected their mistakes as they journeyed through the process, acquiring reading, numerical and planning capabilities, which they integrated into the business.

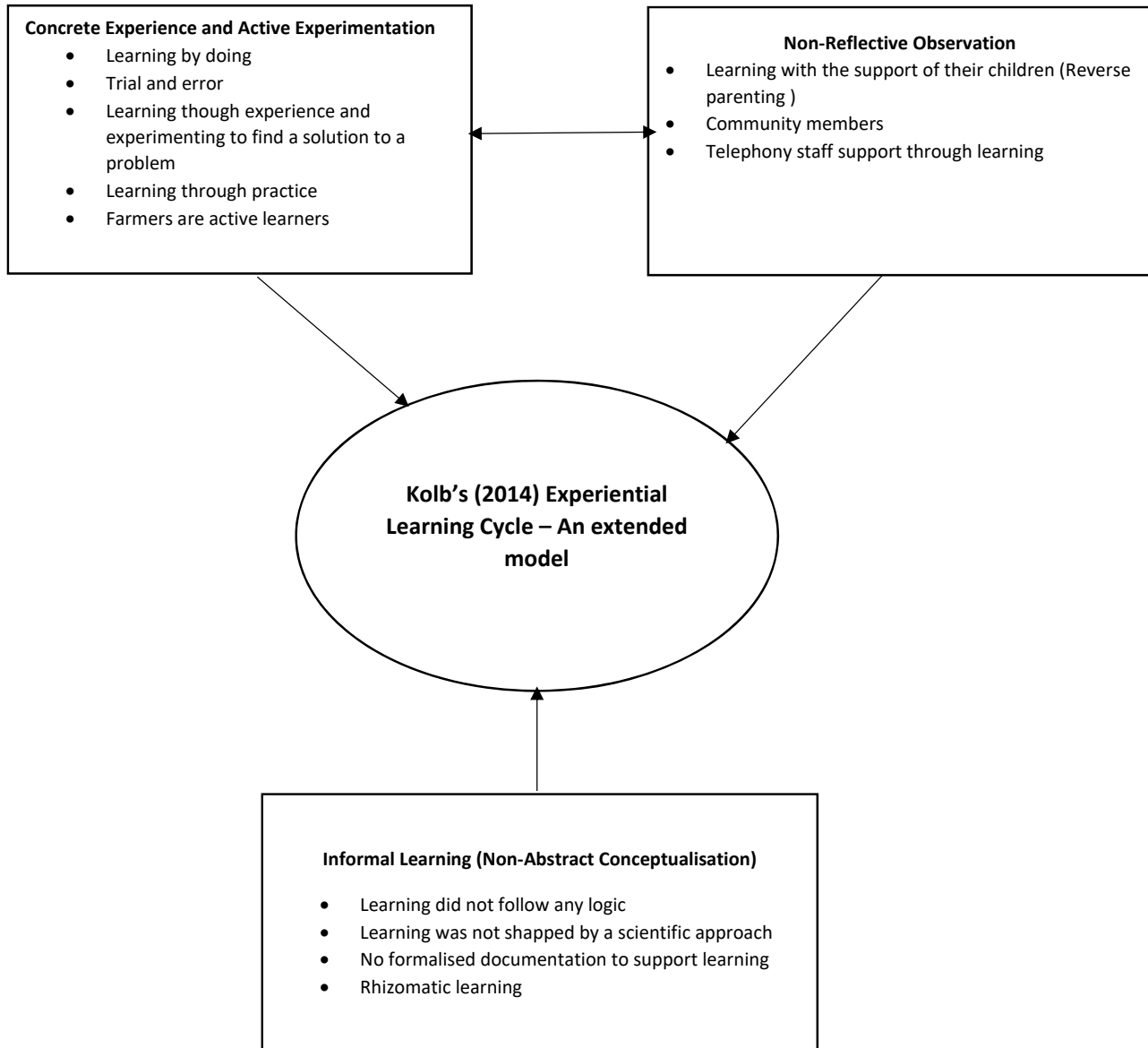
Thus, the study identified the farmer's learning style as rhizomatic learning: farmers in rural Ghana seem to learn in the way that the rhizome plant grows with roots extending everywhere to get water and nutrients in the soil. Some farmers also learned from the educational programmes organised by MOFA and Esoko, where the mobile phone was used to facilitate the transfer of messages and communications.

7.5.4 How rural Farmers intergrate skills acquired from learning with the mobile phone

On how rural farmers integrate the skills acquired from learning with the mobile phone into the farming business, the study advances the views of Gibbs (1998) and Akter *et al.* (2020), suggesting that as rural farmers use the technology, they also develop capabilities and competencies. The study also contributes by highlighting the stakeholder and customer network capabilities, such as customer relationships management, sharing content and monitoring the weather and sharing information with other farmers. In the process, farmers learn and acquire skills that support them in the farming business. The advancement of Kolb's (2014) Experiential Learning Cycle is shown in the revised model below in Figure 7.4.0 below.

As can be seen from the model below in figure 7.4 the study advances Kolb's (2014) experiential learning model. In terms of concrete experience and experimentation, the study is partially consistent with Kolb's (2014) concrete experience as farmers using the technology were actively involved, although they were supported to get experience through continuous practice, which is also consistent with the activity theory of Vygotsky (1978) and Engeström (1999). Yet, farmers learn by themselves and sometimes through trial and error and thus through practice. The figure further shows that farmers used non-reflective observation methods, asking for support from children, family or the community in the learning process, in contrast to the premise of reflective observation premise in Kolb's (2014) model. Furthermore Figure 7.4 shows that farmers used informal learning or non-abstract conceptualisation methods. Farmers did not use any scientific approach or logical plan; rather farmers learned rhizomatically.

Figure 7.4 Kolb's Revised Model



7.6 Constraints Associated with Mobile Phone Technology Use

Farmers did indicate that though the mobile phone has been helpful to the farming business there have been three main constraints associated with the use of the technology. These are data breaches, network problems and cost of airtime or data, which the farmers buy and upload on the phones. The constraints faced by farmers suggest that regulations in Ghana regarding the use of mobile phone seem not to be working consistent with the views of Dzidzah *et al.* (2020), which provides insights that mobile phone technology companies face challenges regarding data issues and cybersecurity. Farmers are sometimes approached by scammers purporting to be calling from the telephony companies and wanting to solve a problem regarding their mobile banking facilities. If farmers respond to the calls and provide their mobile banking security details, these scammers then take their money from their mobile wallet. The Ministry of Information, Communication and Technology and the National Communication Authority (NCA), in collaboration with the telephony companies and the radio media, can only remind farmers, constantly and consistently, to be aware of these scammers and the calls. Interestingly, not much could be found in the study as to why these scammers could get access to the data of the farmers.

Even though laws regarding data protection and cybersecurity, notably the Electronic Transactions Act 2008 (Act 772), are in place they are hardly implemented. Hence, apart from occasionally getting messages through government information centres and the radio to be wary of robbers and scammers, farmers learned to keep their phones secure, changing their passwords regularly and keeping their PIN to themselves. Some farmers said they allowed only their children to help them access and make money transactions. This is consistent with the views of Adjei Kwakwa (2012), Boadi *et al.* (2007) and Agwu and Carter (2014).

The study also provides insights on the impact of network problems on the use of the mobile phone technology use. The study found that most of the farmers in rural Ghana work in villages that are remote. The topographical nature of the land, and sometimes the density of the forest, makes it difficult for farmers in these areas to access mobile networks. Farmers may have credit or airtime but be unable to make calls on the farm since they lose network. These factors explained why some of the farmers had more than one SIM card and preferred either to have two phones or a phone that could take more than one SIM. This is an interesting

insight that account for the reasons why farmers in the Kwahu district of rural Ghana use more than one mobile phone and more than one SIM card, as shown in the demographic details in Table 6.3. Such findings are supported by the World Bank Group report (2016), Hampshire *et al.* (2017) and Owusu *et al.* (2021), suggesting that users of mobile phones in such parts of the world still have the challenge of access to a network.

The farmers also complained about the costs of credit and airtime. Although the use of the internet and social media, especially WhatsApp, is becoming a necessity, and although the farmers recognised the importance of social networks to their farming business, they felt they did not get value for money when buying credits for the phone. According to the farmers, regular sales depend on keeping relationships with the customers. Without a good relationships, sales contract could be lost to other farmers. The main means of communication, according to the study, has been WhatsApp and calls, which uses their internet data or the credit they buy. Their credit seems to be used quickly, and they complained that they might spend a fortune in a month, which is consistent with the views of (Senyo *et al.*; 2022).

The farmers have complained to the telephony companies many times, but not much has been done. As they have no alternatives to the mobile phone technology, farmers concede that they will continue to buy data but will also continue to complain to the telephony companies. The study offers ongoing support for the findings from Sambasivan *et al.* (2013) and Tanle and Abane (2018) on the costs associated with managing and using mobile phones in Ghana.

7.7 Chapter Summary

This chapter sought to discuss how farmers in rural Ghana use mobile phone technology to improve their farming business activities. The discussions assisted in providing insights into why the farmers adopt the technology and how they integrate the knowledge acquired through learning and usage into the farming operations. The study contributes to the importance of Information Technology for Development (ICT4D), highlighting the importance of the micro factors and extending the views of Asongu *et al.* (2021), Butakor (2021) and Abor *et al.* (2018) by showing how, among other things, farmers adopted the technology as a resource to enable them to create value.

Farmers used the mobile phone to facilitate marketing and sales, financial mobilisation and access to banking services, access to health and business insurance policies and access to information on agricultural inputs and weather. Using the phone for these activities enabled farmers to develop and enhance skills and achieve capabilities in literacy and numeracy and business applications, including financial resource management (MoMo) usage, social media usage through Facebook and WhatsApp, and research and communication capabilities. These capabilities led to the development of enhanced capabilities in the form of the competences which gives the rural farmers competitive advantage. These competencies include customer relationship management, social networking, researching on best practices and access to local and international markets, and content creation, sharing and development. Using the technology also enabled farmers to develop, which in turn created advantages (Barney, 1992) for their businesses.

The thesis therefore confirms some aspects of Barney's (1992) Resource-Based View that firms create advantages based on the resources they have and acquire and on how effectively they use these as assets to enhance capabilities and competences to deliver superior competitive advantage. However, Barney's (1992) VRIO criteria does not apply to rural farming businesses using mobile phone technology to gain competitive advantage. Barney (1992) argues that resources must meet the VRIO criteria. The thesis, however, shows that the Value, Rare, Costly to Imitate and Organised to capture value criteria don't apply to the mobile phone as a resource for the rural farmer in Ghana because the mobile is not rare and inimitable. Rather it is how the rural farmer organises its usage to capture value in the farming business that creates competitive advantage.

On the behaviour of farmers in rural Ghana, the study affirms some aspects of the Technology Acceptance Model by Davis *et al.* (1989). The study shows that the adoption of mobile technology by farmers is influenced by perceived ease of use of the technology and the perceived usefulness. Yet, the study shows further that for farmers PEOU and PU are influenced by specific external factors, namely sociocultural variables (family, friends, and community), topography, transportation challenges and weather issues. Other variables that influence adoption are a lack of confidence in traditional banks, and perceived trust and perceived security associated with the technology use, as well as support from the media and telephony companies in educating farmers.

Furthermore, farmers' behavioural intention is influenced by a sense of pride for owning a mobile phone, self-belief and self-sufficiency, and social status. The study therefore extends the theory by highlighting the above influences on the rural farmers' adoption of mobile phone technology, and these are not available in the literature.

The study further indicates that the mobile phone technology serves as a boundary object (Star and Griesemer, 1989) that influences activities and relationships in rural Ghana. The study shows that the rural farmers use the mobile phone technology to connect with workers, customers, suppliers, family and friends. Farmers did not need to be at the farms but could coordinate their workflow from any location that they find themselves. The domestication of the mobile phone technology also reduced gender, generational and demographic boundaries, allowing women and university graduates to join the farming business community. These groups had previously not been involved in farming, which is traditionally for males and the uneducated. The study suggests further that farmer in rural Ghana are surrounded by various institutions and boundaries that connect or support the rural farmer. It shows that the mobile phone technology lies at the centre of the farming businesses to eliminate these boundaries and connect the boundaries to the farming activities, allowing the farmer to interact and bridging gaps between the stakeholders such as governmental organisations and Non governmental which support farming.

In terms of how Kolb's Learning Cycle helps to explain how rural farmers learn in the adoption of the mobile phone, the study shows that rural farmers combine concrete experience with experimentation while learning. The study shows that while farmers do gain concrete experience in using the technology, this is done through self-learning, sometimes through trial and error. Farmers also asked for support from the community or from children and family in the learning process, in contrast to the reflective observation premise of Kolb's (2014) model. Furthermore, farmers use informal learning or non-abstract conceptualisation methods. They did not use any scientific approach or follow any logical plan, but rather learned rhizomatically as already indicated. The findings in the study are therefore partially consistent with Kolb's (2014) concrete experience stage of the cycle while refuting its reflective observation and abstract conceptualisation stages.

Despite the usefulness of the adoption and usage of mobile phone technology, farmers identified a number of constraints. Security issues concerning the usage of the technology are a major constraint to the farmers, who indicated that they sometimes noticed deductions from the money in their mobile wallet for which the telephony companies are not able to provide explanations. Occasionally farmers got calls from scammers purporting to be staff of the telephony companies and requesting the farmers' personal identification numbers (PINs) to help them access their mobile money benefits. Farmers who fall prey to these scams cannot get their money back, as there are no cybersecurity systems to trace the perpetrators. Farmers on their way from the marketplace have also been targeted by armed robbers and robbed of their mobile phones. Failure to comply with the robbers' demands may even result in death (Abdul-Rahaman and Abdulai, 2018).

Farmers indicate that the cost of airtime and data puts a ceiling on their use of mobile services and platforms. Data limits can also be eroded once promotional messages from the telephony companies are assessed. This implies that farmers had to spend a lot of money buying airtime, and when probed further, farmers indicated that they wished airtime and data had not been lost to promotional messages. Some of the farmers said that they felt that the data and airtime received did not reflect accurately the amount of money they paid. In managing this constraint, farmers prioritised calls and internet searches, hoping to save some money. This is consistent with the views of Abane *et al.* (2021) and Sey (2011). The next chapter offers the conclusions that sum up the study and highlights the contributions of the study as well as its limitations and makes suggestions for future research.

CHAPTER 8 – CONCLUSIONS, CONTRIBUTIONS AND FUTURE RESEARCH

8.1 Introduction

This chapter concludes the study on how farmers in rural Ghana learn to adopt mobile phone technology as a resource and a boundary object and incorporate it into their farming business activities to achieve competitive advantage. Rural areas in Ghana and other developing economies rely on the use of mobile phone technology to help connect to the rest of the world due to a lack of telecommunications infrastructure for landline facilities and other support (Asongu, 2018). For agricultural and farming businesses in rural Ghana, there is the difficulty in access to international and local markets. Hence farmers in rural Ghana rely on the mobile phone technology in their farming business. Ghana's agriculture contribution to GDP was 18.24% in 2020 (Naik, 2021). However, this is one of the sectors that has received little support in terms of transportation, telecommunication or cybersecurity infrastructure, all of which could help to improve market access both locally and abroad. Hence, for farmers in rural Ghana to connect with the rest of the world, and explore business opportunities, they adopt mobile phone technology because they have no access to alternatives forms of communication. However, there is a dearth of knowledge on how these farmers adopt the technology and learn to use it in supporting their farming business activities. This study attempted to address this gap by seeking to answer the research questions below:

Research Questions

- 1. In what ways does the adoption of mobile phone technology influence the farming business activities of rural farmers in Ghana?**
 - a. How can the Resource-Based View of the firm help to frame an understanding of mobile phone technology use by Farming Small Business Entrepreneurships in Rural Ghana?*
 - b. How can the Technology Acceptance Model explain the behaviour of farmers in rural Ghana when adopting mobile phone technology as part of their farming business activities?*

2. How do rural farmers in Ghana learn to adopt the technology and integrate it into their farming business activities?

- a. *In what ways does mobile phone technology become a boundary object in influencing farming activities and relationships in rural Ghana?*
- b. *How can Kolb's Learning Cycle help to explain the process of mobile phone adoption by Farming Small Business Entrepreneurships in rural Ghana?*

To answer these questions both theoretical (conceptual) and empirical studies were undertaken. The theoretical study was informed by four theories, namely the Resource-Based View (RBV) by Barney (1992), Technology Acceptance Model by Davis (1989), Boundary Object theory by Star and Griesemer (1989) and Kolb's (2014) Learning Cycle.

8.2 Theoretical Study

The literature review suggested that understanding the role of ICT and ICT4D is fundamental for understanding how rural farmers in Ghana adopt mobile phone technology and learn to use it in support of their farming businesses. The literature suggests further that in Ghana and Africa, the investments made into the telecommunications infrastructure, backed by policies of liberalisation of the sector, have attracted many telephony and network companies into the sector, which has helped to open up new channels of communication, and this in turn has helped to connect regions, districts and rural areas, ensuring the regular flow of information from one place to another. It has also improved financial activities. This has been possible because of the reforms in the telecommunication sector since the year 2000 (Nstiful *et al.*, 2019; Karakara and Osabuohien, 2019; Mustapha, 2021; Agyei *et al.*, 2020). This has helped to increase government revenue through taxes and also to create employment, consistent with the views of Heeks (2010) and Olokonyo *et al.* (2021). The next section summarises the literature review based on the Resource Based View (Barney, 1992), Technology Acceptance Model (Davis 1989), Boundary Object Theory (Star and Griesemer, 1989) and Kolb's (2014) Learning Cycle to show how the existing literature provides insights into this important research area.

8.2.1 The RBV of the Firm and Mobile Phone Technology use by Farmers in Rural Ghana

In this section, the conceptual study seeks to answer RQ1a and RQ1b using Barney's (1992) Resource-Based View theory and Davis' (1989) TAM respectively. Theoretically, the study provides some understanding on how farmers in rural Ghana adopt mobile phone technology and platforms and how this influences their farming business activities. The extant literature suggests that as part of ICT and ICT4D, the adoption of mobile phone technology as a resource could help solve some of the development challenges faced by rural farmers in Ghana and Africa (see Tobbin 2010). For example, mobile phones can be used to support agricultural extension services to communicate with farmers on planting, fertiliser and the availability of other resources (Cole and Fernando, 2012; Odhiambo *et al.*, 2020).

Barney's (1992) work focuses managerial attention on a firm's internal resources to identify assets, capabilities and competences with the potential to deliver superior competitive advantage. Barney (1992) goes further to say that firms create advantages based on the resources they have, and how they effectively and efficiently use them. To Barney (1992), for an organisation's resource to hold potential as a source of competitive advantage, it should be Valuable, Rare, and Inimitable and of Organisational value (VRIO). Hence, achieving competitive advantage in using a resource should be based on the VRIO criteria.

The review suggests that using mobile phone as a resource enables organisations to engage in important activities such as mobile money transactions and e-commerce, and helps to avoid travelling as much as possible. The use of the mobile phone and the associated platforms also enables businesses to develop capabilities including literacy and numeracy skills, as well as speedy communications with customers and the ability to connect with the world (Abdul-Rahaman and Abdulai, 2022, Owusu *et al.*, 2021, Ayarkwa *et al.*, 2021). These capabilities enable businesses to develop stakeholder relationships and ease of communication.

As the capabilities develop over time, they provide organisations with competencies that enable competitive advantage over other businesses or individuals who do not have them (Argote and Hora, 2017). Despite these insights in the extant literature, very little is known about how the Resource-Based View of the firm helps to frame an understanding of mobile phone technology use by farmers in rural areas in Ghana. The next section reviews the literature on the behaviour of farmers when adopting the mobile phone technology as part of the farming business activities in Ghana (RQ1b).

To explain the behaviour of farmers in rural Ghana when adopting mobile phone technology as part of their farming business activities, the literature on the most widely used model – the Technology Adoption Model (TAM) – was reviewed. TAM suggests that there are five variables that determine whether technology will be accepted by potential users. These are (i) external factors, (ii) perceived ease of use (PEOU), (iii) perceived use (PU), (iv) behavioural intentions (BI), and (v) the actual system use (AU). The model suggests that the adoption of the mobile technology is because the user does not need to learn deeply about how to use it due to the ease of the technology, simplicity, positive attitude of users and social and family usage (see Mariano *et al.*, 2022; Mohamad *et al.*, 2021; Kwateng, 2015).

Some of the mobile phones have interfaces or features that are simple, which allows the user in Ghana and Africa to learn by teaching themselves, and PEOU of the technology also influences the user behaviour (Kwateng, 2018). However, despite these insights in the literature, not much can be found in the extant literature on how the Technology Acceptance Model explains the behaviour of rural farmers in Ghana in the adoption process. Adopting the technology also encouraged learning by the users, and the next section sums up the extant literature on how rural farmers in Ghana learn to adopt the mobile phone technology and integrate it into their farming business activities (RQ2a).

8.2.2 How Rural Farmers in Ghana Learn to Adopt and Integrate the Mobile Phone Technology into their Farming Business Activities

RQ2a seeks to understand the ways in which the mobile phone technology becomes a boundary object in influencing farming activities in rural Ghana. The literature review shows that the Boundary Object Theory has been used to highlight how the mobile phone helps partnerships and stakeholders to undertake activities no matter their location (Del Chiappa, Bregoli and Kim, 2019). Users of the boundary object technology can be in two places at the same, performing different functions using the same technology. This is because the technology can be appropriated (Kummitha, 2020; Bar, 2012). The mobile phone technology appeals to users as a boundary object because it could be used no matter the location and for multiple tasks. For example, attending family meetings while supporting farming assistants (Griesemer, 1989). It also helps to intersect the social, cultural and other worlds of the user by tearing down the time boundary (Islind *et al.*, 2022) because the technology can be used for the purpose chosen by the user, no matter the time. Arguably, for users of mobile technology in developing economies, it is the aforementioned benefits that have been fundamental to the increase in the adoption of the technology. However, despite the benefits which the technology provides as indicated in the literature, Ejemeyovwi and Osabuohien (2020) intimate that there appears to be little or no information on the ways the rural farmer sees the mobile phone technology as a boundary object and how it influences farming activities and relationships.

The adoption of the mobile phone also enabled users to learn to acquire skills. However, there is little understanding of how users learn using the mobile phone technology. RQ2b attempted to address this gap by reviewing the literature using Kolb's (2014) Learning Cycle as a lens to explain the process of learning during mobile phone adoption by Farming Small businesses in rural Ghana. Kolb's (2014) learning theory posits that in the learning process, knowledge is created through the transformation of experience. Kolb's learning theory identified four methods: experimentation, abstract conceptualisation, reflective observation and concrete experience (see Chapter 2 for a detailed review).

The review of the literature suggested that users of mobile phone technology and related platforms may go through a cycle of learning in the process of adopting the technology. That is, they acquire knowledge, some of which involves abstract concepts, and apply it in different situations, in line with Kolb's (2014) theory on learning. Looking more specifically at learning with technology, Engeström's (1991) Activity Theory posits that in the learning process, the user's interaction with the technology is influenced by mediating objects; these could be the technology itself or stakeholders supporting the use of the technology, including telephony companies, mobile phone repairers and independent retailers of mobile phone accessories. As learning progresses, skills and knowledge are acquired, which impact the experience that users of the technology acquire (Aker *et al.*, 2012). However, the literature does not give much insight into how users of mobile phone technology in rural areas learn, including farmers in Ghana, nor could much be found on the skills and experience rural farmers acquire through using the technology.

To sum up the theoretical study, while the literature review provides knowledge on the adoption of mobile phone technology and how farmers may learn while using the phone, not much knowledge exists on (i) how Barney's (1992) Resource-Based View (RBV) of the firm helps to frame an understanding of mobile phone technology adoption by farmers in rural Ghana, (ii) how farmers in rural Ghana's behaviour is influenced in the technology adoption process as suggested by Technology Adoption Model (TAM) (Davis, 1992), (iii) how the technology bridges the social, economic and other worlds of farmers in rural Ghana based on the Boundary Object theory (Star and Griesemer, 1989), and (iv) the applicability of Kolb's (2014) Experiential Learning Cycles to the rural farmers. The empirical study therefore explored and answered these questions using in-depth interviews and participant observation with the two main farming groups in the Kwahu district of rural Ghana.

8.3 Methodology

At the empirical level, the study was conducted in two stages. Stage one was deductive, during which a pilot study was undertaken based on the Resource-Based View (Barney, 1992) and Kolb's (2014) Experiential Learning Cycles with the farmers. The sample comprised six businesses. The in-depth interview process lasted between 45 minutes and 1 hour for each respondent. The findings indicated that the rural farmers adopt the technology not only because they see it as a resource and learn during adoption, but also because its adoption influences their behaviour as they are able to appropriate and domesticate the technology to achieve additional benefits. As a boundary object, mobile phone technology appeals to rural farmers because it can be used no matter the location and for multiple tasks. Based on the findings of the deductive study, two additional research questions were added, and the literature was reviewed further. Consequently, the Boundary Object theory (Star and Griesemer 1989) and the Technology Acceptance Model by Davis (1989) were included in the main study. The main study used an inductive approach to allow an in-depth investigation of how farmers in rural Ghana adopt mobile phone technology and how this influences farming business activities from interpretivist and social constructionist approaches. The main study involved in-depth interviews with 24 farmers in the Kwahu district of the eastern region of Ghana. The farmers were chosen from each of the two main farming groups – namely the Ministry of Agriculture Farmers (MOFA) and the Esoko. The respondents were purposively sampled. The in-depth interviews lasted between 45 minutes to 1 hour in the farms and in the homes of the farmers (Creswell, 2019; Bryman and Bell, 2015).

Before the Interview, the purpose of the study was explained to the farmers who had agreed to participate and who then signed the consent forms. Farmers were also assured that upon completion of the audio and video interview and analysis, their documents would be disposed of to maintain privacy and confidentiality (Easterby-Smith *et al.*, 2008). Farmers were further assured that during the interview process should they want to opt out, they would be given the chance to do so. The in-depth interviews were also backed by a day's observation of one farmer from each group two farmers during 'A Day in the Life of the Farmer'. The observation allowed the researcher to spend a day with them, from their homes to the farms and back to their homes. The objective was to further understand how the farmers use the technology in order to complement the in-depth interviews.

8.4 Mapping Principal Findings of Empirical Study to RQ1 and RQ2

8.4.1 Influences on the Adoption of Mobile Phone Technology on the Farming Business Activities in Rural Ghana

Research Question 1 focuses on the ways through which the adoption of mobile phone technology influences the farming business activities of rural farmers in Ghana. The findings from Research Questions 1a and 1b are presented below based on Barney's (1992) RBV theory and Davis (1989) TAM. The findings suggest that the farmers adopt the technology as a resource that enables the farming businesses to acquire capabilities and competencies in order to gain competitive advantage. However, the adoption process is influenced by specific external variables and farmers' behavioural intentions, including a sense of pride for owning a mobile phone, self-belief, self-sufficiency and social status.

8.4.2 RQ1a. How the RBV of the Firm Help to Understand Mobile Phone Technology Use by Farmers in Rural Ghana

Regarding how the Resource-Based View of the firm frames the rural farmers' adoption of the mobile technology, the findings indicated that farmers stated that the mobile phone served as (i) a resource, (ii) a technology that offers capabilities, and (iii) a technology that offers competence based on the capabilities acquired. As a resource, the technology enables farmers to create value. Farmers used the mobile phone to facilitate marketing and sales, financial mobilisation and access to banking services, access to health and business insurance policies, and access to information on agricultural inputs and weather. For example, farmers used the technology to communicate with customers and thus improve marketing and sales. As a result of the technology, farmers, as well as their customers and suppliers, did not have to travel with physical cash to meet one another but did transfers using the mobile wallets and the banking facilities, extending the views of Asongu *et al.* (2012; 2019). On financial mobilisation, farmers were able to access short-term loans and insurance to support both the farming and family, extending the views of Alhassan and Kwakwa (2012) and Folitse *et al.* (2019) on mobile phone adoption as a resource by small-scale farmers. The technology also helped farmers to be able to identify and check prices of produce in Ghana. As farmers continued to use the technology, they developed specific capabilities or advanced skills which

allow them to do the farming business more efficiently. These included literacy, numeracy, the usage of business applications including financial resource management (MoMo), social media usage through Facebook and WhatsApp, and research and communication capabilities. These capabilities in turn led to the development of competencies including customer relationship management, social networking, research on best practices and access to local and international markets. Other capabilities developed were content creation, development and sharing. These findings confirm Barney's (1992) Resource-Based View. However, interestingly Barney's (1992) VRIO criteria does not apply to rural farming businesses adoption of mobile phone technology to gain competitive advantage. The findings of the study show that the Value, Rare, and Costly to Imitate and Organised to capture value criteria do not apply to rural farmers in Ghana and how they gained competitive advantage because the mobile phone is not rare and inimitable as shown in Figure 7.2 and the revised conceptual model Figure 8.1. Rather, it is how the rural farmer organises its usage to capture value in the farming business that creates competitive advantage.

8.4.3 RQ1b. How the Technology Acceptance Model Explains the Behaviour of Farmers in Rural Ghana

The Technology Acceptance model thrives on the assumption that users of a particular technology are likely to adopt it if they perceive the technology to be useful, based on its features and benefits. The likelihood of adopting the technology is based on the following: (i) external variables, (ii) perceived ease of use (PEOU) and perceived usage (PU), (iii) behavioural intention (BI), (iv) attitude towards use, and (v) actual system use (AU). In answering Research Question 1b on the Technology Acceptance Model (Davis, 2018), the findings show that the adoption of mobile technology by farmers in rural Ghana is influenced by perceived ease of use (PEOU) and the perceived usefulness (PU) of the technology. On PEOU and PU, the study is consistent with Davis (1986, 1989 and 2000) and Owusu *et al.* (2021), indicating that the mobile phone technology is simple to use and that the features and designs influence the adoption with ease coupled with the benefits that it provides. Experiencing the use of the technology extended farmers' belief in it and its perceived usefulness. Furthermore, the study shows that farmers' PEOU and PU are influenced by specific external variables.

These variables were influences from family, friends and community and network providers; topography, transportation problems and weather issues; and perceived trust, perceived security and perceived safety associated with the mobile phone technology. According to the farmers, problems of transportation, the weather and the topography of the lands where the farms were located posed problems for alternative forms of telecommunication infrastructure. However, the mobile phone technology allows them to communicate no matter the location, and this finding extends the views of Dillion and Morris (1996) and Lin (2007).

Other external variables that influenced adoption were a lack of confidence in traditional banks; perceived trust and perceived security associated with the technology use; and support from the media and telephony companies in educating farmers. Farmers' behavioural intention was influenced by a sense of pride for owning a mobile phone, self-belief and self-sufficiency and social status. These finding regarding external factors and behavioural intentions of farmers are not in the extant literature, and as a result the study extends the TAM by highlighting the above influences on the rural farmer's adoption of mobile phone technology in rural Ghana.

8.4.3 How Rural Farmers in Ghana Learn to Adopt Mobile Phone Technology

Research Question 2 sought to understand how farmers in rural Ghana learn to adopt mobile phone technology and incorporate that into their farming business activities. The findings suggest that as the farmers adopt the technology, they acquire skills and knowledge that makes it easier for them to domesticate and appropriate the technology to suit their farming business activities. The findings from Research Questions 2a and 2b presented below draw on the perspectives of Star and Griesemer's (1989) Boundary Object theory and Kolb's (2014) Learning Cycle.

8.4.4 RQ2a. The Mobile Phone Technology as a Boundary Object for Farmers in Rural Ghana

In answering Research Question 2a, the study shows that the mobile phone is a boundary object (Star and Griesemer, 1989). The study shows that the technology as an artefact influences the rural farmers' business relationships from three areas. These are: (i) as a bridging device, (ii) as a technology that eliminated gender and generational divides, bringing women and university graduates into farming, and (iii) as a relationship-building technology. As a bridging device, the technology connected farmers and employees as well as other social networks without having to travel to places. Farmwork could be coordinated no matter the location of the farmers, using the technology as a connecting device (see Figure 7.4). This was corroborated by Farmer #7, who was overhead arranging a meeting on the phone with other people while he was on the farm. The study also provides interesting insights on how the mobile phone technology eliminates gender and generational divides, helping women and university graduates to get into a centuries-old farming profession which has been dominated by men. Women in the Kwahu districts are known for doing subsistence farming to support the home rather than farming as a business, due to their additional role of managing the home if they are married and have children. However, the study shows that the mobile phone technology allows the women to multitask without having to be in two places. University graduates are known for doing white- and blue-collar jobs in the cities rather than farming in a rural area. The technology allows them to network and access support when needed. The influence of mobile phone technology in farming is therefore changing farming from a profession reserved for older, uneducated men to a business that can be done by women and university graduates. On relationship building, using the technology allows farmers to build relationships between governmental and non-governmental institutions that support rural farmers in rural Ghana. The relationships between these institutions and the farmers centres around advice on best practices in farming, fertiliser applications, weedicide applications and storage issues.

As most representatives of these institutions could not always travel to the farms due to transportation problems and seasonality issues, the mobile phone acts as a conduit that connected the farmers and the institutions to enable the swift flow of information and advice in support of the farming businesses. Thus, the study provides a new understanding to the Boundary Object theory from the perspective of rural farmers' adoption of technology in Ghana, and its impact in the agricultural sector. This understanding differs from how mobile technology is used as a Boundary Object in schools and in the health sectors in developed economies (Cattaneo *et al.*, 2021, Akkerman, 2011).

8.4.5 How Kolb's Learning Cycle Helps to Explain Mobile Phone Adoption by Farmers in Rural Ghana

In response to Research Question 2b on Kolb's Learning Cycle, the findings show that farmers learn through experimentation and experience, reflective observation and abstract conceptualisation. Regarding experimentation and experience, farmers learned through do it yourself (DIY) and through mistakes. Observational findings from Farmer #7 corroborated with the in-depth interviews. The farmer was seen flipping his phone during the observation trying to respond to a message. Farmers also used non-reflective observation methods as they sought support from their children, otherwise known as reverse parenting. With the support of the children, farmers learned how to operate the phone, receive and make calls.

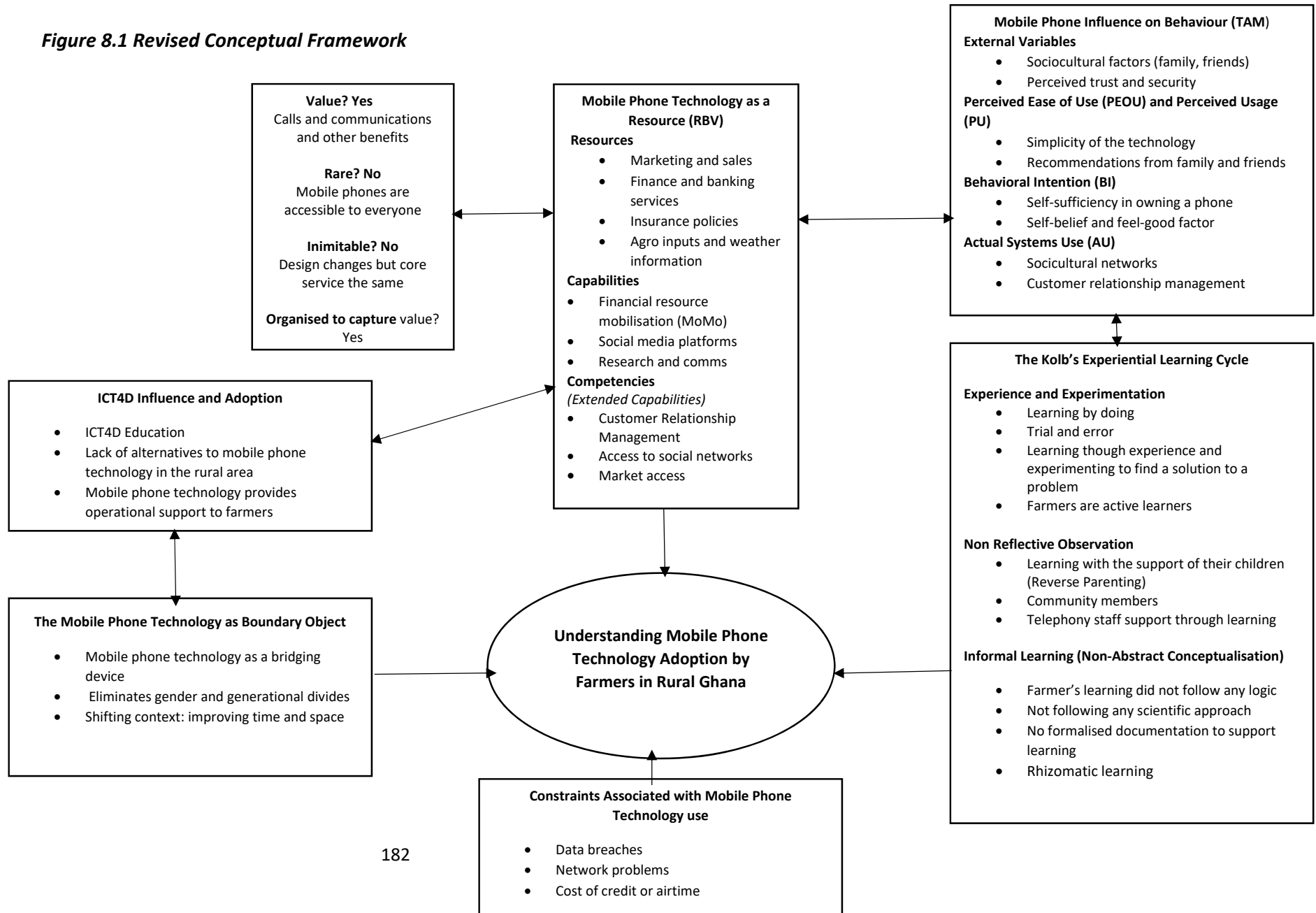
In addition to relying on their children, they also relied on the community, and the staff of the telephony companies for advice on using the technology. Furthermore, farmers used informal learning or non-abstract conceptualisation methods. Farmers also learned with support from radio programmes, which they accessed on their phone. According to the farmers, these programmes supported them in learning about best practices in farming without having to attend formal classes. The findings show that farmers did not use any scientific approach or follow any logical plan, but rather learned rhizomatically. The findings in the study are therefore partially consistent with the concrete experience stage of Kolb's (1992) Learning Cycle while refuting the reflective observation and abstract conceptualisation stages.

8.4.6 Constraints Associated with the Use of Mobile Phone Technology

Despite the benefits associated with the adoption of mobile phone technology, farmers indicated that network problems, data breaches and the cost of airtime were constraints that they grapple with. On network issues, farmers sometimes lose networks at home and on the farm. This is because most of the farms are in the hilly areas, in the forests and across the Afram River where the topography and the weather impact on the networks. Due to network problems, farmers believed that some of the telephony companies are better than others, hence some of them having two or more SIMs (see Table 6.3). The cost of credit was also another issue identified by the farmers. According to the farmers they spent a lot of money on buying credit, which gives them access to make calls and use the internet. The study shows that data was sold as bundles, encouraging farmers to spend more and make more calls. The farmers further stated that sometimes the promotional messages from the telephony companies received also cost them in terms of data and credit loss.

Farmers further complained of data breaches. Sometimes they would receive calls from people claiming to be working with the telephony companies and asking for the PINs to their mobile wallets. After giving out these numbers, they reported that money from their wallets was stolen. Farmers found it difficult to understand how these scammers got access to their data from the telephony companies. Nonetheless, the farmers indicated that the telephony companies had been educating them through messages and radio advertising on keeping their telephones and their PINs safe, and not giving them to anyone. Drawing on these empirical findings, the conceptual model of Figure 4.1 has been revised (see Figure 8.1) to provide an understanding of mobile phone technology adoption by farmers in rural Ghana.

Figure 8.1 Revised Conceptual Framework



8.5 Contributions to Knowledge

8.5.1 Theoretical Contributions

Theoretically, the study presents a conceptual framework summed up in Figure 8.1 to contribute to understanding how users, including farmers in rural Ghana, adopt mobile phone technology and how this influences their business activities. The conceptual framework integrates ICT and ICT4D and the four theories that underpin the study – namely, the Resource-Based View (Barney, 1992), Kolb's (2014) Learning Cycle, the Technology Acceptance Model (Davis 1989) and the Boundary Object theory (Star and Griesemer, 1989) – to show how existing literature provides insights into this important research area. The framework shows that in Ghana and Africa, the adoption of mobile phone technology as a resource confirms how ICT and ICT4D help to solve some of the development challenges faced by rural farmers (see Tobbin 2010). Using the mobile phone as a resource enables the development of capabilities and competencies that allow businesses to engage in important activities such as mobile money transactions and e-commerce and to avoid travelling as much as possible.

According to theory, the TAM posits that there are five factors that determine whether technology will be accepted by potential users. These are: (i) external factors, (ii) perceived ease of use (PEOU), (iii) perceived use (PU), (iv) behavioural intentions (BI), and (v) the actual system use (AU). Perceived usefulness is determined by the belief that the technology will do the job for which it is assigned for (Mariano *et al.*, 2022). The core function of the mobile phone technology is communication and information exchange, and it can be seen to perform that function (Chocarro *et al.*, 2021). On PEOU, research has indicated that users of a technology are likely to accept it if they perceive the technology as easy to use. In addition, those using it for business indicate that the technology reduces the cost of transportation between them and their business stakeholders. Adopting and using the technology makes the world available at the press of a button. Not only that, but the technology is also domesticated – that is, can be adapted to do different things, from making calls and sending messages to taking pictures and storing the data of friends, family and customers.

In developed countries, the literature confirms the benefits of technology through availability and use of applications (Kabbiri *et al.*, 2018) which allow users to buy, sell and undertake financial transactions. The technology facilitates online shopping, making irrelevant the location of the customers. The framework suggests that users of mobile phone technology and related platforms go through a cycle of learning in the process of adopting the technology. That is, they acquire knowledge, some of which involves abstract concepts, and apply it in different situations, in line with Kolb's (2014) theory on learning. As learning progresses, skills and knowledge are acquired, which impact the experience that users of the technology acquire (Aker *et al.*, 2012).

The framework suggests further that the mobile phone technology serves as a boundary object because it could be used for multiple tasks. In intersecting the social, cultural and other worlds of the user, the mobile phone technology as a boundary object tears down the time boundary (Islind *et al.*, 2022) because the technology can be used for the purpose the user chooses, no matter the time. Users of the boundary object technology can also be in two places at the same, performing different functions via the same technology. This is because the technology can be appropriated (Kummitha, 2020; Bar, 2012).

8.5.2 Empirical Contributions

Revised Conceptual Framework Framework

The empirical study contributes to the importance of ICT and ICT4D Information. Farmers indicate that the mobile phone has been a resource equipping them with capabilities and competencies which in turn have enabled them to have competitive advantage. However, there are three main challenges associated with the use of the technology. These are data breaches, network problems and cost of airtime or data which the farmers buy and upload on the phones. However, the issue of cost of data as a constraint has not been highlighted in the literature. That said, the farmers did indicate that regulations in Ghana regarding data issues and cyber security when using the mobile phone seems not to be working, and that was consistent with the views of Dzidzah *et al.* (2020) who suggest that mobile phone technology companies face challenges regarding data issues and cybersecurity. Regarding

mobile phone technology as a resource, the study shows how farmers adopted the technology as a resource to enable them to create value.

While confirming Asongu *et al.* (2021), Butakor (2021) and Abor *et al.* (2018) on how farmers create value by using the mobile phone, this study extends the literature by highlighting how the use of the mobile phone facilitates access to specific resources and enables the development of specific capabilities and competencies which together provide competitive advantage to farmers. The resources that are accessed are marketing and sales, finance and banking services, health and business insurance policies, and information on agricultural inputs and weather. Using the phone to access these resources enables farmers to develop and enhance skills and achieve capabilities. The capabilities include literacy and numeracy, business applications usage including financial resource management (MoMo), social media usage through Facebook and WhatsApp, research and communication. These capabilities led to the development of enhanced capabilities in the form of the competences which gives the rural farmers competitive advantage. The competencies include customer relationship management, social networking, research on best practices and local and international markets, content creation, sharing and development. These capabilities in turn created advantages (Barney, 1992) for their businesses. The thesis therefore confirms some aspects of Barney's (1992) Resource-Based View – namely, that firms create advantages based on the resources they have, how they acquire and then effectively use these as assets to enhance their capabilities, and as competences to deliver superior competitive advantage.

However, Barney's (1992) VRIO criteria does not apply to rural farming businesses using mobile phone technology to gain competitive advantage. Barney (1992) argues that resources must meet the VRIO criteria (Value, Rare, and Costly to Imitate and Organised to capture value). The study, however, shows that the criteria don't apply to mobile phone as a resource to the rural farmer in Ghana, as the mobile phone is not rare and inimitable as shown in Figure 8.1. Rather, it is how the rural farmer organises its usage to capture value in the farming business that creates competitive advantage. On how the Technology Acceptance Model by Davis *et al.* (1989) explains the behaviour of farmers in rural Ghana, the study affirms some aspects of the model. The study shows that farmers in rural Ghana's adoption of mobile technology is influenced by perceived ease of use of the technology and the perceived usefulness.

Yet, the study contributes to the literature by showing that farmers' PEOU and PU are influenced by specific external factors namely sociocultural networks (family, friends, and community and network providers), topography, transportation challenges and weather issues. Other variables that influence adoption are a lack of confidence in traditional banks, perceived trust, perceived security associated with the technology use and support from the media and telephony companies in educating farmers. Interestingly, the study shows that farmers' behavioural intentions are influenced by a sense of pride for owning a mobile phone, self-belief, self-sufficiency and social status. Interestingly, these influences have received little attention in the literature. The study therefore extends Technology Acceptance Model by Davis (1989) by highlighting the above influences on the rural farmer's adoption of mobile phone technology.

The study affirms that the mobile phone technology serves as a Boundary Object (Star and Griesemer, 1989) that influences activities and relationships of rural farmers in Ghana. However, the study contributes to knowledge by showing how rural farmers use the mobile phone technology as a bridging device to connect with workers, customers, suppliers, family and friends (see Figure 8.1). Farmers did not need to be at the farms but could coordinate their workflow from any location. The domestication of the mobile phone technology also reduces gender, generational and demographic boundaries, allowing women and university graduates to join the farming business community. The groups had previously not been involved in farming business, which is traditionally for men and the uneducated. The study suggests further that the mobile phone technology helps to eliminate the boundaries and connect various institutions and stakeholders such as governmental organisations and NGOs that support farming to the farmers.

In terms of how Kolb's (2014) Learning Cycle helps to explain the adoption of the mobile phone by the rural farmer, the study makes a contribution by showing that rural farmers combine concrete experience with experimentation while learning. Further, the study shows that while farmers do gain concrete experience in using the technology, this is done through self-learning, sometimes through trial and error.

Farmers also use non-reflective observation methods as they seek support from their children, community and telephony companies in the learning process, in contrast to the reflective observation cycle of Kolb's (2014) model. Furthermore, farmers used informal learning or non-abstract conceptualisation methods. Farmers did not use any scientific approach or follow any logical plan, but learned rhizomatically as already indicated. The findings in the study is therefore partially consistent with Kolb's (2014) experimentation and concrete experience stages of the cycle while refuting the reflective observation and abstract conceptualisation stages of the learning cycle. The next section discusses the methodological contributions of the study.

8.5.3 Methodological Contributions – The Hard-to-Reach Kwahu Farming Areas

The study took place in the Kwahu District of the Eastern Region of Ghana. This area was selected because it is one of the fastest-growing areas for agriculture in Ghana. Information from MOFA indicates that this district is predominantly a farming area, with most adults and young people going into farming for employment and to improve their livelihoods. The farming community comprises the Akan natives, with a few migrant workers (MOFA, 2020). The study indicates that the farmers are discreet and secretive and do not want to have anything to do with officials in the public and government sectors except, perhaps, extension officers, for personal and cultural reasons.

Most of these farming communities are on the small islands in the river Afram and on Lake Volta, making access very difficult due to the risks associated with canoe travel. As a result, there is little infrastructure and farmers rely on mobile phone technology to stay connected to the rest of the farming and fishing communities. Consequently, little academic research has taken place in this area, either, perhaps for fear of not receiving the support needed or even gaining access to respondents. The literature suggests that accessing these hard-to-reach respondents depends on connecting with them for who they are and through their community settings to be able to understand them (see Savard and Kilpatrick, 2022; Abrams (2010). This researcher is a native, and even so it was difficult and complex to undertake the study.

The study contributes to knowledge on reaching hard-to-access respondents by showing that spending some time with the community was required, from May 2018 to September 2019, not only to collect data but also to gain trust and develop a rapport with the farmers. It was also necessary to engage the community leaders and the chiefs, gain the support of the agriculture extension officers and Esoko officers who have been in the community for years and are well known to the farmers, and rely on the researcher's parents who are natives. In addition to using these networks, building rapport and negotiations are important when undertaking research in areas with similar characteristics to this study.

8.5.4 Practice and Policy Contributions

This section of the thesis discusses the implications of the research for the broader SME sector, especially agricultural SMEs in rural areas in Ghana and Africa. It suggests that ICT and ICT4D organisations have helped to promote the technology and, in response, farmers using it acquire capabilities that help to improve their farming business activities. The SME sector, in general, needs to recognise the benefits of appropriating mobile phone technology, especially when looking at improving farming business activities.

In rural Ghana, the agriculture sector employs about 50% of the population. Some of these farms are managed as businesses run by families or partnerships. They supply staple foods such as maize, yams, vegetables, poultry and pork, not only for the local area or district consumption but nationwide. Nevertheless, this is one of the areas in Ghana's economy that is least developed when it comes to good transportation and telecommunication facilities and infrastructure. Hence the sector relies on mobile phone technology and related platforms to facilitate their business activities, connect to the outside world, and stay in contact with families and friends. This study shows that farming small business enterprises (FSBEs), which form part of the agricultural sector SMEs, benefit from mobile phone technology in sales and customer relationships, networking, access to new markets, and weather and price information. The mobile phone enables farmers to gain access to customers and the other stakeholders involved in their farming business. Farmers will understand customers' and stakeholders' expectations, which enables them to adjust their supply strategies to meet them.

Once the produce is ready, farmers and customers communicate via the mobile phone to ensure the smooth completion of the payment and supply agreements. The benefits that the technology provides by enabling financial transactions for farmers who do not have formal banking facilities, can be replicated in the broader SME sector. Most agricultural SMEs are informal businesses, neither registered nor having formal business accounts, and mobile banking is seen as an alternative to formal banking. Ghana's mobile money (MoMo) interoperability system, which supports money transfers between the telephony companies and the banks, could also be encouraged within the broader SME sector. Ghanaians, like most people around the world, do business in a way that aligns to their culture. But this study also shows that adopting mobile phone technology engenders a sense of pride and improves relationships between families and friends. Improving sociocultural networks also creates new market opportunities. These reasons for the adoption of mobile phone technology could be used as a promotional strategy by the broader SME sector and the mobile telephony companies to facilitate business relationships that could help improve market shares for the telephony companies.

Regarding policy, the current study confirms the logic for the government's deregulation of the telecommunication sector in Ghana (Tobbin, 2010; Matheson and Petit, 2020) and support for adopting mobile phone technology through the Electronic Transaction Act, 2008 (Act 772) and the National Communications Authority Act, 2008 (Act 769) to help users of the technology and the telephony companies. MOFA and Esoko help some farmers in Ghana, providing them with agricultural and agronomic support via mobile phone technology. However, government needs to do more to address the challenges faced by rural farmers with regards to security issues, data loss or mismanagement, and scammers who could access users' mobile wallets and provide tax incentives to enable mobile telephone companies to reduce the cost of airtime. The government could also collaborate with ICT and ICT4D companies, to promote the adoption of mobile phone technology and provide tax rebates to encourage wider adoption of the technology in rural parts of the country. The study shows that the government could expand use of mobile phone technology in agriculture through radio programmes like *Akuafo mere nie (Farmers' Hour)* to educate farmers to promote economic development.

8.6 Limitations of the Research

8.6.1 A Cross-sectional versus a Longitudinal Approach

A cross-sectional approach was used in this study. However, given the dynamic nature of the adoption and knowledge of modern technology, it would have been more useful if the study had been longitudinally designed to help unravel and understand the complex nature of the adoption of mobile phone technology in rural Ghana, especially when working with respondents who do not have much education and who regard community privacy as paramount. This is because they do not want to have any engagement with government officials that is related to revenue investigation and or taxation. Nonetheless, with the limited time for the interviews, a one-day observation dubbed 'A Day in the Life of the Farmer' was included in the data collection process to understand the life of the rural farmer beyond the in-depth interviews to enhance validity.

8.6.2 Sampling

The sampling frame could be criticised since the selection of the 24 farmers from the two farming groups was done purposively. It is possible to criticise the judgement of the researcher for using this method without considering methods like quota and snowball sampling, which are simple, efficient to implement and cost-effective. Two farming groups of 12 farmers each from MOFA and ESOKO were selected to enhance the maximum variation and validity of the findings (Creswell, 2012; Saunders *et al.*, 2014). Furthermore, the two farming groups were selected from the Kwahu District of the eastern region of Ghana, as they are the two main farming groups in the district. Ghana depends on these types of farming groups, as agriculture is one of the main contributors to the country's gross domestic product (GSS, 2019). Nonetheless, this sampling method seemed to be appropriate because it took into consideration the research questions and the theories underpinning the study (Creswell and Tashakkori, 2007). Secondly, the sampling strategy was appropriate because the study aimed to understand how and why rural farmers adopt mobile phone technology and learn to use it in conducting farming business activities in rural Ghana.

8.6.3 Farming Entrepreneurs versus Single Respondents

The study relied on farming entrepreneurs as single respondents in each of the sampled farming businesses due to the way farming businesses are set up in Ghana. About 80% of the small businesses are owned by sole proprietors – that is, they are individually owned. This is consistent with previous studies in SMEs and technology usage (Frempong, 2009; Asare *et al.*, 2012; Agboh, 2015; Chenge and Wang, 2020; Amaglo, 2020). The study has shown that in the context of farming small businesses entrepreneurship in rural Ghana, the owners run the business. They conduct all the activities in the business if they can afford to, from land acquisition to planting, harvesting, and sales and marketing. They connect with the relevant stakeholders in the business, including fertiliser suppliers and companies that supply agrochemicals. Other important stakeholders include governmental and non-governmental organisations like MOFA and ESOKO. Using mobile phone technology has helped to improve relationships between the farmers (owner-managers) and the rest of the farming and business community through farming information exchange. Because of this, focusing on the owner-managers in this area of research was the obvious choice in trying to understand how rural businesses in Africa adopt technology and learn to use it in running their respective businesses.

8.7 Suggestions for Future Research

The findings and the limitations of the research offer opportunities for future research. Because adoption and learning are complex and dynamic processes when it comes to technology adoption, it would be appropriate to extend the research longitudinally, involving a similar or larger sample from within three to five years. This would help to understand and unravel the complexities of how businesses owners in rural Africa, with little exposure to education, adopt and learn to use modern technology. The study demonstrates that rural farmers use the technology for farming business and in their daily lives, such as managing social and family networks, as indicated in the one-day observational research study called ‘A Day in the Life of the Farmer’. It would therefore be useful to take the observation further by

using a larger sample or a survey on small farming businesses or subsistence farmers to understand more about the use of mobile phone technology in life beyond farming, as highlighted in the current study. Since the study was limited to rural Ghana and farming, it would be useful to replicate this study in different developing economies to facilitate comparisons of factors that influence the adoption and knowledge of mobile phone technology. The study could be replicated using different farming groups, within different industries and or comparing different countries.

8.8 References

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APPENDICES

Appendix 1 to Appendix 18 (pages 243 - 291) removed to protect the anonymity of participants.

Appendix 19 – The Participant Information Sheet

This information sheet provides you with details about a research study on mobile phones and related platforms, as used by small businesses in rural Ghana. You have been invited to take part in this research. *Before you decide whether or not to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully.*

Why have I been invited to participate?

The 24 FSBEs that have been selected for the study have been selected based on data from a number of sources, including the Ministry of Food and Agriculture Ghana, the Kwahu South District Assembly and the National Board for Small Scale Industries. A key aspect of the selection process has been the role of mobile phone technology and related platforms in these small businesses. You have been approached, using the sources mentioned, because we believe you fit with the sample criteria above.

Criteria for Inclusion/Exclusion

In addition to the above, your business has been selected because (i) the business fits the FSBE criteria reference to size and income; (ii) the business uses mobile technology to facilitate business processes; and (iii) the business is within the Kwahu District of the Eastern Region of Ghana.

Do I have to take part?

The study is voluntary. *If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form. If you decide not to take part, you are still free to withdraw at any time and without giving reasons.*

What will happen to me if I take part?

Once you decide to take part, the researcher will make an appointment for a visit. This is when you will be interviewed. Your consent will be sought as to whether the interview should be audio or video recorded. This will be done informally and will only last for about 30 to 60 minutes. There is no disadvantage involved in taking part of the study.

What will happen if I do not want to take part?

Nothing happens if you do not want to take part. Choosing not to take part in the study will not have any impact on your relationship with the government or any other non-governmental organisation you are involved with.

What are the possible benefits of taking part?

Results from the analysis of the study would help your business understand and make good use of mobile phone technology to help your business grow. This is the direct benefit. The findings will be useful to many other rural communities on how mobile phone technology and related platforms would help improve their business processes, as well as other bodies, such as the World Bank and the International Telecommunication Unions (ITU), who are interested in promoting the economic prosperity of areas like rural Ghana.

Will what I say in this study be kept confidential?

All information collected about you as an individual will be kept strictly confidential. The recording equipment and the data will be kept under lock and key. Where the information is stored online, this will be password protected. I would be the only person to have access to it. Once the information has been transcribed, the recordings will be deleted. In addition, all paperwork collected will also be securely stored and participants will also be anonymised in line with data protection policies.

What should I do if I want to take part?

To take part in the study, you will simply need to complete the consent form once you have been invited to participate. You will still have the chance to opt out if you choose to.

What will happen to the results of the research study?

Once the research is completed, the results will be used in my thesis for the pursuit of the PhD degree. Should you want a copy of the research report, this will be sent to you on request.

Who is organising and funding the research?

I am conducting the research as a student of Oxford Brookes University. This is self-funded research.

Who has reviewed the study?

The research has been approved by the University Research Ethics Committee, Oxford Brookes University.

What is the purpose of the study?

The research is intended to explore the reasons behind the adoption of mobile phones in rural Ghana by Small Business Entrepreneurships (FSBEs), and how these have helped improved business activities. Mobile phones are used for business for many reasons in particular, and the research will focus on the following questions: (i) What are the reasons for the adoption of mobile phones and related platforms by SBEs in rural Ghana; and (ii) How do mobile phones and related platforms help in improving SBEs' business processes. For this study, 24 FSBE owner-managers of various farms, ranging from cocoa to coffee, cassava, and pineapple farms, will be interviewed. The data for this research will be collected in September 2018.

Contact for Further Information

Emmanuel Mensah Asiedu
Oxford Brookes Business School
Headington Campus
Oxford Brookes University
Oxford
OX3 0BP
Email address: 15004565@brookes.ac.uk

Finally, should you have any concerns about the way in which the study has been conducted, please do contact the Chair of the University Research Ethics Committee on ethics@brookes.ac.uk or the Director of Studies.

Thank you

Once again, I would like to offer my sincere thanks to you for taking part in this study and hope the results of the research would benefit your business in the future.

Date

18th September 2018



CONSENT FORM

Full title of Project:

Understanding how Mobile Technology and Related Platforms influence Farming Small Business Activities in Rural Ghana

Name, position and contact address of Researcher:

Emmanuel Mensah Asiedu

Oxford Brookes Business School

Headington Campus

Oxford Brookes University

Oxford

OX3 0BP

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.

☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.

☐

3. I agree to take part in the above study.

☐

Please initial box

	Yes	No
4. I agree to the interview being audio recorded	☐	☐
5. I agree to the interview being video recorded	☐	☐
6. I agree to the use of anonymised quotes in publications	☐	☐
7. I agree that my data gathered in this study may be stored (after it has been anonymised) in a specialist data centre and may be used for future research.	☐	☐

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Emmanuel Mensah Asiedu	Date	

Appendix 21 Permission to use farmer's data

August 2018,

ESOKO FARMERS GROUP – AFRAM PLAINS

To whom it may concern,

Permission to use farmer's data

I am a research student with the above university studying for a philosophy degree. I am researching the role of mobile phone technology in supporting farming small business entrepreneurship in rural Ghana, but within the Kwahu District of the Eastern Region. The research is to explore the reasons for the adoption of mobile phones in rural Ghana by Small Business Entrepreneurships (FSBEs) and how these have helped improved business processes. This is an interview-based study which would last between 45 minutes to 1 hour. This implies I will need to have access to the data of the farmers with your support as the extension officer within the district area. I would be grateful for your support in granting me access to the data of the farmers who are willing to participate in the research study.

Once again, I would like to thank you for your support in the study and hope the results would help to improve the businesses in your area. Please see the data compliance form attached as well.

Yours Sincerely,

Emmanuel Mensah Asiedu

Esoko Officer

Department of Accounting, Finance and Economics

Afram Plains

Oxford Brookes Business School

Address.....

Oxford Brookes University

Contact Number.....

Headington Campus

Oxford

Signature

.....

OX3 0BP

Email : 15004565@brookes.ac.uk

Research Student

August 2018,

The Ministry of Food and Agriculture (MOFA) – Eastern Region Ghana
Kwahu District (North, South, East, West)

To whom it may concern,

Permission to use farmer's data

I am a research student with the above university studying for a philosophy degree. I am researching about the role of mobile phone technology in supporting farming small business entrepreneurship in rural Ghana, but within the Kwahu District of the Eastern Region.

The research is to explore the reasons for the adoption of mobile phones in rural Ghana by Small Business Entrepreneurships (FSBEs) and how these have helped improved business processes. This is an interview-based study which would last 30–45 minutes.

This implies I will need to have access to the data of the farmers with your support as the extension officer within the district area. I would be grateful for your support in granting me access to the data of the farmers who are willing to participate in the research study.

Once again, I would like to thank you for your support in the study and hope the results would help to improve the businesses in your area. Please see the data compliance form attached as well.

Yours Sincerely,

Emmanuel Mensah Asiedu

Department of Accounting, Finance and Economics

Oxford Brookes Business School

Oxford Brookes University

Headington Campus

Oxford

.....

OX3 0BP

Email : 15004565@brookes.ac.uk

Research Student

Extension Officer

Kwahu Area

Address.....

Contact Number.....

Signature

Date: 2nd–7th September 2018

**Study Title: Understanding how mobile phone technology and platforms influence farming
business activities in rural Ghana**

Translation Services and Transcription of Interviews

In order for the University to utilise the Services, Emmanuel Asiedu a PhD student may need to have access to some personal data ('**Data**') which data is protected under the Data Protection Act 1998 ('**the Act**').

These Data will include, but not necessarily be limited to: Transcription of interviews as directed by the Principal Investigator of the project, or moderator and note taker of group interviews or focus groups.

The parties agree that in respect of the Data, the University is the Data Controller and Ministry of Food and Agriculture Kwahu is the Data Processor. Emmanuel Asiedu warrants to the University that it shall:

- (i) process the Data at all times in accordance with the Act and solely for the purposes of providing the Services to the University and for no other purpose or in any manner except with the express prior written consent of the Data Controller; and
- (ii) comply with the seventh Data Protection Principle by implementing appropriate technical and organisational measures to prevent unauthorised and unlawful processing of the Data and to prevent accidental loss, or destruction of, or damage to the Data; and

- (iii) ensure that each of its employees, agents and subcontractors are made aware of its obligations with regard to the security and protection of the Data and require that they enter into binding obligations with the Data Processor to maintain the appropriate levels of security and protection of the Data; and
- (iv) not divulge the Data whether directly or indirectly to any person, firm or company or otherwise without the express prior written consent of the Data Controller except to those of its employees, agents and subcontractors who are subject to (iii) above or except as may be required by any law or regulation; and
- (v) not process the Data outside of the European Economic Area except with the express prior written authority of the Data Controller; and
- (vi) to comply with any request from the Data Controller to amend, transfer or delete data and on completion of the Services to deliver to the Data Controller or destroy, at the Data Controller's sole option, all the Data Controller's Data in its possession or under its control

Ministry of Food and Agriculture agrees to indemnify the University for any fine it may receive from the Information Commissioner and/or pursuant to sections 13 and 14 of the Act arising from any breach by Emmanuel Asiedu of the above warranties; provided:

- (a) Emmanuel Asiedu has sole control of the defence and/or settlement of such claim to the extent possible; and
- (b) the University notifies Ministry of Food and Agriculture promptly in writing of each such claim and gives Emmanuel Asiedu all information known to the University relating thereto; and
- (c) The University cooperates with Ministry of Food and Agriculture in the settlement and/or defence of such claim; and
- (d) the University mitigates its loss to the fullest extent possible; and

(e) the University makes no admission in respect of such claim.

The parties agree that any commercially sensitive information disclosed during the provision of the Services shall be treated with confidence and used only to the extent necessary to perform the Services.

For the avoidance of doubt these terms and conditions replace and supersede any other terms and conditions between the parties relating to their respective obligations under the Act.

Please counter-sign a copy of this letter if you are happy to provide the Services on these terms.

Date: 10th–15th September 2018

**Study Title: Understanding how mobile phone technology and platforms influence farming
business activities in rural Ghana**

Translation Services and Transcription of Interviews

In order for the University to utilise the Services, Emmanuel Asiedu a PhD student may need to have access to some personal data (**'Data'**) which data is protected under the Data Protection Act 1998 (**'the Act'**).

These Data will include, but not necessarily be limited to: Transcription of interviews as directed by the Principal Investigator of the project, or moderator and note taker of group interviews or focus groups.

The parties agree that in respect of the Data, the University is the Data Controller and ESOKO is the Data Processor. Emmanuel Asiedu warrants to the University that it shall:

- (i) process the Data at all times in accordance with the Act and solely for the purposes of providing the Services to the University and for no other purpose or in any manner except with the express prior written consent of the Data Controller; and
- (ii) comply with the seventh Data Protection Principle by implementing appropriate technical and organisational measures to prevent unauthorised and unlawful processing of the Data and to prevent accidental loss, or destruction of, or damage to the Data; and
- (iii) ensure that each of its employees, agents and subcontractors are made aware of its obligations with regard to the security and protection of the Data and require that

they enter into binding obligations with the Data Processor to maintain the appropriate levels of security and protection of the Data; and

- (iv) not divulge the Data whether directly or indirectly to any person, firm or company or otherwise without the express prior written consent of the Data Controller except to those of its employees, agents and subcontractors who are subject to (iii) above or except as may be required by any law or regulation; and
- (v) not process the Data outside of the European Economic Area except with the express prior written authority of the Data Controller; and
- (vi) to comply with any request from the Data Controller to amend, transfer or delete data and on completion of the Services to deliver to the Data Controller or destroy, at the Data Controller's sole option, all the Data Controller's Data in its possession or under its control.

ESOKO agrees to indemnify the University for any fine it may receive from the Information Commissioner and/or pursuant to sections 13 and 14 of the Act arising from any breach by Emmanuel Asiedu of the above warranties; provided:

- (a) Emmanuel Asiedu has sole control of the defence and/or settlement of such claim to the extent possible; and
- (b) the University notifies ESOKO promptly in writing of each such claim and gives Emmanuel Asiedu all information known to the University relating thereto; and
- (c) the University cooperates with ESOKO in the settlement and/or defence of such claim;
- (d) the University mitigates its loss to the fullest extent possible; and
- (e) the University makes no admission in respect of such claim.

The parties agree that any commercially sensitive information disclosed during the provision of the Services shall be treated with confidence and used only to the extent necessary to perform the Services.

For the avoidance of doubt these terms and conditions replace and supersede any other terms and conditions between the parties relating to their respective obligations under the Act.

Please counter-sign a copy of this letter if you are happy to provide the Services on these terms.

Appendix 23 Data Protection Document

Name of researcher – Emmanuel Mensah Asiedu

Study title: Understanding how mobile phone technology and platforms influence farming business activities in rural Ghana

Data Protection Act 1998 Compliance & Confidentiality Acceptance

I refer to the terms of your letter set out above and hereby unconditionally accept its terms and agree to comply with all Data Protection Act 1998 requirements in respect of any processing of personal data performed by me in the provision of the Services and to treat in confidence any confidential information which may become known to us during the provision of the Services.

Yours faithfully

Emmanuel Mensah Asiedu

10th September

.....

.....

Printed Name of person undertaking transcription or moderation Date

Name of researcher – Emmanuel Mensah Asiedu

**Study title: Understanding how mobile phone technology and platforms influence
farming business activities in rural Ghana**

Data Protection Act 1998 Compliance & Confidentiality Acceptance

I refer to the terms of your letter set out above and hereby unconditionally accept its terms and agree to comply with all Data Protection Act 1998 requirements in respect of any processing of personal data performed by me in the provision of the Services and to treat in confidence any confidential information which may become known to us during the provision of the Services.

Yours faithfully

Emmanuel Mensah Asiedu

8th September 2018

.....

.....

Printed Name of person undertaking Date
transcription or moderation