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THE USE OF MOBILE TECHNOLOGY FOR AGRIBUSINESSES TO MANAGE OUTGROWERS IN ZIMBABWE: A CASE OF THE CHILLI PEPPER COMPANY, ZIMBABWE

by

OZASALA MOYO

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Supervisor: Prof M Twum-Darko
Co-supervisor: Ms L Harker

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ABSTRACT

Mobile technology has gained much traction due to its ease of use, affordability and computing power that supports many software applications which are useful for social and business contexts, supporting day-to-day life. Several businesses are benefiting from mobile technology as they have moved from inefficient paper-based systems to efficient and productive digital systems which increase productivity through remote working. However, the agricultural sector in sub-Saharan countries has been slow to adopt mobile technology, as compared to other sectors. The distribution of information and the management of small holder farmers still relies on traditional, inefficient, paper-based systems. Mobile technology has the potential to improve productivity among rural, smallholder farmers by overcoming traditional isolation. Therefore, the aim of this study was to explore the potential of using mobile technology to manage outgrower processes to improve their productivity, profitability and sustainability.

The study was qualitative in nature, employing an interpretivist paradigm, and exploratory research design. Primary data was collected using semi-structured, face-to-face interviews conducted with eleven employees who were purposively sampled from various departments within The Chilli Pepper Company (CPC), including executive directors, operations managers, outgrower managers, regional managers, field supervisors, and Agritex officers. Content analysis was used to analyse the qualitative data, and the data analysis was guided by the themes and concepts emanating from a conceptual framework developed from the review of the literature.

Empirical evidence from the study indicated a highly positive perception among participants regarding the use of mobile technology to enhance productivity and profitability for growers, while harnessing their livelihoods. Participants highlighted various compelling benefits associated with the adoption of mobile technology in agribusiness for outgrower management. However, it was emphasized that deploying mobile technology for such purposes requires meticulous planning and execution, rather than being a straightforward endeavor. A preliminary study is deemed essential to comprehensively grasp the multifaceted factors pivotal to the successful adoption and implementation of a model for effective outgrower management using mobile technology. This proactive approach ensures that potential obstacles to seamless technology integration are anticipated and addressed beforehand.

The research offers practical guidelines for agribusiness managers to leverage mobile technology in optimizing outgrower management and enhancing productivity.

Furthermore, the study proposes a model/framework that agribusinesses, including CPC, can adopt to facilitate the implementation of such technology.

Key Words: Agribusiness, Mobile technology, Smallholder farming, Outgrowers, Outgrower management, Zimbabwe

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DEDICATION

I dedicate this dissertation to my mother, Rutendo Mubingi, and her sisters: Virginia Mubingi (deceased), Eunice Mubingi, Miriam Mubingi, Faith Mubingi, and Rachel Mubingi. They have all played crucial motherly roles in my upbringing and have supported me throughout the years. It is truly a great blessing to have six mothers!

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CHAPTER 1
INTRODUCTION

1.1 Preamble

The agricultural sector is critical in socioeconomic development and food security in Zimbabwe (Zim). They contribute close to 17% of the gross domestic product (GDP) and employ up to 70% of the population. Outgrower schemes are agricultural arrangements where small-scale farmers cultivate crops under contract with a larger buyer, typically a processing company or a marketing organization. These schemes often involve the buyer providing inputs, technical assistance, and guaranteed market for the produce (FAO, 2013). Outgrower schemes contribute significantly to the agricultural industry of Zim, as they support the food and nutrition security in the country, with their production accounting for the bulk of the country's food and contributing to Zim's total export earnings (FAO, 2017). However, most Outgrower schemes are less productive and profitable than they could be (Nguthi,2007; Brugger, 2011; FAO, 2011;). Arguably, better management and support from agribusinesses that manage outgrowers can help them to be more productive, sustainable and profitable, thereby reducing poverty through employment creation and enhancing economic growth (AgDevCo, 2017). In addition, the management of outgrowers can be improved by providing agronomy support and information to outgrowers on time.

The dissemination of information and management of smallholder farmers still relies on traditional, inefficient systems (The Chilli Pepper Company annual report, 2016). Mobile technology has the potential to improve productivity and sustainability among rural smallholder farmers by overcoming traditional isolation (Goldblatt, 2010; Brugger, 2011; Halewood & Surya, 2012; Nyamba & Mlozi, 2012; Oladele, 2015;). However, in the context of Zimbabwe, no research has been done to explore the usefulness of mobile technology by agribusinesses who manage smallholder farmers in Outgrower schemes.

1.2 Rationale

1.2.1 Overview of the Case Study

The case study focused on The Chilli Pepper Company (CPC), founded in 2001 in Zimbabwe. The company operated in Zimbabwe for the first three years of trading before expanding its operations to Zambia in its fourth year and further expanding its operations to other Southern African countries. Today, CPC operates in the Southern African countries of Zimbabwe, Malawi and South Africa. The company's business is to grow, process and supply the local and international food industries (sauce manufacturers,

chefs, kitchens and restaurants) with chillies as a raw ingredient for making sauces, marinades and anything that calls for chillies. The chillies are grown, harvested and processed into a raw ingredient called chilli mash, then exported to American and European markets and supplied to local markets for further processing.

CPC mainly works with smallholder farmers in outgrower schemes and a few commercial farmers. Their responsibility is to educate, manage and monitor these farmers on growing chillies throughout the growing season, from when they receive seed to when they deliver harvested crops to a depot. This is in line with efforts to ensure farmers deliver crops that meet the company's quality standards, i.e., chillies free of banned pesticide chemical residues, with acceptable minimum pesticide residue and chillies with the right colour. CPC's mission is centred on changing the lives and livelihoods of smallholder and commercial farmers through sustainable, innovative, effective chilli growing and processing. Its vision is to become the most competitive agribusiness in chilli growing and processing in Southern Africa. With this vision and mission in mind, CPC should keep up with the ever-changing world of technology and take advantage of these technological advancements to improve efficiencies in managing and monitoring its out growers. Over the past years, farming has become a more time-critical and information-intense business (De Silva & Ratnadiwakara, 2008; Brugger, 2011). Studies show that outgrowers accessing relevant information using appropriate technology have a greater chance of becoming more productive, profitable and sustainable (Musungwini, 2016; Masuka B. et al., 2016). Agribusinesses must manage outgrowers to be productive, efficient, and sustainable to create a win-win situation (AgDevCo,2017). CPC relies primarily on traditional paper-based systems to manage and monitor its outgrowers. Paper-based systems are associated with inefficiencies and can lead to ineffective management and monitoring of growers. This may further lead to farmer unproductivity and unprofitability.

Additionally, with food safety and quality increasingly becoming a global concern due to numerous food safety and quality-related scandals and outbreaks (International Trade Centre, 2015), most agribusinesses are now required by the market to up their game in product traceability to minimise trade disruptions, i.e., product recalls. Mobile technology can track farmers' crops effectively, from when farmers receive seed to when they deliver the final crop to an agribusiness. In addition, seed varieties, chemicals and fertilisers applied can be traced back to the farmer effectively and efficiently using mobile technology.

Therefore, considering CPC's use of traditional systems to manage outgrowers, poor product traceability systems, and low productivity recorded, it is essential to address the problems faced by outgrower schemes in Zimbabwe to improve the output of the agricultural industry, as it is critical to the economy (FAO, 2019). Thus, the company as a case study was found suitable for conducting a study for exploring mobile technology use by agribusinesses in managing outgrowers1.2.2 Background

Over the past decade, mobile technology has gained much traction due to several factors, including portability, ease of use, and computing power that is useful for social and business contexts, among other things (Pongnumkul, Chaovalit & Surasvadi, 2015; IBM, 2022). Several industry sectors benefit from mobile technology as they have moved from inefficient paper-based systems to efficient and productive digital systems that help increase productivity through remote working (Deloitte, 2012). For instance, the financial sector has taken the lead in using mobile technology to conduct its operations. Mobile technology has improved the efficiency of how the formal banking sector operates on the African continent (Kim, 2020). On the other hand, the adoption and use of mobile technology in the agricultural space seems stagnant (Suri & Udry, 2022). Mobile technology is considered the solution to address inefficiencies associated with information dissemination to outgrowers (Molony, 2006; Aker, 2011; Duncombe., 2012; Baumüller, 2012). The lack of timely information access negatively affects agricultural productivity and economic development because farmers make poor, costly, uninformed decisions (Van Gent, 2010). Use ofweather forecasts to plan land preparation and planting can reduce crop damage (Walker, 2021). Limited market price information can result in farmers selling their produce at unfavorable rates, reducing their income (World Bank, 2018). Additionally, outdated farming methods due to lack of information on new technologies can decrease efficiency and sustainability (IFAD, 2019).

The focus of this study is to explore the potential use of mobile technology in the management of outgrower farmers. Typical management processes include training or retraining outgrowers, monitoring outgrower activities throughout the grower season, and disseminating information to all outgrowers, among others (Gent, 2010; Asian Development Bank, 2015, USAID, 2018). Mobile technology has been perceived as a game changer in the effective management and monitoring of outgrower activities, thereby improving productivity and sustainability in the agricultural sector (Brugger, 2011; Goldblatt, 2010; Halewood & Surya, 2012). However, minimal empirical data is available on the use of mobile technology by agribusinesses to manage outgrowers. Therefore, this study explores how mobile technology use by agribusinesses can contribute to better management of outgrowers within the context of Zimbabwe.

Arguably, better management and support from agribusinesses can help growers to become more productive, sustainable, and profitable, thereby addressing the socioeconomic welfare of small-scale farmers and enhancing economic growth (AgDevCo, 2017).

Addressing this knowledge gap is pertinent, considering what outgrower schemes contribute toward the agricultural industry, as they support the food and nutrition security of a country, with most of its production contributing to the bulk of the country's food and total exports earnings in Zimbabwe specifically (FAO, 2017). Therefore, it is of great importance that outgrower schemes become sustainable as this can address numerous sustainable agricultural objectives and create long-term viability for both growers and agribusiness involved in the outgrower projects (Warning, 2002; Gulati et al., 2005; Minot et al., 2009; Rao, 2011; Barrett, 2012; Bellemare, 2012).

1.2.2 Problem statement

Over the past few years, farming has become a more time-critical and information-intensive business (De Silva & Ratnadiwakara, 2008; Brugger, 2011). Previous research has shown that outgrowers who can access relevant information using appropriate technology have a greater chance of becoming more productive, profitable and sustainable (Mather & Mghenyi, 2006; World Bank, 2011; Safdar & Sen, 2012; Mago, 2012; Tadesse & Bahiigwa, 2015; Musungwini, 2016; Masuka, B. et al.,2016). This research will focus on the Chilli Pepper Company (CPC), an agricultural processing company that sources its raw materials from outgrower farmers that they subcontract and manage to grow red chillies. The company relies mainly on traditional, paper-based systems to manage and monitor its outgrowers. In a preliminary investigation carried out by the researcher, some senior managers of CPC pointed out that their current systems fail to monitor outgrowers efficiently and effectively.

Moreover, the traceability of outgrower produce from seed to crops delivered to the depot to the final raw ingredient produced (chilli mash) is a challenge (poor product traceability). Furthermore, data collection methods cannot effectively identify farmers facing challenges, so technical assistance, agronomy support and training can be directed where needed. Additionally, there is a lack of an efficient way to disseminate vital information to farmers in real-time so that farmers can readily make informed decisions, while the collection of feedback from outgrower farmers to help estimate yield forecasts for postharvest operations management remains a challenge

Agribusinesses must manage outgrowers to be productive and sustainable to create a win-win situation (AgDevCo, 2017). However, the company lacks the know-how to

integrate and adopt mobile technology to run its operations. This is evidenced by the continued use of inefficient, traditional systems, poor product traceability systems, and low productivity recorded (The Chilli Pepper Company annual report, 2016). Therefore, it is essential to address problems faced by outgrower schemes in Zimbabwe to improve the output of the agricultural industry, as it is critical to the economy and employment (FAO, 2019).

1.2.3 Aim and objectives of the study

Given the problem statement, this research aims to explore the potential for mobile technology use by agribusinesses to manage outgrowers. As such, the main objective of this study is:

- To explore the use of mobile technology to manage outgrowers of agribusinesses better.

The sub-objectives are:

- To determine what information is required for the management of outgrowers by agribusinesses.
- To determine how mobile technology can enable agribusinesses to manage outgrowers better.

1.3 Research questions

The main research question is:

- How can mobile technology be effectively utilized to enhance the management of outgrower farmers within agribusinesses, leading to improved productivity, sustainability, and economic benefits?

The sub -question are:

- What information is required by agribusinesses to manage outgrowers?
- How can mobile technology be deployed to enable agribusinesses to manage outgrowers remotely?

1.3.1 Contribution of the study

1.3.1.1 To practice

- The research provides guidelines that agribusiness managers can use to understand how mobile technology can help them manage outgrowers and improve their productivity.
- The research provides a framework that agribusinesses, including CPC, can use to enable them to implement the technology.

1.3.1.2 To academic field

- The academic contribution of the research is a general frameworkdeveloped based on empirical and non-empirical research findings.
- This research addresses the existing literature gap and contributes to the theoretical body of knowledge by exploring mobile technology used by agribusinesses to manage outgrowers in the context of Zimbabwe, specifically in respect of the Chilli Pepper Company.

1.4 Delineation of the Research

Delimitations are limits or boundaries that a researcher sets for their study so that the research objectives do not become impossible to attain. Delimitations involve defining the study's geographical area and theoretical context (Ellis & Levy, 2009; Leedy & Ormrod, 2016). Regarding the theoretical context, the study was limited to mobile technology used by agribusiness to manage outgrowers. Geographically, the study was limited to the context of The Chilli Pepper Company, Zimbabwe and its operations. Also, the study was limited to the farming industry; thus, the findings cannot necessarily be extended to other sectors.

In addition, the study was limited to interviews with selected management and employees of CPC. They have been with the company for at least two years, are aware of the company's outgrower management activities, and are involved in interacting with outgrowers in some manner. Therefore, participants were purposively selected based on their work and years served with the company. As such, participants were limited to management and employees from selected departments.

1.5 The Research limitations

The study was conducted on one organisation as a case study. As such, the results are limited to one organisation; therefore, they cannot be generalised beyond the context of the case study. Also, most journals and publications on mobile technology use in farming and agribusinesses were published outside Zimbabwe, with a few sources from Zimbabwe. At the same time, such data sources were necessary to bring out the literature's implications for this study. They, however, were not sufficient to provide the real architecture of the Zimbabwe agribusiness setup and mobile technology use.

1.6 Overview of the Rest of the Dissertation

The dissertation consists of the following chapters to address the research problem at hand:

Chapter 1

The chapter introduces the research problem and provides the background to the study. Furthermore, it outlines the research problem statement, aims and objectives of the research, research questions, the significance of the study, and delineation and limitations of the study.

Chapter 2

This chapter reviews the existing literature on mobile technology and outgrower management processes by agribusinesses. The literature review evaluates the knowledge base upon which this study was founded. The work of several writers and scholars was consulted to develop the concepts of mobile technology and outgrower management by agribusiness. The chapter further identifies the gaps in existing literature related to the problem under study. Finally, it concludes with a conceptual framework that represents the current status of the research to guide the collection, interpretation and analysis of the data.

Chapter 3

Chapter three provides a detailed description of the research paradigm selected for this study, and the corresponding research methodology and design, providing justifications for the use of each research strategy and technique employed in this research. In addition, it describes the research methods, population, participants, target population, sampling techniques, data sources, research instrument, data collection and analysis

techniques, quality assurance, reliability and validity issues, ethical considerations, and research limitations.

Chapter 4

This chapter focuses on analysing the empirical data collected and presenting and discussing the findings concerning the literature and conceptual framework to produce a refined general framework.

Chapter 5

Chapter five summarises the research findings, conclusions, and recommendations for future research, notwithstanding the study's limitations. The chapter also articulates the significance of the research and its implications.

1.7 Summary

The chapter introduced the research problem and provided the background to the study. Furthermore, it outlined the research problem statement, which identified and described the issue at hand, and the need to explore the use of mobile technology to manage outgrower farming. Subsequently, the aims and objectives of the research, research questions, significance of the study, and delineation of the study were described. The following chapter provides a review of the current status of the literature about the phenomenon at hand. Moreover, the chapter identifies the gaps that necessitated this study. Finally, the literature review provides a preliminary investigation of existing literature to answer the research questions, concluding with the developing of a conceptual framework to guide the collection, interpretation and analysis of the empirical data.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Mobile technology (portable technology that allows two-way communication through computing devices such as smartphones, tablets, laptops and smartwatches) has recently gained much traction. This is due to their ease of use, portability, affordability and computing power that supports many software applications that are useful for social and business contexts, supporting day-to-day activities (Pongnumkul et al., 2015; IBM, 2022). In addition, several companies benefit from mobile technology as they have moved from inefficient paper-based systems to efficient and productive digital systems, increasing productivity through remote work (Deloitte, 2012).

In the agricultural space, numerous studies have been conducted on the impact, effectiveness, user attitude, assessment, empowerment, and potential use of mobile phone technology in agriculture. As a result, there is consensus that mobile technology is vital to farmers and has the potential to enhance crop productivity and, as a result, improve food security and reduce poverty in developing countries (De Silva & Ratnadiwakara, 2008; Furuholt & Matotay, 2011; CIARD, 2012; Baumüller, 2013; Duncombe, 2016; Wellard, Rafanomezana, Nyirenda, Okotel,& Subbey, 2013; Gayi & Tsowou, 2016).

Research on the use of mobile technology by farmers shows that they can share information and knowledge among peers rapidly and efficiently compared to face-to-face meetings or farm visits. Farmers can obtain information related to suppliers, markets, market prices for products, weather data and agronomy support to make informed decisions (Nyamba & Mlozi, 2012; Bhandari & Heeks, 2012; Carmody, 2013; Chhachhar & Hassan, 2013; Bohara, & Satyal, 2014; Ogbeide & Ele, 2015; Shyam, 2015; Tadesse & Bahiigwa, 2015). Moreover, mobile technology use was found to enable financial transactions, obtain technical advice, seek emergency agronomy assistance and access inputs (Ogbeide & Ele, 2015).

It is undeniable that mobile technology may boost agricultural productivity. First, however, it is necessary to analyse the long-term viability and applicability of agrarian innovations for rural smallholders, considering environmental resilience, economic viability and social and technical sustainability (Gatzweiler & Braun, 2016; Kriesemer, Virchow et al., 2016).

While existing literature addresses the need for technology to manage information optimally within the agricultural sector, there is scant empirical data available on mobile technology use by agribusinesses in managing outgrowers, specifically, and how this phenomenon can be approached pragmatically.

The following sections first address the current status of research on this phenomenon. Subsequently, they provide an exploratory survey of the literature to examine and record the main focus areas to construct a problem conceptualisation of the phenomenon.

2.2 Current Status of Research

Over the past few decades, we have seen outgrower schemes gaining much traction and attention from both public and private sector institutions, i.e., parastatal industrial and marketing boards, agribusinesses (processors), exporters, distributors and non-profit organisations (NPOs) (Swinnen & Maertens, 2007; Reardon, Barrett, Berdegué, Swinnen, 2009). These institutions perceive supporting outgrower schemes as a pro-poor strategy in supporting small-scale farmers to overcome production, financial, managerial, and marketing constraints. Lack of support is a barrier to farmers' success, leading to unproductivity, unprofitability and unsustainability (Singh, 2000; Eaton & Shepherd, 2001; Swinnen & Maertens, 2007; Barrett, Bachke, Bellemare, Michelson, Narayanan, 2012). Moreover, outgrower schemes are viewed as a way of overcoming the market imperfections that led to the failure of macroeconomics and sectoral adjustment policies (Gross, 1994; Gow, 2000).

In Tanzania, contract farming was introduced by the government in 2010 to increase agricultural production by providing farmers with essential requirements they lacked, such as technical skills, farm inputs and favourable prices for their produce. This resulted in increased earnings and buyers receiving quality products for their investment (Mwimo, Mbowe, Kombe et al., 2016). Similarly, in Zambia, the government channelled resources and implemented policies prioritising smallholders' commercialisation through outgrower schemes to integrate poor, rural farmers into the national economy (World Bank, 2007).

The term outgrower scheme is often used interchangeably with contract farming because an outgrower scheme is defined as a fixed-term contract between a farmer and a firm agreed verbally or in writing before the start of production. The farmer is provided with resources, and one or more production conditions is specified, in addition to one or more marketing condition for agricultural production on land owned or controlled by the farmer. The agreement is non-transferable and confers exclusive rights and legal titles on the firm, not the farmer (Prowse, 2012). These outgrower schemes are often seen and presented as a solution for smallholders to engage with agribusiness and commercial agriculture. They potentially benefit from access to secured inputs and

prices, increased earnings, financial services (credit/loans), a ready market, and new technology. Thus addressing extreme poverty through agricultural development, ensuring growth is shared by all and improving the well-being of the bottom 40 per cent of the population in every country (Treville, 1986; Glover, 2000; World Bank, 2020).

Moreover, Singh (2000) indicates that growers and agribusiness who engage in contract farming have different motives. However, their primary shared motivation to engage in outgrower schemes is to explore local market opportunities and ensure supplies. Therefore, both parties are likely to engage in contract farming where risk can be minimised and where high transaction costs and risk associated with spot market exchange can be minimised (ibid.).

The existing literature shows divergent results concerning the effects of outgrower schemes on the welfare of growers in developing countries. Some authors contend that outgrower farming benefits the growers by allowing them to access local and global markets, thereby increasing their income. In addition, increased access to inputs and new technology leads to increased farming productivity (yield) and profitability (Minot,1986; Key and Rusten,1999; Warnings and Key, 2002; Gulati et al., 2005; Minot and Roy, 2006; Minot et al., 2009; Rao 2011; Barrett, 2012; Bellemare, 2012). Conversely, other research has revealed evidence of high rates of defaulting by growers due to unproductivity and not making money within the schemes. In addition, some agribusinesses do not adhere to their contractual agreement, delay payments to farmers, and fail to compensate for crop losses in the scheme (Key and Rusten, 1999; Singh, 2000; Simmons et al., 2005). Furthermore, a study conducted by Dube and Guveya (2014) analysing the productivity of smallholder farmers who grow tea in the Chipinge district in Zimbabwe revealed that most outgrower farmers produce way below the potential expected yield per hectare because of farmer education level and experience (Sharma et al.,1999; Mathijs & Vranken, 2001; Munroe, 2001; Chen et al., 2009). Sotnikov (1998) contends that this is likely to occur when agricultural education emphasises technological aspects over practices. In addition, productivity can be negatively affected due to the hesitancy of older growers to change and their unwillingness or lack of skill to adopt technological innovations (Lambarra et al., 2009; Latruffe et al., 2008a; Hadley, 2006). Similar studies show that farmer education and experience are critical in improving the productivity and profitability of smallholder farmers because an increased level of education and experience will lead to increased output (Ezeh and Nwachukwu, 2010; Nwaobiala, 2010; Adesope, 2010; Dolisca and jolly, 2008; Bonabana-Wabbi et al., 2012; Wanya et al., 2014).

A study was conducted on two cassava outgrower schemes in Ghana (one state-owned and another private-owned) on the role of contract design and conditions in facilitating sustainable outgrower scheme arrangements. The outcome showed that government-led outgrower schemes are generally ineffective at overcoming market failures that impede smallholders' commercialisation of agricultural production due to poorly structured contracts. The study further revealed that state-operated firms that aimed to improve the socioeconomic welfare of outgrowers failed dismally to either benefit the state-owned firm or the growers due to using a low-investment outgrower scheme model and reluctance to invest resources in production to avoid incurring monitoring costs. As a result, the state-operated firm received an inadequate supply of products from growers, and outgrower productivity and income did not improve. Conversely, the privately operated outgrower scheme performed well regarding grower productivity and earning comparatively higher returns. This was due to having formalised and professional contracts in place, provision of inputs to growers, offering of technical assistance to growers through the use of improved technology and extension services, investing in robust outgrower scheme models, and timely payments to growers to influence and boost the morale of growers' participation in schemes. Abdullah et al. (2006) agree that service by an extension office significantly positively influences growers' productivity compared to a project with no extension officers. Agricultural extension service comprises well-trained agricultural experts who offer agronomy support and train and educate farmers on good agricultural practices (GAP), new practices and farming technology to assist farmers in improving their productivity. The frequency of contact between extension officers and growers influences the growth of agricultural knowledge by disseminating new technology to farmers, thus increasing productivity. In addition, access to extension services positively affects on-farm productivity, as an agricultural extension system reduces the time lag between the development of new technologies and their adoption, and as such, results in a more immediate impact on productivity (Ahearn et al., 1998; Makki et al., 1999; Tchale and Sauer, 2007; Carroll et al., 2009).

In the African context, research shows that most outgrower schemes still struggle to address sustainability, profitability and productivity issues, resulting in many outgrower schemes defaulting. Several studies have suggested that these issues can be addressed through improved technology, better contract design, extension contact use, and offering training and technical support. Few researchers have explored the usefulness of mobile technology agribusinesses use to manage smallholder farmers in outgrower schemes. Arguably better management and support from agribusinesses that manage outgrowers can help growers become more productive, sustainable, and profitable, thereby addressing the socioeconomic welfare of small-scale farmers and

enhancing economic growth (AgDevCo, 2017). Mobile devices are considered the solution to address inefficiencies associated with information dissemination to outgrowers (Molony, 2006; Aker, 2011; Duncombe, 2012; Baumüller, 2012). The lack of timely information access negatively affects agricultural productivity and economic development because farmers make poor, costly, uninformed decisions. Efficient communication, information processing, and monitoring of outgrowers require implementing proper computer-based platforms specifically designed to address these requirements (Van Gent, 2010). The platform should enable tracking of the performance of individual outgrower farmers and provide a basis for identifying the farmers needing agronomy technical support. It should also allow optimal dissemination or receipt of information between agribusinesses and outgrowers. While some of the literature addresses the need for technology to manage information optimally within the agricultural sector, there is scant empirical data available on mobile technology use by agribusinesses in managing outgrowers, specifically, and how this phenomenon can be approached pragmatically. Addressing this knowledge gap is pertinent, considering what outgrower schemes contribute toward the agricultural industry, as they support the food and nutrition security of a country, with most of its production contributing to the bulk of the country's food and total exports earnings in Zimbabwe specifically (FAO, 2017). It is of great importance that outgrower schemes become sustainable as this can address numerous sustainable agricultural objectives and create long-term viability for both growers and agribusiness involved in the outgrower projects (Warning, 2002; Gulati et al., 2005; Minot et al., 2009; Rao 2011; Barrett, 2012; Bellemare, 2012).

2.3 Mobile Technology

Mobile technology has become a game changer in most economical, productive and social sectors operating worldwide, from the health sector, to educational, agricultural, retail and the financial/banking sector, to name a few. It has enhanced social inclusion, communication, economic activity and productivity (Baumüller, 2012; Delloite LLP, 2012). According to Asenso- Okyere and Mekonnen (2012), information and communications technology (ICT) has long been recognised as a powerful tool for the success of the development process in any sector. Also, ICTs are crucial in achieving the United Nations' Sustainable Development goal number two, achieving zero hunger in 2030 through e-agriculture, i.e., access to market updates and weather forecasts to increase rural business productivity (United Nations, 2020).

In the agricultural space, numerous studies have been conducted on the impact, effectiveness, user attitude, assessment, empowerment, and the potential use of mobile phone technology in agriculture. There is consensus that mobile tech is essential to

farmers and has the potential to enhance crop productivity and, as a result, improve food security and reduce poverty in developing countries (De Silva & Ratnadiwakara, 2008; Furuholt & Matotay, 2011; CIARD, 2012; Baumüller, 2013; Duncombe, 2016; Wellard, Rafanomezana, Nyirenda, Okotel,& Subbey, 2013; Gayi & Tsowou, 2016). Research on the use of mobile technology by farmers shows that they can share information and knowledge among peers rapidly and efficiently compared to face-to-face meetings or farm visits. Farmers can obtain information related to suppliers, markets, market prices for products, weather data and agronomy support to make informed decisions (Nyamba & Mlozi, 2012; Bhandari & Heeks, 2012; Carmody, 2013; Chhachhar & Hassan, 2013; Bohara, & Satyal, 2014; Ogbeide & Ele, 2015; Shyam, 2015; Tadesse & Bahiigwa, 2015). In a study by Grober (2020), modern digital technologies significantly simplify the decision-making process and make farm management more effective. Moreover, successful contract farming typically involves technology and capital transfers since local suppliers do not have access to the required skills, know-how, technology, management, capital and inputs. In many cases, enabling these value chains to function requires farm assistance programs, which can help overcome constraints on domestic firms in low-income countries with limited access to capital and technology. Several empirical studies document these technology transfers and productivity increases (Gow et al., 2000; Dries & Swinnen, 2004; Maertens & Swinnen, 2009; Minten et al., 2009; Negash & Swinnen. 2013). These studies find that technology and management transfer through value chains generates significant productivity increases both for the product itself and for other production activities at the farm level.

More specific research shows an increase in mobile technology use among smallholder farms in Nigeria to enable financial transactions, obtain technical advice, seek emergency agronomy assistance and access inputs (Ogbeide & Ele, 2015). In Zimbabwe, mobile technology was shown to enable negotiations between smallholder farmers and both inputs suppliers and agricultural product buyers (Musungwini, 2018). Farmers also make and receive payments and insure their crops using mobile technology (Econet, 2015). In Kenya, mobile technology was found to be used for the identification and management and monitoring of livestock diseases (FARM-Africa, 2007; Martin & Abbott, 2011). Also, in Kenya, a platform called the M-Farm was developed to assist small-scale farmers in providing daily wholesale market price information, selling produce and purchasing inputs. The platform managed to help farmers to improve their production planning, i.e., making decisions about what to grow, what quantities to grow, when to sell, and whom to sell to (Gatzweiler & Braun, 2016). In South Africa, a mobile phone application called AgriCloud was developed to assist extensionists and small-scale farmers with daily updates of a 10-14 day weather

forecast for better planning and on-farm decision-making. The AgriCloud platform provides extension offices and small-scale farmers access to information related to their specific location and local language. This has enabled farmers to use rainfall more sustainably as they plan land preparation and planting according to weather forecasts for their farms (Walker, 2021).

It is undeniable that mobile technology may boost agricultural productivity. However, it is necessary to analyse the long-term viability and applicability of farming innovations for rural smallholders, considering environmental resilience, economic viability and social and technical sustainability. In addition, indicators that help smallholders and local extension agents make locally adapted and more sustainable decisions need to increase resilience (Gatzweiler & Braun, 2016; Kriesemer, Virchow et al., 2016).

While there is widespread evidence of the steady uptake of mobile technology among farmers and the improvement it can bring to the farming sector, there is limited empirical information available on the use of mobile technology by agribusinesses in managing outgrowers. This applies particularly to how this phenomenon can be approached pragmatically. Available studies mainly point to the use of mobile technology among independent farmers for communication and transacting. This study can address a gap in the literature that focuses specifically on facilitating the contractual business relationship between agribusinesses and outgrower farmers. This relationship presents a unique dynamic that relies on the effective agribusiness oversight of the outgrower, thus facilitating the end-to-end engagement to ensure a successful crop is produced. The following sections propose how mobile technology can facilitate this relationship. First, however, the following section provides a survey of the information needs that should be enabled by mobile technology to manage outgrower farmers and their relationships with agribusinesses better.

2.4 Information Required for the Management of Outgrowers by Agribusinesses

2.4.1 Farmer Profile Data

Managing outgrower farmers requires a network of players to gather a wide range of farmer data throughout the season. It involves field agents, auditors and technical staff conducting field visits and audits, checking harvest quality and reporting problems timeously to avoid inefficiencies or delays (Vodafone & Accenture, 2011). According to Gent (2010), the effective management of outgrowers in outgrower schemes requires that clear and complete information for each farmer is recorded. Therefore, basic and monitoring data should be collected (USAID,2009; AgDevCo, 2017). Primary data help

agribusinesses to create farmer profiles that can be used to get to know their farmers better. They can include location, credit provided, agricultural knowledge and experience, and field size of the outgrower crop. This data enables agribusinesses to know where their farmers are located and decide on the number of seeds, tools and financial support their farmers might require based on the farmer's field size (USAID, 2009; USAID, 2018).

Using conventional, paper-based methods to collect farmer data can be time-consuming and create gaps in data sharing between players involved in managing farmers. This, therefore, results in incomplete data and delays in decision-making. According to Cadavid, Babcock, Gray, Tobias, McCord, Herrera and Osei (2018), the digitalisation of farmer management processes allows farmer profile data and records to be kept in the cloud and tracked in real-time. This technology can predict and prescribe solutions and provide immediate assistance to farmers. Additionally, digital service technology can reach out to farmers who are hard to reach when the need arises to recode or update farmer profile data.

2.4.2 Farmer Monitoring Data

Monitoring data relates to the performance of each smallholder farmer from when they receive seed and inputs from agribusinesses to when they deliver the final harvested crop and receive payment. The monitoring grower data required includes the contracted area data, distribution of inputs, nursery management, land preparation data, transplanting, timely weeding and adherence to good agriculture practices, implementation of pest and disease control practices, timely harvesting, harvesting techniques, post-harvest production data, and farmer payment records (Gent; 2010; Asian Development Bank, 2015, USAID, 2018). Mobile technology applications can facilitate monitoring the activities of each outgrower farmer to provide a basis for allocating resources or offer agronomy support where needed through tracking farmer performance (ibid.).

2.4.3 Product traceability

Today, food safety has become a global concern due to numerous food safety and quality-related scandals and outbreaks (International Trade Centre, 2015). Food standards are increasingly becoming regulated by stringent public and private requirements regarding food quality and safety, as well as ethical and environmental considerations (Jaffee & Henson, 2005; Henson & Reardon, 2005; Maertens & Swinnen, 2009). Product traceability enables accurate information dissemination through the food supply chain and to the public, thereby minimising trade disruptions. Traceability can

significantly reduce the scope of a recall by up to 95% in some cases. This minimises product waste that would have occurred without the required traceability systems (International Trade Centre, 2015; The World Bank Group, 2019). Mobile technology can track farmers' crops efficiently, from receiving seed to delivering the final produce to an agribusiness. In addition, seed varieties, chemicals and fertilisers applied can be traced back to the farmer effectively and efficiently using mobile technology (ibid).

2.4.4 Communication

Communication is vital for agribusinesses to maintain close contact with their farmers to establish trust between both parties. For example, technical information (product specifications and quality parameters) can be discussed to make sure every farmer understands what crop, production targets (quantity) and quality parameters are expected from each farmer to produce (Stringfellow, 1996; USAID, 2009). In addition, communication is required for reporting disease outbreaks (Walker et al., 2011; ILRI, 2018) when negotiating input prices with suppliers and consumer market prices with buyers (Ogbeide & Ele, 2015, Baumüller, 2015; Mansingh & Erena, 2016), when applying for loans from banks (Ogbeide & Ele, 2015), and accessing weather data and agronomy support to make informed decisions (Nyamba & Mlozi, 2012; Tadesse & Bahiigwa, 2015).

For effective communication between agribusinesses and outgrowers, there is a need for agribusiness to think deeply about what information it needs to communicate to its outgrowers, how it will communicate with the outgrowers, and how it will ensure that there is effective two-way communication with its outgrowers (USAID, 2009; Zhang, Wang, and Duan, 2016). In addressing the 'what', agribusinesses must communicate good agronomic practices and prohibited practices so that outgrowers can distinguish between best and worst practices (Stringfellow, 1996; USAID, 2009). For example, sustainable and conservation agriculture has become necessary, where farmers are encouraged to preserve the ecological system within the environment, reducing the use of pesticides and fertilisers, conserving water, and promoting biodiversity in crops grown and the ecosystem (Edwards, Lal, Madden, Miller & House, 1990). Additionally, information related to procurement arrangements, prices, crop yield and quality parameters is vital and needs to be effectively communicated to growers (Stringfellow, 1996; USAID, 2009; Gent, 2010; Cadavid et al., 2018).

In addressing the 'how', agribusinesses are advised to contact farmers regularly to receive direct feedback from outgrowers, assess satisfaction levels and expectations, and ensure that growers receive and properly understand important information from the company. Effective communication between growers and agribusiness can be

achieved using mobile technology (i.e., mobile devices), where company field agents are assigned to periodically visit farmers, with a mobile phone or farmer mobile application in hand to capture monitoring and traceability farmer data, during field visits, contract signing, workshop and demonstration days. (Stringfellow, 1996; USAID, 2009; Gent, 2010; Asian Development Bank, 2015, Cadavid et al., 2018).

2.4.5 Payments, Transacting and Funding

Making timeous payments is crucial when working with outgrower farmers because it encourages greater trust and builds good relationships between agribusinesses and farmers (Stringfellow,1996; World Bank Group, 2019). Delays in payments make outgrowers feel uncertain, especially when there is no trust between the two parties. In addition, due to a lack of access to credit /loans, outgrowers prefer to receive payment for their crop immediately when they deliver to a buyer (USAID, 2009). Any delays in payments can lead to annoyance by farmers, and consequently, farmers may end up side-selling to obtain cash. It is, therefore, vital for agribusinesses to budget, project, and allocate enough funds for when the harvesting and procurement phases start (Singh,2002; Arouna, Adegbola, Babatunde, Diagne & Patrice, 2015). This can be achieved through working closely with local banks before the procurement phase to make sure that the company has sufficient liquidity to make payments to outgrowers on time (Reardon and Berdegue,2002; Guo, Jolly and Zhu, 2005; Arouna et al., 2015).

A tobacco outgrower scheme in the Serenje district in Zambia is an example of the effects of delayed payments by agribusiness. In 1995, due to several managerial issues, payments to farmers for output delivered in May were delayed until November. Farmers' confidence in the company's ability to purchase appeared to have been damaged by this experience, as they ended up selling tobacco to local fishermen, who buy small quantities of the commodity at a price allegedly a sixth of what the company offers (Stringfellow, 1996; Zambia Farmer,1996). In this ever-changing world of technology, agribusinesses can now arrange with banks to make payments to farmers using mobile technology without the company having to visit the banking hall. The use of mobile technology also enables farmers to make payments to suppliers of inputs and receive payments from product buyers using mobile services. Thus, they do not need to travel to a bank to withdraw or deposit funds. Additionally, mobile money services ensure that their money is secure in their mobile money wallet (Deloitte,2012; Econet, 2015; World Bank Group, 2019).

2.4.6 Reporting

Reporting data relates to grower data collected throughout the growing season and can be processed, analysed and reported. Reporting can include information about crop deliveries, disease outbreaks, challenges, and payment history. Reporting formats used by farmers and field officers should be developed to capture data consistently to enable easy processing and reporting (Gent, 2010). According to USAID (2009) and Zhang et al. (2016), agribusinesses need to identify the data type and information required by the company to manage the outgrower operation. It is also essential to identify the users of such data or information within the organisation, i.e., field agents or managers. Agribusiness should develop information and reporting systems (dashboards) that help to manage outgrower farmers, lead farmers (if the intermediary model is used), distribute inputs, measure outgrower productivity, manage procurement operations, and monitor field agent activities (ibid.).

2.4.7 Training

Ogbeide and Ele (2015) state that most sub-Saharan African governments support farmers by administering extension services. This involves sending field extension officers/agents to visit farmers at their homes or field to give them agronomy support or training on what and when to apply chemicals and fertilisers and crop management harvesting techniques. Similarly, USAID (2009) and world bank Group (2019) report that apart from having a good quality seed, outgrower farmers require agronomy/ technical support from agribusinesses to manage their crops throughout the season. Technical and agronomy support needed by growers can be administered through conducting group training sessions, demonstrations and field-based advice visits. The support that agribusinesses provide to farmers is critical as it assists and guides farmers in producing crops that meet the company's specifications and possibly result in increased yields and good crop quality, thus benefiting both the farmer and the company.

Additionally, the support received motivates outgrowers and boosts their morale to perform better concerning productivity because of the constant contact with the company's representatives, i.e., field agents. As a result, mutual trust and loyalty between the two parties (agribusiness and farmers) are attained, enabling effectiveness (Stringfellow, 1996; World Bank Group, 2019). Moreover, PepsiCo (Food and Agriculture Organization, 2005) emphasised peer-to-peer learning as an effective way to facilitate knowledge sharing between farmers where successful farmers share their stories, experience, and agronomy knowledge (Jill Majerus, 2010; Food and Agriculture Organization, 2015).

2.5 Deployment of Mobile Technology for Outgrower Management

Agribusinesses are challenged by modern trends, including digital transformation, which has seen an increase in technology uptake, the substitution of manual procedures with digital procedures, and the irrelevance of some functions due to efficient digital alternatives (Musungwini, 2018). Deployment is bringing resources into effective use among a group of subjects. In the agricultural ecosystem earmarked for this research, it is the deployment of mobile technology which is of primary concern. Such mobile technology includes handheld devices like mobile phones (voice and short message service (SMS) enabled phones and smartphones) and tablets. These technologies can also include a hybrid communication between a laptop or desktop and a mobile device, especially for sending and receiving information via Internet-based mobile applications, e-mail or WhatsApp (Caine et al., 2015). This section addresses the deployment of such devices and their enabled applications by agribusinesses to manage outgrowers remotely.

2.5.1 Mobile technology adoption

Musungwini (2018) conducted extensive research on mobile phone use by Zimbabwean smallholder farmers. It was found that at least 50% of the study population used mobile phones to conduct farming activities and gather agricultural-related information, i.e., general farming housekeeping, enquiring for inputs, pest and disease control information and post-harvesting management. Furthermore, the research revealed that the smallholder farmers using mobile phones were comparatively well-resourced in terms of having household assets, i.e., scotch carts and cattle. However, the other 50% were not as well-resourced regarding possessions. In an African agricultural setup, farmer adoption of mobile technology depends on several factors. These factors include but are not limited to a lack of funds to acquire mobile devices that can perform advanced farming activities and a lack of funds to recharge mobile phones. Also, low literacy levels, which make it difficult to use mobile devices to access information, difficulty in navigating, little farming expertise (farmer with minimal exposure, formal training and education) and a lack of knowledge of mobile technology use as a tool to improve productivity and efficiency in farming (Okello et al., 2009; Kirui et al., 2010; Baumuller,2012; Agyekumhene, 2020).

In most parts of Africa, outgrower schemes are located in rural areas where network coverage and electricity are a problem, so connecting to the Internet is always challenging. This was evident in a study by Walker et al. (2011) on disease reporting using mobile devices. Also, poor road network and electricity infrastructure were a drawback in implementing the livestock diseases e-surveillance system (Walker et al.,

2011; ILRI, 2018). Consequently, there is a need to address current technology infrastructure gaps and knowledge for the effective digitisation of African agriculture and improved technology adoption. Awareness and skills gaps among farmers, such as mobile technology, is a vital tool for increased efficiency in communicating, monitoring, obtaining consumer market information, and transacting, but also for increased efficiency in disseminating agronomy support in real-time (Masuka et al., 2016).

Caine et al. (2015) contend that for increased adoption of smartphones by smallholder farmers, there is a need for custom development of farming tools as per user requirements and technological abilities of smallholder farmers. Smallholder farmers should be invited to contribute to the development process of farmer management platforms so that their ideas can be heard and they can feel like part of the development team, thus addressing resistance to change to new farmer management technology. In addition, their involvement encourages agribusinesses and farmer platform development companies to develop tools that are user-friendly to farmers (May et al., 2015; Aker et al., 2016). Consequently, farmers will have a connection to the digital farming system and feel the need to utilise the benefits of mobile technology.

2.5.2 Mobile technology for managing farmer profiles

Managing digital farmer profiles is a process that involves gathering different types of data related to growers, their farms and business activities. This is done by registering data in a digital system for further analysis. The outcomes give meaning to the data so that agribusiness can understand their farmers better based on the research and interpretation. Consequently, farmers' performance can then be enhanced through timely directed support where needed most to minimise the chances of failure by a farmer. (Addison, Figuères, Owesiga, Muwonge, Nsimidala, Sezibera, Boyera, Besemer, Pesce, Birba and Muyiramye, 2020).

Digital farmer profiles increase efficiency in managing farmer-related activities in real-time by providing targeted information to growers who require support, thereby improving the quality of farmer agricultural production to maximise farm revenues and profits. It also includes source location information to improve access to new markets and information per individual farm profile that can be used to access credit and provide accurate knowledge of farmers that can help enhance agribusiness's value chain. Additionally, farmer profiles can allow agribusinesses to share information with growers that enable them to move from an often-inefficient utilisation of inputs (seeds, water, pesticides, fertilisers) to an intensive utilisation of knowledge based on up-to-date data and information (Addison et al.,2020)

In 2016, Eastern Africa Farmers' Federation (EAFF), in collaboration with Pan African Farmers Organisation (PAFO), Agriterra, AgriCord and Technical Centre for Agricultural and Rural Cooperation (CTA), launched a project to improve access to the market information and advisory services to outgrowers in Kenya through use of a mobile platform called e-Granary. Through e-Granary, farmers could make informed decisions related to agricultural production and marketing decisions, i.e., such as when, where and at what price to sell their products. The platform used Unstructured Supplementary Service Data (USSD) technology for sending and receiving messages between farmers and agribusiness. As a result, farmers captured data about their fields, crop type and wages paid to workers. This data was pushed to agribusinesses and analysed to determine inputs required by specific farmers to maximise production. Details of required inputs by farmers were then sent to credit providers for loan disbursement in the form of credits (Addison et al., 2020).

Additionally, the e-Granary platform aimed to increase the attractiveness of farmers to insurance and credit companies by keeping records of e-Granary registered farmers' production and financial history that could be submitted to insurance and credit companies when a farmer was seeking a loan. This enabled agribusinesses to obtain greater access to and better management of farmer information to improve financial services to their farmers (access to credit). The project goals of increasing farmers' access to market information helped inform food production and trade within the region and increased e-extension services for farmers. The e-Granary mobile platform addressed the lack of access to traditional extension services, providing farmers with timely information to anticipate risks and mitigate losses. Additionally, EAFF found that combining insurance services and input loans as a single product resulted in improved buy-in by farmers. Farmer profile information, such as location or crops to be marketed, was critical for efficient interactive voice response (IVR) systems. As of 2018, 43 400 farmers in Kenya were registered on the e-Granary platform, and targeted voice messages were sent to registered farmers based on location and crop type.

2.5.3 Mobile technology for communication

Aker and Mbiti (2010) and Aminuzzaman et al. (2003) discovered that farmers' adoption of the mobile phone is driven by the belief that mobile phone use as a communication tool is superior to most other traditional communication. This is due to its ease of use and is relatively inexpensive. Tangentially, it appears to raise the social status of users. Similarly, Anderson and Feder (2007) found that traditional ways of delivering information in the agricultural space are inefficient and problematic, with no real-time monitoring of agricultural extension workers who are responsible for providing farmer

information (BenYishay and Mobarak (2013). Therefore, mobile phone use in the farming space aligns with the efforts to increase the productivity and efficiency of farmers through the delivery of personalised/customised agricultural information to farmers at an affordable price and in a manner that is customised to their context and matches relevant farmer current phase of the growing season.

In a case study conducted in Kenya on the use of a mobile electronic livestock disease surveillance system (e-surveillance system), a programme was rolled out in the northern regions of Kenya where community disease reporters were trained on the use of a smartphone mobile surveillance system app for identification and reporting of diseases. Reporters' duties were to collect data on disease syndromes in real time and share data with veterinarians managing the area where the disease syndrome was identified. The veterinarian would further post the data received on an online service designed to collate, analyse and map the disease occurrence patterns. Results generated would guide the type of veterinary drugs to supply to that area. This helped reduce diseases' occurrence and impact, especially in hotspot areas. Additionally, the technology was used for improving early detection, reporting, monitoring and controlling livestock diseases, and deploying the right drugs cost-effectively (Walker et al., 2011; ILRI, 2018).

The use of mobile phone technology by smallholder farmers to access market information to coordinate access to agricultural inputs, seek agriculture emergency assistance for financial transactions, communicate with their customers to bargain better deals, and obtain expert advice is on the rise (Ogbeide & Ele, 2015; Chhachhar et al., 2016). Farmers use their mobile devices to perform farm-related activities such as voice calls, short message service (SMS), multimedia systems, and the Internet (Nyamba & Mlozi, 2012; Tadesse & Bahiigwa, 2015). Increased use of mobile phone technology as a means of communication in the day-to-day life of smallholder farmers can improve their productivity and sustainability, enabling farm activities to be carried out on time with few or no delays encountered to achieve desired outcomes. Additionally, access to current market information benefits smallholder farmers and consumers as they can bargain and attain better prices from their input suppliers and crop buyers (agribusinesses). Mobile technology has made it possible for improved communication and distribution of crops from smallholder farmers to consumer markets with a clear indication of the price range, crop variety, quality parameters and quantity of crops required. This information is vital as it helps smallholder farmers to make informed decisions based on facts. As a result, disease outbreaks can be communicated on time, agronomy support can be conveyed efficiently, and consequently, high yields can be achieved (Martin & Abbott, 2011; Okello et al., 2012; GSMA, 2013; AgDevCo, 2017).

2.5.4 Mobile technology for payments, transacting and funding

Mobile technology is a game changer in addressing smallholder agricultural problems as it can provide market-driven solutions. Over the years, several countries have adopted digital mobile technology, providing access to market information via mobile phones, mobile payments, mobile banking and others. Today, through mobile banking technology, smallholder farmers have a higher chance of financial inclusion (access to credit) and improved access to inputs and output markets (Yao & Shanoyan, 2018). Furthermore, access to funding, digitisation of transactions and payments, and farmer data analytics can help smallholder farmers improve their access to finance from financial institutions and agribusinesses (Varangis, Kioko & Spahr, 2014; World Bank Group, 2019). Less than 10% of smallholder farmers globally have access to formal credit; that said, digital technologies can increase smallholder access to finance by lowering operating costs and providing improved methods for assessing market and credit risk (Townsend et al., 2019). Additionally, financial institutions and agribusinesses can use historical transaction records to process and facilitate credit for farmers.

Mobile payment systems have replaced inefficient, unsecured and costly conventional ways of sending or receiving money (Tsan, Totapally, Hailu, Addom, 2019). They have also enabled employers to securely pay their agricultural workers' wages electronically. Non-Government Organisations (NGOs) and governments can also transfer subsidy funds directly to farmers (Vodafone and Accenture, 2011; Townsend et al., 2019). In Zimbabwe, some smallholder farmers use EcoFarmer. This platform offers insurance services to enable farmers to insure their crops against the risk of excessive rainfall, false rainfall, and drought. Monthly premiums can be paid using a mobile platform called EcoCash (Econet, 2021).

Similarly, Vodafone's M-Pesa mobile money transfer services enable farmers in the remote areas of Kenya (Katitika community) to access safe, clean water through an innovative partnership between water pump manufacturer Grundfos and Vodafone affiliate Safaricom (Grundfos Pumps Limited, 2011; Townsend et al., 2019). To improve yield and overall productivity, a safe and reliable water supply is essential for farmers to irrigate crops (IRIS Center, 2010). Users can prepay safe, clean water using M-Pesa by buying water credits on a special key fob to access a water station. Payments received from about 250 people that used this system in Katitika were directed toward the maintenance of the pump system (IRIS Center, 2010; Jack & Suri, 2011; Townsend et al., 2019).

2.5.5 Mobile technology for monitoring and traceability

Effective monitoring of outgrowers throughout the season is essential in managing outgrowers. It contributes to a farmer's success as it provides a basis for allocating resources to farmers timeously through agronomy or input support. On the other hand, through the monitoring process, agribusinesses can capture data that can be used for traceability purposes to address food safety standards that have become increasingly regulated worldwide to mitigate food-related scandals and outbreaks (International Trade Centre, 2015). Therefore, mobile technology is a game changer in monitoring outgrower activities and tracing outgrower produce. Mobile technology can facilitate the tracking of farmers' crops and monitoring farming activities throughout the season, from sowing seed to harvesting (International Trade Centre, 2015; Townsend et al., 2019; Asian Development Bank, 2015, USAID, 2018).

Monitoring and traceability data can be captured through the use of barcodes, radio-frequency identification (RFID) (products are barcoded or tagged with RFID, which can store product data), mobile devices and applications, Internet-based applications, and wireless sensor networks (World Bank, 2017). These mobile technologies prevent irregularities in the flow of information from markets to small-scale growers (Muto & Yamano, 2009). Moreover, through mobile technology and other related advanced technologies, the flow of information from small-scale outgrowers to markets can be improved to meet traceability requirements by the market and for record-keeping of monitoring activities. For instance, small-scale growers can capture information like crop variety grown, planting/ transplanting dates, fertiliser and pesticides used, harvesting dates and farmer inputs. This data can then be pushed to a central repository for analysis and shared with interested partners/ consumers to provide transparency throughout the farming process, from seedling to output. Additionally, amalgamating mobile technologies with complementary advanced technology like wireless sensors and radio-frequency identification could better capture farming monitoring and traceability data to minimise the need for inefficient manual paper-based data capturing (World Bank, 2017).

2.5.6 Mobile technology for reporting

Cloud computing services (using a network of remote servers hosted on the Internet to store, manage, and process data) be valuable and essential in the agricultural space (World Bank, 2017). Through cloud computing, vast amounts of agricultural data can be managed, stored, analysed and shared with farmers, researchers, agricultural policymakers, agribusinesses and extensionists, with minimal management effort or service provider interaction (Mell and Grance, 2011). Through the innovative discovery

of cloud computing by Amazon Web services, cloud computing has enormously improved global access to data and knowledge resources. In the agricultural space, cloud computing, when integrated with other technologies like mobile technology and radio-frequency identification tags, can analyse vast amounts of data, store it and further export or download it while saving time and money that could have been spent to analyse, interpret and present the data to farmers and other parties in the value chain. With cloud computing, data can automatically be analysed with little to no human input, interpreted, and recommendations are formulated and made available to farmers and interested parties within the value chain to review (World Bank, 2017).

2.5.7 Mobile technology for training and workshops

Training is a program that helps individuals enhance their performance by closing skill gaps and managing change (Goldstein & Ford, 2002). Education and training are no exception, as technology continues to advance in all aspects of our lives (Matimbwa & Anney, 2016). Globally, we have seen remote virtual learning being adopted at a swift pace through the use of mobile technology that makes it possible for communication and information to be shared between teachers and learners (Lepp, Barkley, & Karpinski, 2015). Mobile technology use for educational purposes has the potential to enhance effective teaching and learning due to benefits that include knowledge sharing without any limits in space and time, the development of communication skills, and participatory learning (Sanga, Mlozi, Haug, & Tumbo, 2016; Abidin & Tho, 2018).

An Indian-based fertiliser company called Criyagen developed an Android application called AgriApp that offers different practice and learning packages for growing many crops, including cotton, maise, sugarcane, watermelon and others. The company provides these services in various forms, including farming practice videos, news articles and well-referenced literature. Moreover, farmers who use the services can speak with company field officers to enquire about or clarify a specific issue via a call or chat. In addition, the application allows users to obtain information in three different languages to avoid miscommunication and reach a broader market (Criyagen, 2016). Similarly, the Digital Green system in India launched an innovative video communication system to disseminate targeted agricultural learning content for small-scale/ marginal farmers to enhance the efficiency of agricultural extension services and improve how farmers manage their fields with little field support from extension officers (Gandhi, 2009). All the videos were produced using local farmers and agricultural extension officers or peer-to-peer training, where a farmer or extension officer demonstrates a technique on farming via a recording and the video is shared or screened to the community members. However, agricultural extension officers/experts are often

overwhelmed by the number of farmers who request support, which usually leads to delays in delivering aid to farmers.

Moreover, the physical distance between farmers and extension officers contributes to the delay of extension officers in reacting to and offering support to a farmer who needs help. Therefore, video communication systems resolved delays in delivering aid to farmers on time. Farmers could access training via a mobile device in their homes or at a community video screening workshop (Digital Green, 2011).

2.6 Deployment of Mobile Technology to Manage Outgrowers

Agribusinesses must choose a suitable information dissemination model to manage outgrowers effectively. According to Zhang et al. (2016), several factors must be considered before adopting a model. Elements should include looking at the critical information infrastructure, farmers' capabilities, operating costs, farmers' information consumption behaviour and, most importantly, the local context. While there are several information dissemination models, including web-based portals (a collection of relevant websites to form a one-stop centre for users), voice-based services (information dissemination through telephone), text messaging (information dissemination through text messages using mobile phones), an online community (information services provided by a community to its members), interactive video conferencing (using online multimedia technology to facilitate information service), and mobile Internet-based services (information dissemination through smartphone service), to name a few (Zhang et al., 2016; Musungwini, 2016). Agribusinesses must be able to engage and interact with the growers using technology services that are relatively cost-effective, capture and push data in real-time, and incorporate GPS technology to provide location-related service. Additionally, text messages (SMS) can complement smartphone technology through their use to send short and timely news to growers on weather updates, invitations to training workshops and payment notifications, for example (ibid). However, to determine a suitable model for the context of this study requires that empirical data be collected on the local context to determine if the necessary infrastructure is in place to support the technology requirements, that it aligns with the education level, and that skills match requirements for that technology, or whether training is required for the people who will be using the technology (Zhang et al., 2016).

2.7 Problem Conceptualisation

Figure 2.1 presents a conceptualisation of the problem. The diagram depicts the processes involved in the management of outgrowers; the data that is needed from outgrowers, or shared with outgrowers, by agribusiness for better management;

proposed mobile technologies to be used to achieve improved efficiency and effectiveness for these processes, and the proposed relationship to enhancing sustainability, profitability and productivity through the application of mobile technology to facilitate these processes. The problem conceptualisation was developed from the literature survey to assimilate the preliminary findings and to use it to guide the data collection and analysis of empirical data and the discussion of the results.

2.7.1 Improved productivity

It is arguable that deploying mobile technology for managing farmer profiles, communication, transacting, and funding can improve growers' productivity in outgrower schemes.

2.7.1.1 Management

Mobile devices with cloud computing and other technologies, such as RFID, enable good digital farmer profile management. Digital farmer profiles increase efficiency in managing farmer-related activities in real-time through the timely provision of targeted information to growers who require support, improving the quality and yield of farmer agricultural produce to maximise productivity (World Bank, 2017; Addison et al., 2020). This support can include sharing information with growers that help them to optimise the utilisation of inputs (seeds, water, pesticides, fertilisers) and providing them with access to a knowledge base of up-to-date data and information (Addison et al., 2020).

2.7.1.2 Communication

Traditional ways of communication are inefficient for real-time monitoring by agricultural extension workers responsible for delivering information to farmers (agronomy support) (Anderson & Feder 2007; BenYishay & Mobarak 2013). The use of mobile phone technology in the agricultural space to execute communication through mobile applications, SMS and voice calls is more likely to realise efforts to increase the productivity of farmers through the delivery of personalised agricultural information to farmers at an affordable price and in a manner that is customised to their context (Martin & Abbott 2011; Okello et al. 2012; GSMA 2013; AgDevCo, 2017). For instance, when a farmer faces a crop disease, mobile technology can more suitably provide the immediate agronomy advice required to fight the disease and save the crop.

2.7.1.3 Payments

Farmers must make payments to suppliers of inputs for farming to ensure that the farmer can maintain their output and, thus, their productivity. These payments depend on

timeous payments from agribusinesses and access to finance and funding (Stringfellow,1996; World Bank Group, 2019). Mobile banking technology improves the chances of smallholder farmers accessing credit from financial institutions, payments from agribusinesses, and funding from NGOs and governments (Vodafone and Accenture, 2011; Varangis, Kioko & Spahr, 2014; Yao & Shanoyan, 2018; World Bank Group, 2019). Additionally, insurance services available on digital platforms enable farmers to insure their crops (Econet, 2021), while mobile money transfer services enable farmers in remote areas to access necessary inputs such as safe, clean water (Grundfos Pumps Limited, 2011; World Bank Group, 2019), collectively assuring a productive crop output.

2.7.2 Improved profitability

It is proposed that the profitability of outgrower farming activities would depend on effective monitoring and product traceability. Traceability depends on data like crop variety, planting and transplanting dates, fertiliser and pesticides applied, harvesting dates and other farmer inputs used. With effective monitoring and traceability, accurate information is disseminated through the food supply chain and minimises trade disruptions. Effective traceability can significantly reduce the scope of a recall by up to 95% by maximising profits. This minimises product waste that would have occurred without the required traceability systems (International Trade Centre, 2015; The World Bank Group, 2019). Mobile phones, mobile-based applications, Internet-based applications, mobile scannable barcodes and QR codes can facilitate monitoring farmer activities and tracking of products (crops) throughout a season from seed to the final product and beyond (International Trade Centre, 2015; The World Bank Group, 2019; Asian Development Bank, 2015, USAID, 2018) using data about the contracted area, distribution of inputs, nursery management, land preparation, transplanting, timely weeding and adherence to good agriculture practices, implementation of pest and disease control practices, timely harvesting, harvesting techniques, and post-harvest production (Gent; 2010; Asian Development Bank, 2015, USAID, 2018). This data can be uploaded to a central repository or cloud computing system for analysis and shared with consumers to provide transparency (International Trade Centre, 2015; The World Bank Group, 2019). Consumer markets are willing to pay a premium since farmer produce is traceable through the food supply chain (World Bank, 2017).

2.7.3 Improved sustainability

The sustainability of outgrower farming can arguably be achieved through accurate reporting and training. Reporting is crucial for accurate crop history and identifying areas that require improvement. Additionally, training and workshops improve farmer

awareness, close farmer skills gaps so that farmers can make informed decisions and equip farmers to maintain proper farming practices beyond training.

2.7.3.1 Reporting

Accurate reporting would depend on agribusinesses developing an information system that helps to manage outgrower farmers, distribute inputs (resource allocation), measure outgrower productivity, manage procurement operations, and monitor field agent activities. Gent, 2010). Reporting data should include information about crop deliveries, disease outbreaks and challenges to identify and address opportunities for improvement and growth (USAID, 2009; Zhang et al., 2016). Cloud-based management reporting can provide capabilities to manage, analyse, report and store vast amounts of data made accessible to farmers, researchers, agricultural policymakers, agribusinesses and extensionists to facilitate interaction for ensuring sustainable farming operations (Mell & Grance, 2011; World Bank, 2017).

2.7.3.2 Training and Workshop

Outgrowers must receive farmer training (i.e., agronomy advice and support) to excel in practising farming and therefore become sustainable because training is targeted at improving performance and skills so that individuals can make informed decisions and improve awareness (Goldstein & Ford, 2002). Furthermore, visual training, e-learning and video conferencing can be used for farmer training, and workshops can be conducted through mobile devices. Knowledge sharing without any limit in space and time can be achieved (Abidin & Tho, 2018), and quality, timely agronomy support from agricultural extensionists can be shared without any physical distance hindrance, which presents a limitation for the context of this study today.(Ferroni & Zhou, 2012).

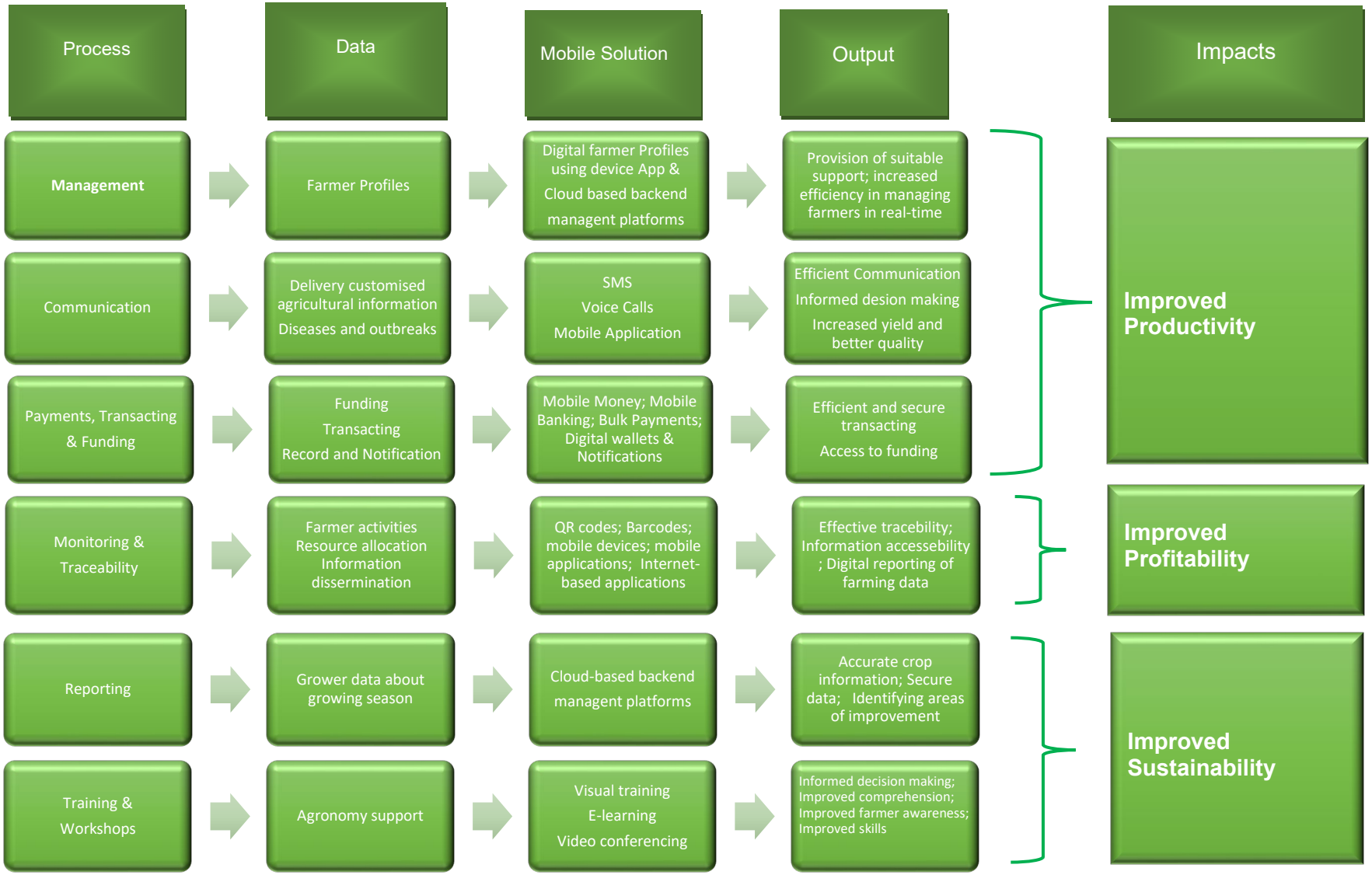

Figure 2.1: Problem conceptualisation

CHAPTER 3
RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents the research methodology of the dissertation. First, the researcher outlines an overview of the purpose of the research, the problem statement and the research questions. Furthermore, the researcher presents the research paradigm, research approach, research design, population, participants, sampling technique, research procedure, data collection and processing, quality assurance, ethical considerations, and research limitations. Finally, in a systematic approach, each of these stated research aspects is explained in a way that defines them and augments the researcher's justifications behind the research strategies and techniques employed in this research.

3.2 Overview of the Problem, Purpose of the Study and Research Questions

This research aimed to explore the use of mobile technology to better manage outgrowers of agribusinesses by collecting data from participants to address the research questions using qualitative research techniques. The problem identified in this research is the lack of know-how and underutilisation of technology in the Zimbabwe farming ecosystem in an increasingly technological and digital environment to improve productivity, profitability and sustainability. This study aims to establish how digitalisation can better transform farming, particularly its management, monitoring and operational front. This study seeks to answer the following research questions using interviews as the primary source of data collection:

a. What information is required by agribusinesses to manage outgrowers?
b. How can mobile technology be deployed to enable agribusiness to manage outgrowers remotely?

3.3 Research Paradigm

A research paradigm is a philosophical way of thinking in research. It describes the researcher's worldview or beliefs that guide research action, direction and interpretation of research data (Guba & Lincoln, 1994; Denzin & Lincoln, 2000; Mackenzie & Knipe, 2006). Research paradigms define the nature of the study (positivist, interpretive or critical) and influence what should be studied, how it should be studied (methodology)

and how the collected data should be examined or interpreted (Lather, 1986; Annum, 2017).

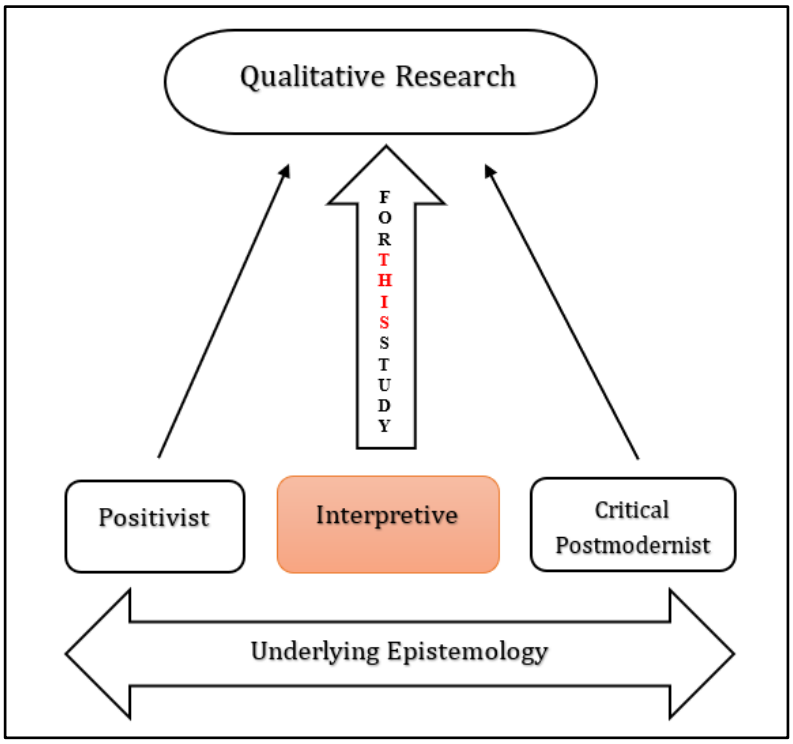

Figure 3.1: The Research Philosophical assumptions

Source: Gephart (1999)

Figure 3.1 presents three philosophical ways of thinking of researchers, namely positivist, interpretive and critical postmodernist. It further highlights the research paradigm ideal for this study as interpretive due to the aim of the study and the exploratory and subjective nature of this research. Interpretivists believe that reality is subjective and mind-dependent (Creswell, 2003; Mertens, 2009). In subjectivist epistemology, the researcher extrapolates data subject to the individual's mind, perception, orientation and thinking patterns, informed by their past, present and future. Therefore, it is only through conversations and dialogue between researcher and participant that such information is obtained, unlike questionnaires or observations; hence a subjectivist epistemology is best suited for this study (Punch, 2005). In this study, as supported by Mertens (2009) and Punch (2005), an interpretive paradigm will be the best philosophy to employ in explaining subjective interpretations from the

participants and subjective reasons and meanings that can shed light on the phenomenon identified in this study, particularly given that the phenomenon is underexplored in the context under study.

An interpretive philosophy allows studies to gain greater scope to understand, explore issues of influence and their resultant outcome, and ask questions such as 'what", 'why', and 'how' a particular phenomenon can change ways of doing things (Deetz, 1996). Additionally, a relativist ontology's view is that in a research study, the reality is limited to subjective experience and has several realities (Denzin & Lincoln, 2005). From a relativist perspective, it is said that reality is indistinguishable from a subjective experience, meaning reality is human experience and vice versa (Guba & Lincoln, 2005). Gathering these multiple different realities can only be acquired or explored through human interaction between the researcher and participants of the study, that is, through conducting interviews to gain an in-depth understanding of a phenomenon under study (Chalmers, Manley & Wasserman, 2005).

Guided by the norms, values, and multifaceted interactions of a relativist ontology, the researcher, could address the "what" research question and explain the "how" research question of this study through human interaction. Hence, naturalist methodologies such as interviews were used to gather participants' verbal and non-verbal language to understand the phenomenon under study better. Figure 3.2 outlines four main aims of academic research, namely, explore, describe, explain and solve. Accordingly, it displays the four main objectives of academic research: investigate, experiment, determine, and analyse (Saunders et al., 2012). Using Saunders et al., 2012 categorisation, this research employs the quadrant highlighted in red, characterised by the interpretive and subjective epistemological positions. As shown in Figure 3.2, the research orientation is exploratory; hence a qualitative research approach was found suitable.

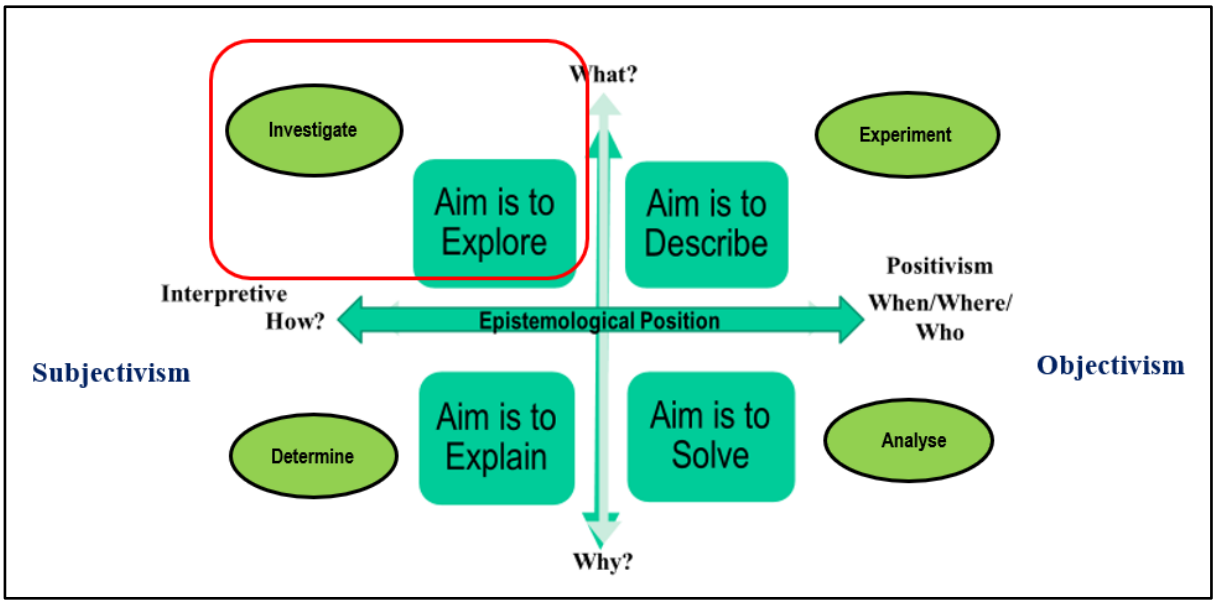

Figure 3.2: Epistemological and ontological positions

Source: Saunders et al. (2012)

According to Walsham (1993), employing an interpretive paradigm in information science generates a clear understanding of a phenomenon and its processes, whereby information science influences the context and vice versa. Therefore, interpretivists are interested in judging, assessing, and enhancing interpretive theories rather than generating new ones (Walsham, 1995). Walsham (1995b) proposes three different theory uses in an interpretive case study. These include theory guiding the design and collection of data, theory as an iterative process of data collection and analysis, and theory as an outcome of a case study. In this study, "theory guiding the design and collection of data" was applied since a conceptual framework was used to guide the research design and collection of data. Additionally, "theory as an outcome of a case study" was applied since the conceptual framework will be refined based on the themes derived from the empirical data collected.

3.4 Research Approach

According to Domegan and Fleming (2007:24), "Qualitative research aims to explore and to discover issues about the problem at hand because very little is known about the problem". There is usually uncertainty about the dimensions and characteristics of a problem. A qualitative research approach is associated with an interpretive paradigm employing a naturalist approach to studying the subject matter. It implies studying

phenomena in their natural setting through interactions between the researcher and their subjects (Denzin & Lincoln, 2005:2). Given the study's problem statement, the research objectives were to explore the use of mobile technology by agribusinesses to determine what information they require to manage outgrowers, and determine how mobile tech can enable agribusiness to manage outgrowers better. Therefore, a qualitative approach could illuminate the variables for the identified phenomenon, as it allows for naturalist methodology whereby both verbal and non-verbal data are collected to understand the understudied phenomenon better and explore issues that influence the phenomenon. In addition, new empirical data and theories can be generated through a qualitative approach. However, a qualitative approach relies on non-numeric data and lacks what a positivist, quantitative approach can offer, which is measurable statistical data to conclude facts and reveal different research patterns (Denzin & Lincoln, 2003).

Table 3.1 illustrates the most common qualitative research approaches as classified by Creswell (2014). There is a phenomenological approach, a case study, grounded theory, a narrative approach and ethnography, but other sources also include observations (ibid.). For example, Gillham (2000) defines a case study as an inquiry into real-life situations to gain evidence (empirical data) from the case settings by asking specific research questions. On the other hand, Yin (2003) explains a case study as an empirical research study that investigates a situation study within the natural parameters of its context, mostly when boundaries of the context of the study and phenomenon are not well defined.

Table 3.1: The five main qualitative research approaches

APPROACH	EXPLANATION
Phenomenological approach	Captures participants' experiences and examines how they make sense of their experiences
Case study	In-depth study of a well-defined case or phenomenon using multiple data sources

Grounded theory approach	Develops an explanation, model or theory that helps in understanding a phenomenon, situation or process
Narrative approach	Collects a participant's story or captures a group of participants' stories and retells their stories
Ethnography	Explores a phenomenon by studying a group of people or individuals in their natural environment

Source: Creswell (2014)

The approach highlighted in the table, namely a Case study approach, was used because it focuses on a specific, well-defined case. Therefore, case study research allowed for an in-depth study of digitalisation, or the lack thereof, across a selected sample of outgrowers in the Chilli Pepper Company in Zimbabwe. In addition, the case study also provided a variety of participant perspectives, thus fostering the reliability of the supposed research outcomes.

3.5 Research Design

A research design helps to plan, arrange, build and execute the research to make the research findings valid, acceptable and accurate (Mouton, 2015). It is a master plan and a road map for research that guides how the study must be conducted and directed. Yin (2003) similarly points out that a research design is an action plan for getting from point A to point B, where point "A" can be defined as the starting point where the research questions must be answered and point "B" as the endpoint where conclusions and answers are provided. For this study, an exploratory research design was employed. Burns and Groove (2001) define exploratory research design as research conducted to generate new empirical data, discover new ideas, and increase knowledge of the phenomenon. This study aimed to answer "what" and "how" research questions of the study: the "what" information unearths elements that ought to be practised by agribusiness to manage outgrowers, and the" how" question reveals how mobile technology should be deployed to enable agribusiness to manage outgrower

remotely. An exploratory research design was used to understand the research problem and generate new empirical data. It selected the appropriate methods to generate primary empirical data from the Chilli Pepper Company, Zim (CPC) management and staff as a case study to understand their views and perceptions concerning the utility of mobile technology in managing outgrower farmers.

3.6 Research Processes

The research process refers to the research throughput from start to finish. Various parameters and key research components guide the research process. Such aspects include, but are not limited to, population, sample method, sample size, data collection, data collection instruments, data analysis and ethical considerations. This section of the chapter shall outline these variables in greater depth.

3.7 Population

The population of a study is defined as the totality of the members or objects that a researcher intends to study, and a sample is drawn from that total population (Van den Broeck et al., 2013). The total population for this study were all management staff and employees of CPC, who have been with the company for at least two years, are aware of the company's outgrower management activities, and are somehow involved in the interaction with outgrowers. Since the research paradigm for this study is interpretive, it considers a theoretical sampling strategy. This entails the selection of participants based on theoretical considerations and how they fit the phenomenon under study or have characteristics that make them the best respondents for the research study (Bhattacherjee, 2012). Therefore, only CPC participants who had worked with outgrowers were considered the population for this research.

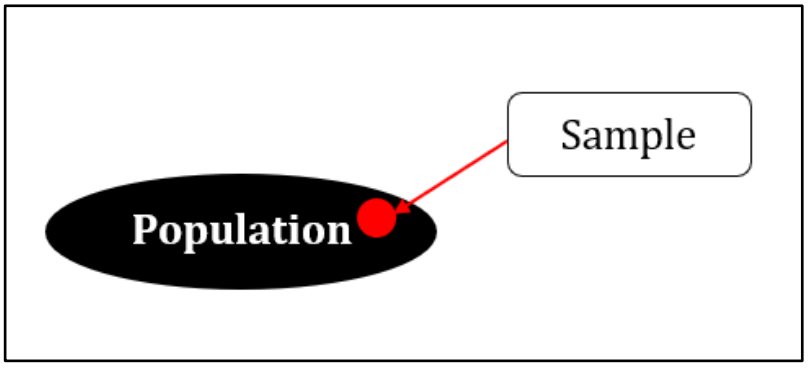

Figure 3.3: Demonstrative definition of population and sample

Source: Nhamoinesu (2021)

Figure 3.3 above illustrates a sample of a population. The shaded part in black represents the totality of the members that the researcher intends to study, and the shaded red represents a sample drawn from that population to represent the total population of the study. The population was 17 and excluded any CPC employees who do not know about working with outgrowers. In addition, any management staff or employees who had not been with the company for at least two years were excluded from the study because the chances were high that they might not be able to produce the depth of data necessary to answer the research questions.

3.7.1 Sampling

Sampling is a process of selecting a subset from the total population to represent the total population of a study. This is done because the total population can be too large for the researcher to handle, or it might not be easy to include every participant in the study. Also, it can be costly or inaccessible for the researcher to reach every participant; thus, selecting a representation of the total population is requisite (Browner et al.,1988; Kamangar & Islami, 2013). This is remarkably illustrated in Figure 3.3. There are two main sampling categories, probability and non-probability sampling, and several methods. Probability sampling is a method where each participant in the total population has an equal chance of being selected to participate in the research. This method is used in quantitative research studies where results can be generalised.

On the other hand, non-probability sampling refers to a method where the chances or probability of a participant being selected is unknown since there is no random selection of participants (non-randomisation). Subjective methods are used to select the participants to be part of the sample, and as such, results cannot be generalised. This method is used in qualitative research studies to explore, explain and discover theories in phenomena with the view to gather valuable data from selected participants. However, each method has its advantages and limitations, mainly regarding how participants of the research are selected and how generalisations of the results to the target population are extended (Battaglia, 2011; Acharya, Prakash, Saxena, Nigam, 2013). The sampling technique for this study was selected based on the nature of the study, which is qualitative. Additionally, the "what" and "how" research questions which aim to explore the phenomenon would best be answered based on a purposeful

selection of respondents to obtain the necessary data. Thus the sampling method aligns with the research paradigm, which aims to obtain an in-depth understanding of the phenomenon, not to generalise the findings.

3.8 Non-Probability Sampling

For this study, non-probability sampling, specifically purposive sampling, was used because of the study's qualitative nature and little information about the phenomenon. Using purposive sampling (judgemental sampling), the researcher selectively chose participants who can and are willing to participate based on their qualities, knowledge and experience (Bernard, 2002). The sample for the study was not selected randomly from the total population of interest, but subjective methods were used to select the participants to be part of the sample.

Since no randomisation was involved in the sample selection, the participants did not have an equal chance of being included in the study (Battaglia, 2008). However, participants were chosen carefully to ensure they added value to the study to attain rich data. Consequently, individuals well-informed on the phenomenon (outgrower schemes) were selected, based on the position held in the company and the number of years with the company on that particular position . Participants were selected based on their years with the company (at least two years). This was done to acquire quality and valuable data on the phenomenon based on their skills and expertise. Moreover, availability and willingness to participate and the ability to communicate experiences and opinions articulately and reflectively were considered upon selecting the participants (Spradley, 1979; Bernard, 2002; Cresswell & Plano Clark, 2011).

3.9 Sample size

Interviews are one of the data-gathering techniques where results are expected to reach the data saturation point. Data saturation is attained when there is enough data to replicate the research study (O'Reilly & Parker, 2012; Walker, 2012). It is a point when no new additional data can be produced in data analysis because a level has been reached where the researcher gets the same information over and over again (Guest et al., 2006) and when further coding (identification of themes) is no longer feasible (Guest et al., 2006). Bernard (2012) indicated that the number of interviews needed for a qualitative study to reach data saturation is a number that cannot be quantified; instead, the researcher should take what he can get. Moreover, interview questions should be formulated to enable the interviewer to ask multiple respondents the same

questions in the same manner; otherwise, it would not be possible to achieve data saturation, as it would be a constant moving target (Guest et al., 2006). Fourteen participants (management staff and employees) were scheduled to be interviewed, with the idea of stopping interviews once a saturation point was reached. The saturation point was reached at 11 According to LoBiondo-Wood and Haber (1998), the largest sample produces a good population representation. In this study, 17 participants would have been the largest possible sample.

Table 3.2: Sample in relation to the population of The Chilli Pepper Company

Department /Level	**Position**	**Number of people holding the position (Population)**	**Number of Participants interviewed (Sample Size)**
Executive Directors	Directors	1	1
Operations	Manager	1	1
Outgrower	Manager	1	1
Regional Manager	Manager	2	1
Agritex Officers	Officers	4	2
Field Supervisors	Supervisor	8	5
		17	**11**

Table 3.2 above shows the sample in relation to the population of The Chilli Pepper Company. The first column represents the department/level of the population, the second column represents the respective positions of the population, and the third column represents the number of people who occupy the positions described. Lastly, the fourth column represents the participants that were interviewed (sample size) drawn from the population number indicated in column 3. The researcher managed to interview

11 participants out of 17 people, comprising senior management and middle-level personnel with knowledge of outgrower schemes, who have been with the company for at least two years.

3.10 Data Collection Instruments

Bell (2009) defined a research instrument as a tool to collect necessary and important data from respondents. Research instruments guide the study in mining, examining, presenting, and interpreting the data. In this study, the researcher collected empirical data from the respondents using a qualitative approach and as such, interviews were used as the selected instrument for data collection. Figure 3.4 outlines five primary data sources: the Delphi technique, the projective technique, focus group interviews, in-depth interviews and questionnaires.

Figure 3.4 demonstrates five common primary data collection methods Yin (2017). First, the questionnaire method obtains individuals' perceptions using a set of questions mainly used in quantitative research and its most suitable for collecting vast volumes of data, i.e., market research data and consumer behaviour surveys. Second, the Delphi technique is a well-established approach to answering a research question through the collaborative and consensus view across subject experts. These experts blend their opinions and the opinions of others to prescribe meaning to the subjects under study. Third, projective techniques allow respondents to predict their subjective or accurate opinions and beliefs about other people or objects. Fourth, focus group interviews are conducted with participants to collect various information. They are usually used in the ethnographic and grounded theory qualitative research approaches. Finally, an interview is a qualitative research method that relies on asking questions to collect data. Interviews involve two or more people, one of whom is the interviewer asking the questions and the other interviewee answering the question. There are several types of interviews, often differentiated by their level of structure, for example, face-to-face interviews, group interviews, telephone interviews, structured interviews, semi-structured interviews and unstructured interviews. This study used face-to-face, one-on-one, and semi-structured interviews that are in-depth in nature.

This study employed the interview method as the primary instrument to collect raw data from the selected participants. Tertiary and secondary data sources such as journals, articles and books were most helpful in obtaining theoretical knowledge of the research aims and objectives. The researcher used structured in-depth interviews, as marked in Figure 3.4, because they provide a wealth of data compared to questionnaires or

observations (Kothari, 2009; Bhattacherjee, 2012). Additionally, the researcher reviewed literature related to mobile technology and how it can be used in the agricultural sector for use by agribusinesses in managing out growers. Further to reviewing the literature related to agribusiness outgrower management processes and mobile technology, a conceptual framework was developed to guide the data collection, which served as a reference along with the literature review to formulate the interview schedule questions.

Semi-structured interview questions were generated because of the interpretive nature of the study, which demands an in-depth understanding of outgrower management processes. Semi-structured interviews are more elaborate than questionnaires, where closed-ended questions give no room for further inquiry. The interaction between the interviewer and the subjects allowed the researcher to extract multiple realities. The researcher followed up with probing questions where clarity was lacking to obtain further justifications. The researcher used a personal mobile device to record the interviews for analysis. Before any recording, the researcher requested permission to record the interview. During the interview, the researcher also had a notebook to take notes on, for instance, the body language of the interviewee, probing questions and important remarks. The researcher would always check with the participant if they wanted to add more comments to make sure the interviewee exhausted all answers to the specific question.

Figure 3.4: Primary data Research Instruments

Suorce: Yin (2017)

3.10.1 Advantages and disadvantages of interviews as a data collection instrument

This research used interviews; therefore, it is important to show an appreciation of the merits and demerits associated with using interviews to gather detailed information, especially to maintain reliability in applying research processes (Myers & Newman, 2007). Interviews help researchers deeply explore when compared with other research methods and allow participants to elaborate answers that could not be achieved using other methods like questionnaires. Participants can use their own words to share their opinions instead of fitting into a perspective created by the researcher, which might create a limitation. Interviews allow for quickly collecting large quantities of relevant data (Marshall & Rossman, 1995). Additionally, due to the subjective nature of this study, interviews were ideal for obtaining the respondents' first answers and ideas, as opposed to issuing questionnaires which carry the risk of being tossed away or answered with irrelevant responses. Finally, interviews allowed the researcher to engage and interact with the respondents. This increases the chances of obtaining accurate or near-accurate responses compared to questionnaires. Interaction brings forth a richer meaning since the interviewer can probe further, clarify and get a sense of the non-verbal motions accompanying every response.

On the other hand, interviews are deemed unreliable because the source of their information is highly subjective opinions which can easily be affected by a bad day, bad weather or a grumpy mood. It is also easy for the interviewer to stereotype certain participants based on their dress, accent or personality. Moreover, to be able to set up a long time to ask questions from a stranger without necessarily paying or rewarding them is always a challenge which, in some cases, badly affects the sample size (Hermanns, 2004; Myers & Newman, 2007). Finally, researcher bias is prone when using interviews due to distorting factors such as state of mind or fatigue. Qualitative research outcomes cannot be generalised to the entire population because each sample displays unique characteristics. Therefore, the researcher focused more on the quality of the data obtained from the sampled units and did not extend generalisations to the sample frame.

Table 3.3 summarises the sequence of events between the researcher and participants during data collection. It gives a brief explanation of each of the following elements: how

interview questions were designed; participants were recruited; location of the interviews; method of data collection employed; style in which data was collected; characteristics of data collected; number of participants and length of interaction; specific action taken; interviewing procedure, and other information included on the consent form and interview guide sheet.

Table 3.3: Tabulated sequence of events between researcher and participants

KEY FEATURE	EXPLANATION
Designing interview questions	A conceptual framework was developed based on the literature reviewed from scholarly books, articles and journals. The framework guided the development of the interview questions
Recruitment of participants	The population comprised The Chilli Pepper Company's top executive, top management and middle-level personnel who have worked at the company for at least two years and with knowledge of outgrower schemes. The researcher managed to interview 11 participants out of a total population of 17 people. The interviewer used heterogeneous purposive sampling to ensure that each department and level were well represented.
Location of the interview	The interviewer travelled to meet with participants in each region in which the Chilli pepper company operates. The places the interviewer travelled to include Masvingo, Nyakomba, Chimanimani and Harare
Method & style of data collection	The researcher used face-to-face, semi-structured in-depth interviews to gather data. All the interviews were conducted at CPC premises. All interviews were conducted one-on-one. A mobile device was used to record each interview.
Characteristics of data	Text field notes, mainly opinions, beliefs, and experiences of participants in response to the research questions. It also included the personal and background information of participants. These were captured mostly as audio with occasional field notes.
Participants and length of interaction	A total of 11 respondents were interviewed within a space period of 2 weeks. On average, each interview was 60 minutes long. However, 2 participants exceeded this by 15 and 28 minutes, respectively.

KEY FEATURE	EXPLANATION
Specific action taken	The researcher would arrive at the CPC premises 30 minutes before the scheduled time for the interview. This was done so the interviewer could prepare for the interview. Once the meeting started, the interviewer would introduce himself and thank the interviewee for agreeing to participate in the study. After that, an introduction and background to the study were provided. Next, the interviewer would take the interviewee through the research procedure and explain the interviewee's rights and how the interview will be conducted. Once the participant agreed to carry on with the interview, the interview would start. Before the recording started, the participant was asked to complete the consent form and section A of the interview guide, which covered basic information about the interview, i.e., gender, number of years with the company, age range A preliminary investigation the researcher conducted found that not every participant was fluent in English. Therefore, the researcher had to translate the interview questions into the Shona language to address the language challenge. Each participant was given a choice to speak in their native language (Shona) or English. All interviewees were thanked at the end of each interview for participating in the research.

KEY FEATURE	EXPLANATION
Interview procedure	The interviewer described the main research procedures to the participant, so the interviewee was informed about what to expect. The interviewer would treat all interviewees respectfully by arriving on time for all the interview schedules and being well prepared. The interviewer would conduct an introduction to the interviewee in order to break the ice. The interviewer would ask permission to record the interviews and take some notes where applicable. Where clarity was needed, the interviewees were allowed to ask for confirmation or clarity of words/sentences/phrases to ensure the accuracy of the data collected. Participants were told that their data would be treated with complete confidentiality and that, if published, it would not be identifiable as theirs. Participants were allowed to omit questions they did not want to answer or with which they felt uncomfortable. Participants were told that questions do not pose any real risk of distress or discomfort, either physically or psychologically, to them. Interviewees were thanked at the end of each interview for their time and the information provided for this study.
Other information included on the Consent form and interview guide sheet	Research title, selection criteria for participants, a brief explanation of the research, and average time to be spent interviewing the interviewee.

3.10.2 Design of the Interview schedule

The researcher used semi-structured interviews to gather empirical data from the participants. All interviews were conducted face-to-face except for one interview, which had to be conducted via the Zoom platform because the participant was in the United States of America. Participants were given an interview guide and asked to sign a copy of the consent form at the beginning of every interview.

The interview questions were developed based on the study's research questions, the literature reviewed, and the conceptual framework developed. The questions were grouped into three categories; the first section (section A) covered basic information about the interview, for example, the participant's gender, job position, number of years with the company and others. The second section (section B) contained questions about outgrower management and reporting processes. All the questions under this section were tied to research question number one; "What information is required by agribusinesses to manage outgrowers?" Finally, the last section (section C) contained questions related to mobile technology use in the agricultural sector and mobile tech use in the agribusiness -outgrower context. All the questions under this section were based on research question number two of the study; "How can mobile technology be deployed to enable agribusinesses to manage outgrowers remotely?"

For sections B and C, the questions were set out logically, starting with more straightforward questions so that the participants would feel at ease and gain confidence before moving to more challenging questions that required applying their minds. This strategy helped establish rapport so all participants could feel comfortable sharing anything with the researcher. According to McNamara (2010), researchers must create practical interview questions as this will impact the data collection type. Therefore, a well-developed set of interview questions should be arranged in such a way that allows maximum collection of data from participants. In addition, the researcher should be able to probe the participant in the search for clarity and gain an in-depth understanding of the phenomenon. The following is a list of recommendations for developing practical interview questions as suggested by McNamara (2010), which guided the development of the Interview schedule in Table 3.4:

- Interview questions should be open-ended so that participants can freely explain using their words and terms when responding to questions.

- Avoid leading questions, as this might influence the responders' answers. Instead, the use of neutral questions is highly recommended. For example, avoid evocative and judgmental wording.
- The researcher should ask one question at a time to avoid confusing the respondent.
- Questions should be worded clearly, and the researcher should know all terms used.
- Caution should be taken when asking "why" questions.

Table 3.4 presents the interview questions used to collect the empirical qualitative data. Again, the questions are presented in English language and Shona language.

Table 3.4: Interview questions

Section A: Basic Information:	
1.	Gender: Male ☐ Female ☐
2.	Age: 18 -25 ☐ 26 – 35 ☐ 36- 45 ☐ 46 -55 ☐ 56 and above ☐
3.	How many years have you been working for The Chilli Pepper Company: 2-3 years ☐ 4-5 years ☐ 6-10 years ☐ above 10 years ☐
4.	Position Held: Executive Director ☐ Manager ☐ Field Supervisor ☐ Agritex officer ☐
5.	Do you own or frequently use any of the following mobile technology devices, smartphone, tablet, laptop, or computer: Yes ☐ No ☐
6.	Region: Masvingo ☐ Nyakomba ☐ Victoria falls ☐ Chimanimani ☐ HQ ☐
Section B: Outgrower management and reporting processes	
1.	Explain the processes for managing outgrowers. Tsanagura maitirwo/nzira ekutungamirira varimi
2.	Explain the challenges of managing outgrowers. Tsanangura zvipingaidzo zvinowanikwa pakutungamirira varimi.
3.	Explain the systems and methods used for managing outgrowers. Tsanangura maitiro nenzira dzinoshandiswa pakutungamirira varimi.
4.	Explain the challenges experienced with the systems and methods used for managing outgrowers. Tsanungura zvipingaidzo zvinowanikwa pakushandisa maitiro nenzira ekutungamirira varimi ?
5.	Outline the data and/or information required to optimally manage outgrowers. Donongodza zvinodiwa pakutungamirira varimi zvine budiriro/ Udzamu
6.	Explain how you ensure that outgrowers operate sustainably, productively, and profitably.

	Tsanungura zvamunoita kuti varimi varambe vachirima zvinebudiriro, gohwo rakanaka nepundutso
7.	Explain the process of reporting outcomes after a growing season. Ipa tsanangudzo inoshandiswa pakuripota pakupera kwemwaka
Section C: Mobile Technology	
1	Are you aware of mobile technology use in the agricultural sector? If yes, explain your answer. Uneruzivo here nekushandiswa kwemasai-sai munezvekurima? Kana wati hongu, tsanangura mhinduro yako.
2	Have you been exposed to using mobile technology within the agricultural farming context? If yes, explain your answer. Wakamboshandisa masaisai here munezvekurima. Kana wati hongu, tsanangura mhinduro yako.
3	Are you aware of any applications of mobile technology within the agribusiness-outgrower context? If yes, explain your answer Uneruzivo here nezvemamwe masaisai anoshandiswa mukurima ? Kana wati hongu, tsanangura mhinduro yako
4.	What challenges will influence implementing mobile technology for managing outgrowers and facilitating outgrower processes? Ndezvipi zvibingaidzo zvingakanganise kushandiswa kwemaisaisai mukutungamirira varimi nekubatsira kubudirira kwavo ?
5.	Do you think it is possible to deploy mobile technology for all outgrower management processes? If yes, explain your answer Unofunga here kuti zvinoita kushandisa masaisai kumabasa ose ekutungamirira varimi pakurima . Kana wati hongu, tsanangura mhinduro yako.
6.	What is your perception of the use of mobile technology to manage outgrowers? Unofungei nezvekushandiswa kwemasaisai pakutungamirira varimi?

3.11 Pilot Study

According to Turner III and Hagstrom-Schmidt (2021), researchers need to conduct a pilot test of the interview questions before conducting actual interviews, as this will allow the researcher to identify areas that require improvement or changes before conducting

the final interviews. In addition, pilot testing assisted the researcher in determining impending limitations and weaknesses. This assisted in refining the research questions before conducting final interviews for the study. Additionally, conducting a pilot study improves the research quality as it further enhances the reliability and dependability of the research process (Van Teijlingen & Hundley, 2001; Kim, 2010; Gudmundsdottir & Brock-Utne, 2010).

A total of two pilot interviews were conducted with two management staff who were potential participants in the study. The interview pilot tests proved helpful as they assisted the researcher in identifying flaws and limitations in the interview questions, thus allowing the researcher to make necessary changes before data collection. Suggestions and recommendations that emanated from the pilot tests were as follows. Under section A (Basic Information), the researcher was advised to ask a question relating to ownership or frequency of mobile technology devices to establish the participant's experience with mobile technology. In addition, the researcher was advised to add a question identifying the participant's region under section A, as this would add value to the data analysis and findings. Under section C, the researcher noticed that questions tended to attract "Yes/No" closed-ended answers. The necessary changes were applied to the questions to allow the respondents to explain their answers freely, thereby enabling the researcher to gather quality, in-depth data. The pilot also served to establish the length of the interviews. The researcher assessed whether the estimated time of 60 minutes allocated to each interview was within a reasonable range.

3.11.1 Data collection/fieldwork

The final structured interview guide was submitted for ethics clearance at the Cape Peninsula University of Technology and was approved. The interviews were conducted as scheduled on the research plan. Each respondent was contacted via email and telephone to schedule the interview on an agreed date and time. The researcher attempted to contact the respondents twice before choosing another respondent. The researcher solely conducted all the face-to-face interviews to observe the respondents' attitudes and behaviour. Notes were taken and recorded in a fieldwork notebook, and an audio recording was used to record the interviews for later transcription and analysis. Participants were informed of the recording and asked permission to record beforehand (Kothari, 2009; Bhattacherjee, 2012).

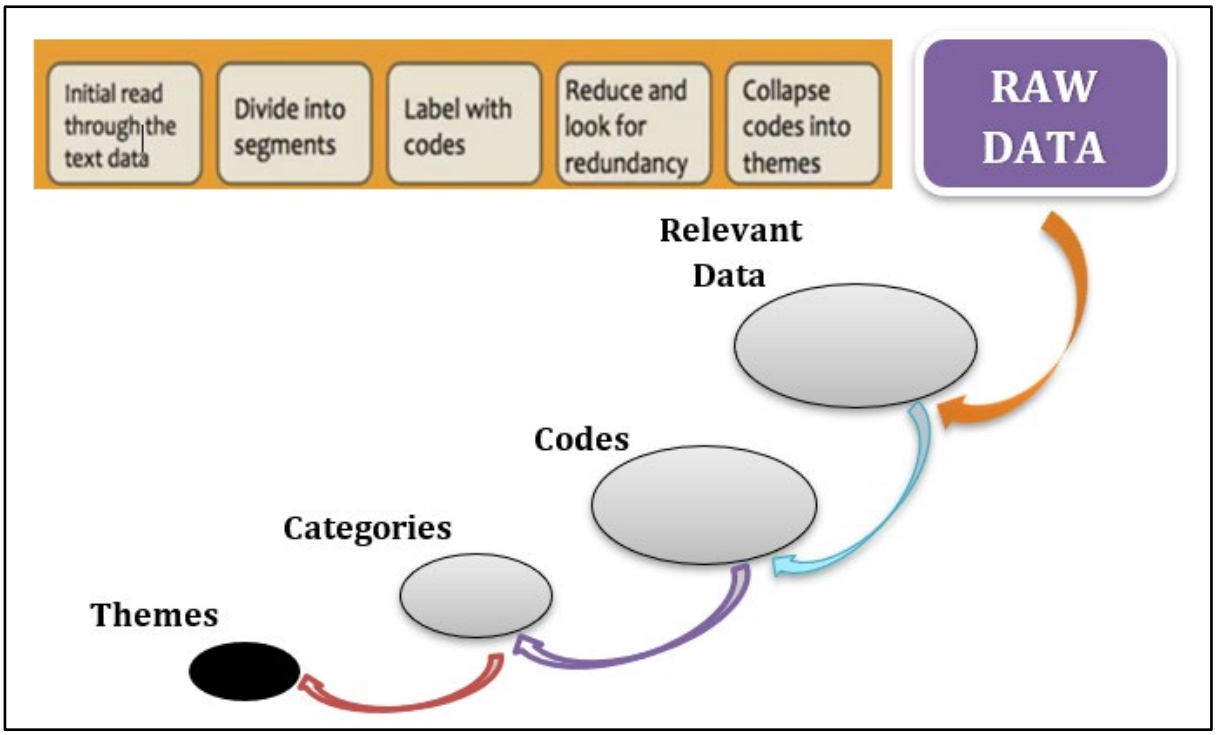

Figure 3.5: Conducting qualitative analysis

Source: Adu, (2016)

Figure 3.5 is an outline of the analytical process undertaken by the researcher. After transcribing the interviews, an initial read-through was conducted to gain a general sense of the data. Transcribing and the initial read-through can be conducted simultaneously, but in this case, the researcher chose the iterative route to enhance reliability. The researcher then identified critical segments and assigned code labels. With the help of anchor codes, they were reduced to their lowest terms to eliminate redundancy. These codes were then collapsed into themes that answered the research question. A systematic manual analysis using MS Excel to organise respondent answers and resultant codes was employed during the entire coding process.

Coding entailed reducing the transcribed data into its lowest terms without losing the meaning (Nhamoinesu, 2021). It starts by assigning labels to critical information; these labels are then grouped into categories based on the scenarios. Themes were then developed based on categories to address the research questions (Adu, 2016). Descriptive, interpretive and presumptive coding are among the most popular methods in qualitative data analysis. Descriptive coding describes transcribed information without interpreting the data; it merely rewrites the respondents' information without

adding anything. Interpretive coding goes further, from describing to making sense of the data, reflecting on the meaning of the data, and aligning the data to the research questions. Presumptive coding uses participants' data as evidence to arrive at a claim supposedly presumed by the researcher; hence it becomes inappropriate for simple technical reports and quasi-dissertations.

For implementing data analysis, the researcher used a dual lance of descriptive and interpretative coding. Descriptive coding allows for the background and context of the data to be easily inferred from the respondents, unlike presumptive coding, which tends to demand a much deeper mental exercise by the researcher in examining the raw data. This makes presumptive coding more appropriate in rigorous qualitative approaches such as ethnography and grounded theory. On the other hand, interpretive coding allowed the researcher to establish a semantic sense based on the descriptions provided in the raw data (Denzin, 1989). Additionally, the researcher used interpretive coding because, while descriptive coding predicates the data, interpretive coding helps to bring a richer profiling of the data because of the cognitive interpretation done by the researcher based on non-textual information obtained like the tone of voice, facial expression and other non-verbal cues. Patton (2002) sums it succinctly by saying, "descriptive and interpretive coding provides sufficient description to allow the reader to understand the basis for an interpretation, and sufficient interpretation to allow the reader to understand the description". Figure 3.6 demonstrates the key stages employed during data analysis.

The initial stage involved data assessment, which meant listening to the recorded interviews and making notes at the same time. The researcher read the notes twice to ascertain the meaning and to gain a deeper understanding of the content. Comprehensive notes were simultaneously made while reviewing as most of the respondents were Shona-speaking, the researcher spent time transcribing and translating Shona into English to retain meaning and not lose the semantic sense at both syntax and lexical levels. This made it possible for content to be understood better and interpreted accurately in the subsequent stages.

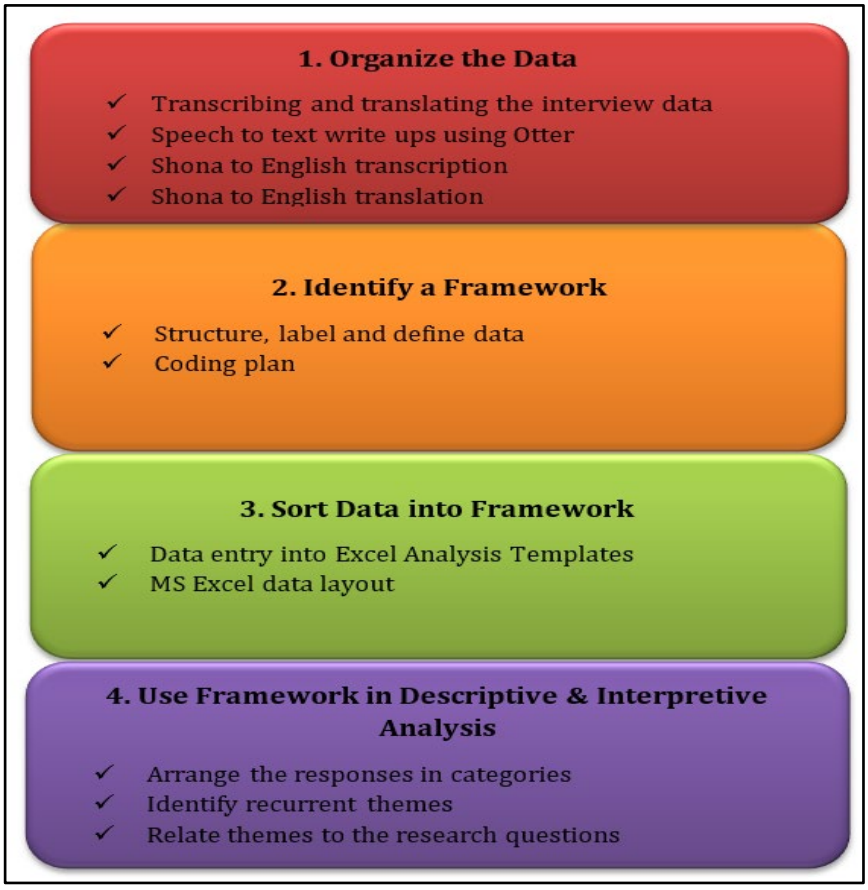

Figure 3.6: Qualitative Data Analysis Sequence

Source: Christopher (2016)

The second stage contained the basic organisation of data transcribed into word and subsequently organised into Excel Templates. It also involved basic data labelling, colour coding, underlining and highlighting data in the Excel template. The researcher employed this manual technique because it also works as a secondary reviewing technique, enabling the researcher to become familiar with the content and providing more control over the data and the entire analysis protocol. The next stage, as shown in Figure 3.6, involved arranging the responses into categories, having identified emerging patterns through anchor coding. Themes were then generated from the outlined categories. The themes aligned to answer the research questions and the established research sub-questions.

3.12 Overview of data Analysis Process

The researcher employed a qualitative research approach to collect, analyse and interpret the empirical data. After completion of the data collection after a two-week period, the transcription and analysis of the data commenced immediately, ensuring that non-verbal cues, initial observations and perceptions of the researcher were still fresh.

Content analysis was used to analyse and make meaning out of the raw data by identifying existing patterns in the transcribed data. Content analysis is an analysis technique used in qualitative research to determine and analyse the presence of words, themes or concepts through categorisation and coding of data (Hsieh & Shannon, 2005; Bates, 2021). In analysing the data, the researcher derived and explained subjective interpretations, reasons and meaning from collected data to understand the study in more depth (Creswell, 2003; Punch, 2005; Polit & Beck, 2006).

The following systematic steps were applied to manually analyse the data:

- Transcribing the data involved converting audio to text through listening to the recorded interviews. Transcriptions represented a verbatim account of the interviews.
- Thereafter, an initial reading of the transcribed data was performed to gain a general sense and understanding of the data.
- After an initial reading of the transcriptions were performed, the data was divided into segments, which involved categorising the data by allocating the data to an anchor code in terms of relevance. Anchor codes were guided by the conceptual framework, as aligned to the research questions, to identify keywords or concepts (critical codes). Additionally, descriptive coding was applied to extract and identify other new emergent topics that surfaced in the transcriptions in relation to the overarching themes of the conceptual framework. Additional codes were created based on the topics that were extracted from the transcriptions. Further, code excerpts were collated all together according to each descriptive code. According to (Adu, 2016), this complementary effect orients any study toward reliability and tends to cement the data analysis process itself.
- After that, code rearrangement occurred, which entailed reducing the codes by identifying redundant codes.

- The emergent codes were collapsed into themes that served to answer the research questions.
- After collapsing the themes, data interpretation was conducted to make sense of the data, reflecting on the meaning of the data and a discussion of the results was performed. Meaning was given to the data by providing an in-depth discussion of the empirical findings in relation to the literature (Adu,2016; Adu, 2019).

3.13 Structuring and coding

Structuring and coding of data refers to the layout, classification and recalibration of meaning derived from the raw data. The data was moulded into codes and categories as an expression of the participants' responses. These codes and categories were arranged in such a way that they served to answer the research questions. In this study, 11 questions were asked, and responses provided per question constituted the sum of the information analysed into codes and categories to generate the broad themes to address the research questions. The average length of the interviews was 56 minutes 50 seconds, with interviewee 9 being the longest interview with 1 hour 27 minutes 27 seconds, and interviewee number 6 being the shortest interview with 39 minutes 29 seconds. This shows that the interviews were an in-depth account, providing volume of data. Structuring and coding of the data entailed coding it, classifying it, merging similar patterns, isolating divergent patterns, collapsing broad meanings, and eliminating redundancy. This procedure was largely informed by the conceptual framework, literature review, and the research questions. Creswell (2014) argues that research questions, while they provide clear parameters for analysis and interpreting raw data, can never alone be sufficient to provide a full framework analysis of the entire research concept and process.

Field notes turned out to be very useful in determining patterns and secondary probing questions served to direct the interviewee to provide unambiguous and non-vague responses. Unlike in the Grounded Theory Method (GTM) where a new theory is developed, grounded in the data collected, this study focused on developing specific themes and sub-themes to answer the research questions, and not to develop a new theory. Structuring and coding helped to affirm information that was included the conceptual framework and literature review, which helped the researcher to confirm and justify certain themes. However, new emergent themes and unexpected findings

obtained constituted the bulk of the findings, showing divergent patterns from that of the conceptual framework and literature review. New emergent codes were grouped under abstracted categories, also referred to as anchor codes (Corbin & Strauss, 1990). Table 3.5 below represents an example of the coding scheme used, which was applied consistently to all responses. It provides the themes, codes and meaning found during data analysis.

Table 3.5 Example of themes, codes and meaning units

Category	Code	Meaning
Process	Training and workshop	*"There's quite a bit of training that we do; we go through a whole process at the beginning of the year to explain the use of chemicals, explain the use of how to manage seed beds, and hopefully give farmers a real 123 in farming and, or chili farming…"* *"…Towards the reaping/harvesting stage we visit them to teach them the right pods to pick and the standards that are expected since we do not expect the foreign materials to be part of the produce so that they meet the quality that is being expected…"*
Data	Farmer profiles	*"Full name, first name and surname, ID number, phone number, date of birth, family size, home address, farm address, postal address and photo of the farmer registering them"*
Mobile Solution	Voice calls Mobile applications	*"In some other cases we don't visit the farmers always, but we can make some calls to the farmers to save time asking them on what we had asked them to do."* *"Yes, actually, I've used Earn as you grow which also had another part called SASA, but*

		the EAYG was for the production side and SASA was for the accounts side."
Output	Informed decision making	*"Towards the reaping/harvesting stage we visit them to teach them the right pods to pick and the standards that are expected since we do not expect the foreign materials to be part of the produce so that they meet the quality that is being expected…"*

3.14 Theory building and testing

In this study, theory building, that is, developing a new theory and theory testing, was not part of the purpose of this research. Theory building and model testing is often found in qualitative research methodologies such as the Grounded Theory Method (GTM), whereby a new theory is systematically built, predicated and grounded in the data that was gathered (Watling & James, 2012). In this study, however, a framework analysis hinged upon the conceptual framework was used to make predictive patterns which the researcher used for a comparative analysis. Primary, secondary and tertiary literature data sources also provided a healthy platform for further comparative analysis, thus directed content analysis was employed by the researcher. This helped to expand the conceptual framework and juxtapose evident patterns against existing theories closely tied to the conceptual framework. The resultant anchor codes, categories and themes derived from the research questions, conceptual framework, literature and empirical findings extrapolated from raw data were thus generated.

3.15 Reporting Interview Data

Reporting is a research process that envisages a detailed outline of empirical results obtained from the data analysis of the participants' responses (Watling & James, 2012). Reporting on the research output based on the empirical findings paves the way to a comparative analysis with fieldwork throughput on one hand, and the conceptual framework and literature review on the other. According to Creswell (2014), such an objective analysis harnesses confirmability and credibility of prominent thematic trends that are useful to answer the research questions and pivot the research objectives. As part of the reporting techniques, the following were considered: major themes,

frequency of the codes culminating into themes, the meaning of these themes, and lastly excerpts quoted from raw data, showcasing the evidence from the participants to substantiate the meaning of the listed themes. According to Watling and James (2012), this is where a touch of descriptive and interpretive coding fosters a better analysis and mastering of the data, from just raw data, to elaborate empirical findings. In this study, several codes and categories were formulated around out grower management and reporting processes and mobile technology.

3.16 Ethical Considerations

Ethics in research generally means the researcher has a moral obligation to protect the participants from harm and unnecessary invasion of their privacy and promote their well-being. Just as ethical theories in business and ethics in the business environment have become crucial in modern-day business sciences, researchers also find themselves challenged with demonstrating high moral values in the entire research process. Ethical clearance has now become mandatory, particularly in primary, secondary and tertiary data sources, because the final data sets (research output) must indicate that the researcher exercised integrity and dependability in his/her research study. (Field & Behrman, 2004, Best & Kahn, 2006; Trimble & Fisher, 2006). As part of the requirements for conducting research at the Cape Peninsula University of Technology (CPUT), every researcher must apply for ethical clearance and topic approval before the researcher can commence collecting data. Only upon receiving the necessary documentation from CPUT and other parties involved in the study can the researcher gather data.

After acquiring consent for the study, the researcher scheduled interviews with potential respondents. During each interview, the researcher would take the participant through the consent participation form before interviewing so that the participant is aware of their rights and can make an informed decision whether to participate in the study or not. The participation consent form included details about the research title; criteria for selecting participants; a brief explanation of what the research is about and what it involves; the interview procedure; the participants' rights; a section with questions to check if the participant understood the purpose of the study and their rights, and lastly a section for signing the consent.

Interviewee rights included in the consent form were: voluntary participation, withdrawal at any point for any reason if they so wished, and assurance that there would be no discrimination against them because of participation or non-participation. Additionally, assurance was made that participants' answers/ responses would be treated with confidentiality and used for the research's sole purpose. Lastly, the participants were made aware that their details were not required and that their identities would remain anonymous (Baez, 2002). The researcher minimised plagiarism by referencing all secondary and tertiary data sources and obtaining expert relevant literature sampling from the CPUT librarian.

3.16.1 Ethics in relation to the Covid-19 restrictions

The respondents and all other parties involved in this study observed Covid-19 regulations (i.e. sanitisation, wearing masks, basic hygiene, shoulder coughing and social distancing practices) while collecting data and interacting with participants.

3.17 Quality Assurance

Quality assurance is a universal standard of uniformity and trustworthiness expected in academic research (Yin, 2017). The aim of every academic work is that the research throughput and output display fair levels of data trustworthiness, which is summed up into credibility, transferability, dependability, and confirmability (Saunders et al., 2012). Figure 3.6 shows all the critical components of trustworthiness and quality assurance in academic research.

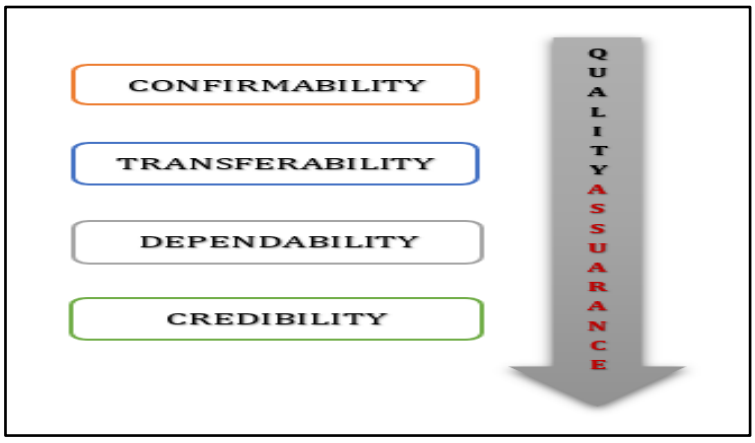

Figure 3.7: Qualitative Data Analysis Sequence

Source: Own adaptation from literature

The researcher is confident that this research is comparable and replicable because the researcher used multiple secondary data sources and interviews as the primary data source to characterise the research methodology (Nhamoinesu, 2021). Using such universal methodological templates makes it easier for research findings to be transferred from one similar situation to another (Creswell, 2014). The researcher also used purposive sampling, which adds to confirmability since the selection of the participants focuses only on persons who are experts or near experts in the subject matter. Joppe (2012) defines credibility as the extent to which results are consistent over time, and credibility can only be ascertained if, and only if, the results can be reproduced under similar settings and methodology. To ensure dependability, the researcher stopped collecting data at saturation point, so there was not too little or excessive data gathered for this study. In addition, a pilot study was carried out to pre-test the interview questions before conducting the final interviews, which ensured the research instrument's adequacy and provided a basis for comparing the study's credibility (Roland, 2012). It is essential, however, to note that matters of trustworthiness in qualitative research are highly fluid and tend to vary from place to place and from time to time because they are subjective and hinge more on the respondent's personal opinions (Adu, 2016).

3.18 Limitations of the research

The study focused on one organisation for the case study, so the results were limited to one organisation and cannot be generalised beyond the context of the case study. The researcher used a qualitative research approach that relies on non-numeric data, therefore lacking what a quantitative approach can offer, that is, measurable statistical data presented in numeric data to conclude facts and reveal different research patterns (Denzin & Lincoln, 2003). It was tedious and cumbersome to translate Shona into English in eight of the transcripts in which the participants chose to either purely answer interview questions in the Shona language or mix the two languages in their responses. In three interviews that were purely conducted in English, Otter software (speech-to-text translator) was used to transcribe, but in some cases, the Otter software failed to pick the accurate pronunciation and misconstrued the different accent for different words, which resulted in a painstaking proof-reading and editing exercise. The locations of the participants were far apart, and with poor navigation systems on Zimbabwe's roads, travelling took longer than expected. Some interview responses were quite comprehensive and made data analysis longer than expected. Due to some

respondents' busy schedules, the researcher failed to meet with three participants twice after attempting to meet with the participants twice. As such, the researcher had to work long hours to complete these tasks, given limited time to conduct data analysis. Working long hours result in fatigue, and a fatigued person is highly likely to miss or make mistakes. With that said, the resulting limitation is that the researcher might have missed or misinterpreted important information that has a bearing on the accuracy of the analysis.

3.19 Chapter Summary

The chapter began by restating the problem statement, the purpose of the study and the research questions. Then, the chapter went on to present the research paradigm and research approach. This included the non-positivist philosophical way of thinking and the selection of a qualitative research approach, aligning suitably with the nature of this research. The research design was also outlined for this study, and the exploratory research design selected hinged on a descriptive and interpretive case study, which was found to be suitable for this study. Additionally, the chapter also includes an articulation of the population, participants, sampling technique, research procedures, data collection and data analysis.

Furthermore, the chapter briefly described the ethical considerations, quality assurance and research limitations. The next chapter will present the findings, outline the collected data~~,~~ present the data and analyse it. MS Excel was the primary data analysis tool to translate collected raw data into analytic content from which codes, themes and meaning could be extrapolated.

CHAPTER 4
DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

The previous chapter addressed the research methodology and the corresponding research processes applied in this research study, providing justifications for the choices made. This chapter will discuss the analysis and interpretation of the empirical data that was collected through semi-structured interviews. An interview guide with a total of thirteen questions was used for the collection of empirical data from a total of eleven respondents purposively selected from The Chilli Pepper Company as the case study. The data was analysed and presented with respect to the research questions posed and guided by the themes of the conceptual framework developed from the review of the literature. The chapter concludes with the presentation of a general framework, which is a revision of the conceptual framework, based on the emergent themes from the empirical data.

4.2 Data coding and analysis

The most common qualitative data analysis techniques include content analysis, grounded analysis, and narrative analysis. Content analysis is a technique used to interpret the subjectivity of text and data through categorisation and coding (Hsieh & Shannon, 2005). The grounded analysis involves analysis grounded upon themes generated from reading and labelling the raw data (Easterby-Smith, Thorpe & Jackson, 2012). On the other hand, narrative analysis refers to various analysis methods, including tertiary and secondary data such as biographies, autobiographies, history, a narrative about life, auto-ethnography, and storytelling (Earthy & Cronin, 2008). Due to the qualitative nature of the study, the interpretive research paradigm and the research objectives, content analysis was used to make meaning from raw data by identifying patterns in the transcribed data.

Moreover, since content analysis requires data to be presented in words and themes, the researcher drew on subjective interpretations, reasons and meaning from the data to understand the phenomenon in more depth (Burnard, 1991; Creswell, 2003; Punch, 2005; Polit & Beck, 2006; Mertens, 2009). The researcher analysed the data manually using the steps presented in Figure 3.5 below. The researcher avoided the use of data analysis software at the risk of the software producing poorer data quality, and the researcher could assume more control of the data analysis. (Bhattacherjee, 2012; Adu,2016).

4.3 Analysis and Interpretation

This research study aims to explore the use of mobile technology to better manage out growers of agribusinesses by collecting data from participants. The problem identified in this research is the lack of know-how and the underutilisation of technology in the Zimbabwe farming ecosystem in spite of an increasingly technological and digital environment. The purpose of this study is to establish the extent to which digitalisation can better transform farming particularly its management, monitoring and operational front. This study sought to answer the following research questions:

a. *What information is required by agribusinesses to manage outgrowers?*
b. *How can mobile technology be deployed to enable agribusiness to manage out growers* remotely?

Anchor codes identified in the empirical findings included outgrower management, information required, mobile technology and deployment. The first two anchor codes have an orientation toward the first research question, while the last two have an orientation toward the second research question. However, on analysis, the researcher took a holistic approach to answering both research questions using empirical findings obtained from raw data. Under outgrower management, the researcher interpretively inferred to the management of outgrower farmers. This was further collapsed into the following codes, namely processes, challenges, systems and methods, data/ information required, reporting process and operations. Mobile technology was collapsed into awareness and exposure, applications, deployment, perception and challenges in implementing mobile technology. These resultant codes and categories brought sufficiency in explaining the identified anchor codes of outgrower management, information required, outgrower reporting processes, mobile technology use and its deployment to manage outgrowers remotely. The following sections outline the results of the analysis, the outcomes, and findings that were used to develop the revised general framework. The findings are discussed in view of the research objectives and research questions pursuant to a credible research throughput and research output.

4.4 What Information is Required by Agribusinesses to Manage Outgrowers?

4.4.1 Outgrower management

Outgrowers is a common agricultural term that refers to farmers who are contracted with a buyer/ agribusiness to supply crops, usually at an agreed-upon price, provided the farmers meet the required quality standards (FAO, 2015). Outgrower scheme farming is a common approach used across the sub-Saharan region, Central and West African countries as a way to empower poor communal and subsistence farmers. It is against this backdrop that the researcher sought to investigate the potential for mobile technology use by agribusinesses to manage outgrowers using the case of the Chilli Pepper Company (CPC), Zimbabwe.

From the conceptual framework developed from the review of literature, it was proposed that for effective outgrower management, there is the need for the involvement of a range of players to gather and disseminate information throughout the season. It requires field agents; extension officers, auditors and technical staff to conduct field visits, audits, check the quality of harvests, and report problems timeously to avoid inefficiencies or delays (Vodafone & Accenture, 2011; Ogbeide & Ele,2015). Additionally, there is the need for effective and efficient management of the following outgrower management processes: management of farmer profiles (USAID,2009; Gent 2010; AgDevCo, 2017); communication (Stringfellow, 1996; USAID, 2009); payments, transaction and funding (Stringfellow,1996; World Bank Group, 2019); monitoring (Asian Development Bank, 2015; USAID, 2018) and traceability (International Trade Centre, 2015; World Bank Group, 2019); reporting (USAID, 2009; Zhang et al., 2016), and lastly training and workshops (USAID ,2009; Ogbeide & Ele, 2015). With the above processes managed well, there is a high chance that the productivity, profitability and sustainability of farmers can be improved (Minot et. al., 2009; Rao, 2011; Barrett, 2012; Negash & Swinnen. 2013; Addison et al.,2020).

The following sections discuss the outgrower management processes as revealed from the empirical data analysed, as well as mobile technology awareness and use within the CPC context. It also addresses the challenges involved in managing outgrowers using current systems and methods.

4.4.1.1 Managing farmer profile data

Over the past few years, we have seen farming become a more time-critical and information-intensive business. (De Silva & Ratnadiwakara, 2008; Brugger, 2011). As

such, the review of the literature revealed that the outgrower management process includes managing farmer profiles. The empirical findings show evidence of farmer profile data as important to manage outgrower farmers. According to the literature, basic data collected about outgrowers helps agribusinesses to create farmer profiles that can be used to get to know their farmers better and can include location, credit provided, agricultural knowledge and experience, and field size of the outgrower crop (USAID,2009; USAID,2018). However, the literature did not show the need for information related to the assessment of the feasibility of potential farmers in irrigation schemes to determine if they meet the minimum requirements stipulated by agribusinesses to become an outgrower. The following empirical data relates to maintaining farmer profile data but extends the farmer profile data to include variables related to the requirements to be an outgrower, including a warehouse, proper road infrastructure, electricity, and water availability throughout the year. These factors, among others, form part of the prerequisite factors that CPC considers when selecting outgrowers. The following represents the respondent feedback about the outgrower farmer profile selection data requirements:

"On managing out growers first of all we look for potential farmers which we believe will help us to boost the production…" (Participant 4)

Another participant added:

" So, the process is, we find a place where out growers are growing, we assess the area for a viability of growing so guys are doing at the moment with various irrigation schemes…" (participant 11)

Additionally, another participant further explained:

"First and foremost, we make a trip to an irrigation scheme to make an assessment, with us we will be having a form which we call an assessment form. This form when we are visiting the irrigation scheme, we will have some questions which we tick yes or no for example if the irrigation scheme has got a warehouse, we tick yes it have a warehouse if not we tick no, another example is about the road to the irrigation because normally if that irrigation is successful we want to grow with it, we have to use 30 tonne truck to go and pick the mash which is the product after grinding the chilies which we then take from the irrigation scheme ,it will be over 22 tonnes per load so we make an assessment to see whether that road is good for 30 tonne trucks, also on the assessment form there are some questions like does this irrigation scheme have

electricity, does it have enough water throughout the year because the thing is our crop we start them in June that's where we issue seed to any irrigation scheme which had successfully passed our test …" (Participant 9).

USAID (2009) indicates that the process of selecting outgrowers is essential to agribusinesses, as it impacts on the success or failure of an outgrowing operation based on the growers selected. That said, companies should develop criteria for selecting its outgrowers based on their needs. While farmer selection profile data is a new finding, farmer basic data is a variable related to managing farmer profiles that was found in the literature. Basic data enables agribusinesses to know where their farmers are located and decide on the number of seeds, tools and/ or financial support their farmers might require based on the farmer's field size (USAID,2009; USAID,2018). For effective management of outgrowers, clear and complete information of farmer basic data is required to be recorded during the farmer onboarding process to create farmer profiles that can be used to get to know farmers better (USAID, 2009; Gent, 2010; AgDevCo, 2017). Within the CPC context, this includes, farmers names, ID number, cell phone number, date of birth , home address, farm address, postal address, family size, location, field size, type of soil, grower number, water source, bank account details, delivery depot, chemicals sprayed, fertiliser applied, source of income and other sources of income, and lastly monitoring and traceability related data. Information related to growers, their farms and business activities can be captured during farmer registration (Addison et al.,2020). Empirical findings revealed that when registering farmers, capturing such basic data is essential for managing farmers and better understanding them and their farming requirements for the allocation of resources. The type of data captured when registering farmers include the following data as described by participant 7:

"*Full name , first name and surname, ID number , phone number , date of birth, family size, home address, farm address, postal address and photo of the farmer registering them"…(Participant 7)*

Participant 2 added:

" Areas they are operating from, hectares they want to grow crop" …(Participant 2)

Participant 6 further added:

" Grower number , size of manpower he needs during the harvesting period and the land size the farmer can grow".

These findings are in agreement with USAID (2009) and USAID (2018) that data like farmer location and field size help in the management process of outgrowers as it enables agribusiness to know where they are located and decide on the number of inputs they require based on farmer profiles that are created when registering farmers. Family size and labour size is said to be important in chilli growing as the chilli growing is labour intensive especially during harvesting phase. This data is also collected during registration phase to help CPC to determine the right hectarage to allocate to a farmer, field size that the farmer will be able to harvest well to realise a profit from the chilli crop. Additionally, banking details of each farmer are essential when managing outgrowers as they are useful during harvesting period when farmers start delivering their produce and get paid through bank transfer by CPC. However, the researcher noted that there was contradictory views on whether farmer selection or farmer registration occurs first. The divergent views were between management and supervisors. Management identified the first process of outgrower management as outgrower selection, where an outgrower manager goes out to search for a potential irrigation scheme and assesses it before registering an outgrower. Conversely, field supervisors defined the first step as the registration of farmers. However, what is required is the management of both types of data. The management of outgrower farmers requires a network of different players to gather a wide range of farmer data (Vodafone & Accenture, 2011). Therefore, the management of farmer profile data can include farmer selection profiles and farmer profiles for registration after the selection process has been concluded. This could also serve to enable records to be kept on file for prior assessments conducted on farmers during the selection process.

4.4.1.2 Monitoring and Traceability

The literature showed that farmer management also includes monitoring and traceability. Monitoring entails periodically checking the performance of each farmer from when they receive seed to when they harvest and deliver the final product to the buyer. This is done to provide a basis for allocating resources or offer agronomy support where it is needed most by tracking farmer performance. On the other hand, traceability is a process that ensures that accurate crop/product information is recorded and disseminated through the food supply chain for food safety and quality reasons. In addition, seed varieties, chemicals and fertilisers applied can be traced back to the farmer through traceability (Henson & Reardon, 2005; Maertens & Swinnen, 2009; The World Bank Group, 2019).

Empirical data revealed that every activity related to growing chillies is captured/ recorded throughout the season. Data recorded include seed issuing and seedbed management data, chemicals spray data and a record of farmer produce (deliveries), among others. This data is collected to monitor if farmers are adhering to good agricultural practices and as a way of allocating resources where they are required, for example agronomy support and inputs. This is evidenced from the following data that emanated from the study:

"We also record every activity done at every stage throughout the season and on harvesting we record the produce of every farmer and during management of crop we also make sure that farmers use the prescribed and authorised chemicals on the crops…" (Participant 2)

A manager indicated that:

" Then we look at giving him/her (farmer) the seed depending on the size of field he/she is going to use in the growing and then after that we monitor farmers making their own seedbeds … We do visits like going to check their seedbeds, going to look into their crops to see if there are any diseases or pests, also encourage them to weed their crop. Application of fertilisers that we normally do until they will come up to harvest point…" (Participant 1)

Another participant added that;

We also give them advice on soil testing, they send their soils for testing usually after each and every three years. Sometimes we use general recommendations on fertilisers but sometimes when a farmer has the soil test results will definitely know the fertiliser to advise the farmer to use" (participant 5)

Furthermore, scheduled periodic visits are conducted to check if farmers are progressing well, either during the seedbed phase or transplanting phase. Field supervisors visit farmers to check if they are applying their knowledge as per the guidelines given during training or workshops. This is evidenced in the following comments:

"We do visits like going to check their seedbeds, going to look into their crops to see if they are any diseases or pests also encourage them to weed their crop. application of fertilisers that we normally do until they will come up to harvest point…" (Participant 1)

A senior manager also commented as follows:

"And then we go back regularly to meet with them(farmers). And then as their crop grow, we try to give them feedback, …(Participant 11).

Another participant also added:

"When transplanting, we monitor the farmer to see how his spacing is, the spacing should be 60 cm from plant to plant in a row. It should be 1.5cm between rows. We check if the farmer has planted correctly. After planting, we have to follow the farmer to see if he knows what he wants because in 4 weeks we apply compound D, and when we start spraying all the copper and Dithen leaf chemicals …" (Participant 7)

The empirical findings related to monitoring agree with that of Gent (2010), Asian Development Bank (2015) and USAID (2018), that monitoring data includes contracted area data, distribution of inputs, nursery management, land preparation data, transplanting, timely weeding and adherence to good agriculture practices, implementation of pest and disease control practices, timely harvesting, harvesting techniques, and post-harvest production data. Additionally, the findings also relate to the literature on product traceability, including the regulation of food standards to ensure food quality and safety, as well as ethical and environmental considerations (Jaffee & Henson, 2005; Henson & Reardon, 2005; Maertens & Swinnen, 2009).

4.4.1.3 Communication

Communication is necessary for agribusinesses to maintain close contact with their farmers to establish trust and share technical information (product specifications and quality parameters) to ensure every farmer understands crop production targets, procurement arrangements, prices, and quality parameters (Stringfellow, 1996; Stringfellow, 1996; USAID, 2009; Gent, 2010; Cadavid et. al., 2018). Communication in the context of this study was found to be essential in almost every aspect of farming. Communication emanated as a variable in the form of reporting, meetings, one-on-one consultation and phone calls. Examples of communication emanated from the following responses:

"In each step all the information is disseminated and arranged from the HQ and it is passed on down to FEOs (Field extension officers) and then the FEOs on the ground passes the information to the farmer and most of the information is manually transmitted, though with phones and the like a few calls may be done, but most of the

data is captured through manual entry by using computers, using Excel paperwork and posting that down to outgrows through the FEOs…" (Participant 8)

Additionally, communication emanated as follows:

"Some of the farmers are negligent with their crops so I must follow them and give them advice, even on chemical application, some they spray the chemicals before notifying you some of the farmers find it difficult to identify some diseases so there is need to assist them. …" (Participant 3)

Another respondent added:

"When doing meetings with farmers they are so called minutes so we compile all those minutes from the beginning of the season to the end, so thus will be the feedback which we would be going back to farmers and which we have compiled through the season so that report will be used to give feedback to farmers so in short, we compile a report"…(Participant 4)

Based on the responses from participants 8, 3, and 4, it is clear that communication is used for the dissemination of information from the top management to outgrowers on the ground through field extension officers. Moreover, field supervisors give advice to outgrowers to help them to identify diseases. Also, communication comes in handy when supervisors follow up to check if farmers have implemented what was previously advised, for example the application of pesticides. These findings agree with that Nyamba and Mlozi (2012) and Tadesse and Bahiigwa (2015), that communication is used to offer agronomy support to farmers, and that Stringfellow (1996) and USAID (2009), which is that communication also ensures that quality parameters are met. While communication according to the literature, focuses primarily on product specification, quality parameters, agronomy support, and procurement arrangements and prices, the empirical evidence shows that communication is mainly maintained through meetings to give feedback to farmers at the end of the season. The findings, however, confirm that agribusinesses must ensure that there is effective two-way communication with its outgrowers (USAID, 2009; Zhang, Wang, and Duan, 2016).

4.4.1.4 Training & Workshops

Training is a program that helps individuals enhance their performance by closing skill gaps and managing change (Goldstein & Ford, 2002). Training/ workshops are

programs put in place to enhance performance and skill so that individuals can make better, informed decisions (ibid.). The following excerpts speak to this variable:

"After meeting potential farmers, we train them on what is expected from them to produce… we teach them how to do land preparation... after that we also give them some trainings on pesticides , fertiliser application and weeds management … and we also teach them the right chemicals to use at the right time to avoid having chemical residues above limit in final produce .Towards the reaping / harvesting stage we visit them to teach them the right pods to pick and the standards that are expected since we do not expect the foreign materials to be part of the produce so that they meet the quality that is being expected…" (participant 4)

Similarly, a senior manager asserted the following:

"There's quite a bit of training that we do, we go through a whole process at the beginning of the year to explain the use of chemicals, explain the use of how to manage seed beds, and hopefully give farmers a real 123 in farming and, or chilli farming…" (Participant 11)

Additionally, another participant commented that:

"Before picking /harvesting we first do commissioning where we do a meeting with our farmers showing them samples of chillies that we expect them to pick , so that they get familiar with the right chillies to pick especially new farmers. We advise our farmers not to spray chemicals with long preharvest intervals during harvesting period as this might result in chemical residues above acceptable levels being picked in chilli…" (Participant 3)

The data shows that CPC conducts training throughout the season and performs follow-up one-on-one field training to assess farmer performance. It appears that training is conducted to enhance outgrower productivity and the quality of produce. Training is provided on land preparation, pesticides, fertiliser application, weed management, chemical use, harvesting, and seed management. Training within the CPC context aligns to that reported in the literature, including sending field extension officers/agents to visit farmers to give agronomy support or training on how, what, when to apply chemicals and fertilisers and crop management harvesting techniques (Ogbeide & Ele, 2015). Additionally, in the CPC context, training is not performed as a once-off event but appears to be an ongoing process conducted throughout the farming season, enabling the farmers to be orientated on the end-to-end process. Similarly, USAID

(2009) and world bank Group (2019) report that outgrower farmers require agronomy/ technical support from agribusinesses to manage their crops throughout the season. Additionally, while the literature mentions that technical and agronomy support can be administered through conducting group training sessions, demonstrations and field-based advice visits, CPC engages primarily in one-on-one training. Therefore, CPC focuses on training that is critical to assist and guide farmers in producing crops that meet the company's specifications and possibly result in increased yields and good crop quality (World bank Group, 2019).

4.4.1.5 Payments, Transactions and Funding

It was determined from the review of the literature that timeous payments is very crucial when working with outgrower farmers because it encourages trust and builds good relationships between agribusinesses and farmers (Stringfellow,1996; World Bank Group, 2019). Additionally, agribusinesses must budget, project, and allocate enough funds for when the harvesting and procurement phases start (Singh,2002; Arouna, Adegbola, Babatunde, Diagne & Patrice, 2015). Therefore, payments, transacting and funding is crucial to maintain the management of outgrower farming activities. The data showed that the management of outgrower farmers also entails transacting with farmers, which is evident from the following excerpts:

“We are very honest with our farmers, when we tell them that we will pay in a certain date, we meet our promise…” (Participant 9)

A senior manager similarly commented that:

“CPC has been always saying by all means to make sure that even the farmers getting the local currency their money is paid promptly at the end of the month as per agreement of the contract. There is no delay. So, CPC has been always proactive in making sure that by middle of the month, the farmers money is in the CPC account, at the end of the month, upon receiving the receipts, everything is compiled, and it's all done so that they get their money from quickly…”(Participant 8)

Additionally, the executive director asserted that:

“And then importantly, we always pay people, no matter what happens, we always will make that effort to, we've never not paid anybody who has delivered product to us. So, I think that gets around…” (Participant 11)

This data affirms the findings in the literature, that delays in payments make outgrowers feel uncertain and outgrowers prefer to receive payment for their crop immediately when they deliver to a buyer (USAID, 2009). Moreover, empirical data also revealed that farmers get input loans in the form of physical inputs handed over to farmers, which the company offer on credit to farmers for repayment later once they start harvesting. CPC gives pesticide chemicals, fertilisers and pays for farmer irrigation water and electricity bills. Further evidence of transacting between outgrowers and agribusinesses emanates from the following excerpts:

“They(farmers) don’t have money to buy the chemical we then buy the chemical for them and depending on the amount or quantity of chemical they take we then deduct some kgs of chilies to go hand in hand with the amount of the chemical for example let say we have given them a chemical which costs $X and we give them $Y per kg when they bring their chilies we divide $X by $Y and we find number of kgs which this $X is worth ,after that when they bring their produce we take off the number of kgs that are worth the loan we don’t take cash from them…” (participant 9)

Another participant commented that:

“And also try to give them some access to a bit of cash that they can use for picking (harvesting). And they bring their chili in, and we grind it, and we pay them you know, that's been the thing…”(Participant 11)

Varangis, et al. (2014) and World Bank Group (2019) also reported that agribusinesses transact with outgrower farmers by providing inputs to farmers, assisting farmers with accessing funding, and helping smallholder farmers improve their access to finance. Whilst loaning inputs to farmers is done to help them improve their productivity, findings revealed that it is also used as a control measure to control what farmers spray on chilli crops to minimise the chance of farmers spraying banned chemicals on the crop that may lead to farmer produce being rejected on the market, and thus leading to a loss by farmer and company too. The following assertions demonstrate this:

“When I mentioned about loaning inputs the company has had to purchase the allowed chemicals or non-pest and diseases and loan that to the farmers just to have control of what is being used and avoid proliferation of non-allowed chemicals…

"*There are loaned chemicals and in agreed areas fertilisers for them to have good production without having to look for the money from other crops or other activities. And the good thing with their loaned products they don't pay back as cash they offset their product as they harvest, they offset their products to pay back the equivalent of the value of the inputs…." (Participant 8)*

This evidence shows that transacting with farmers is a good way to maintain profitability and ensuring sustainable outputs from farmers. For example, the literature review showed that transacting was a means for managing farmer output by providing access to proper inputs, such as safe, clean water (IRIS Center,2010; Jack & Suri, 2011; Grundfos Pumps Limited, 2011; World Bank Group, 2019). This ensured that farmers could improve yield and overall productivity (IRIS Center,2010).

4.4.1.6 Reporting

Reporting data relates to grower data that is collected throughout the growing season, and can be processed, analysed and reported. Reporting can include information about crop deliveries, disease outbreaks, challenges faced, and payments history. The existence of reporting requirements and mechanisms within the CPC context to manage outgrowers is evidenced by the following excerpts:

"At the end of the season, we have a meeting with managers from HQ where we discuss challenges that were faced throughout the season, for example what caused our yield for the season to be low, was it because of too much rainfall we received? or diseases outbreak? …" (Participant 6)

Another participant indicated that:

"Also, we submit notebooks and receipt books that we use for recording chilli sales. In these books when buying chillies from farmers, we record the quantity delivered by each farmer in a summary book (notebook) in case farmer loses a receipt will have a record of the delivery…"(Participant 7)

A senior manager commentated that:

"So, the FEOs report every week during the picking season, to the outgrower manager at HQ their weekly harvest and the outgrower manager updates the CPC stakeholders on a weekly basis. So, the reporting is progressive. Every week is closed with each site, what they've harvested coming from the FEOs, at the end of the season, during the

season or during the picking period they are some exports which are done and those exports there are deducted from the master summary of the yield or the entire region. And at the end of the season, there is comparison to check what was reported during the season, what is reported and what is the balance in stock…."(Participant 8)

The empirical data revealed that reporting depends on position held within the company, for example the manager reports to superiors (executives) or other managers through conducting meetings and through digital written reports using Microsoft Word and Excel spreadsheets, while field supervisors mostly make use of handwritten, verbal, and sometimes pictorial reporting, as well as meetings. Reporting that relates to grower quantity of produce delivered is reported to managers by warehouse supervisors through use of notebooks and receipt books. Additionally, managers advised that reporting to stakeholders doesn't happen at the end of the season only, but as the season progresses output/ yield is reported from each growing region to HQ and that information is used for export purposes. The region with too much stock is prioritised in terms of exporting. Moreover, progress reporting helps in identifying growing sites that are facing challenges so that support can be sent immediately. For example, a growing site can be faced with diseases outbreak and progress reporting helps HQ managers to send support so that the outbreak can be dealt with immediately. The following respondent (manager) said:

"So, the FEOs reports every week during the picking season, to the outgrower manager at HQ their weekly harvest and the outgrower manager updates the CPC stakeholders on a weekly basis. So, the reporting is progressive. Every week is closed with each site, what they've harvested coming from the FEOs…"(participant 9)

These findings align to that of USAID (2009) and Zhang et al. (2016), who stated that reporting data should include information about crop deliveries, disease outbreaks, challenges faced, and payments history. The following assertations reveal how reporting is conducted within CPC:

''Yes at the end of the season we write a report after that we do a round table meeting to discuss where we went wrong and the challenges we faced that time, for example this last season, most of our good farmers in Nyakomba, their crop was affected by water logging in their fields so this time when we give our farmers the seed on our training we try to tell them that they must avoid water logging because it is one of the main reasons why the crop failed, so this are some of the things we discuss we try to rectify those failures on our next season …" (participant 9)

An Executive director added:

“Yeah, it's one of the things that we do have a report that we have to provide, or we do provide to our buyer. But then, we often then go back and look at the amount of kgs of salt and kgs of chili that we have purchased and do an analysis of that after the fact. But and then we try to go around and look at how much each grower’s growing site produced and what were there, you know, strengths and weaknesses. And why was it a problem…, (participant 11)

A supervisor asserted that:

“At the end of the season we write a report, reporting what went on during the whole season. We also report challenges that were encountered during harvesting period. Mostly we face challenges like a diseases outbreak, too much rainfall causing chili plants to dry. Also, at the end of the season we write about reasons for having low yield. For, example the past season we recorded low yield…” (Participant 7)

An Executive director revealed that, as much as there is reporting that happens at the end of the season, comprehensive full analysis reporting takes place in December when a report is compiled and sent to buyer/s and stakeholders to give them insight on the previous growing season . The report is sent so late to stakeholders because when one season ends, another one immediately starts and seeds start getting issued to farmers in preparation for the next season. Due to this situation, reporting is mostly to tick the boxes as opposed to real analysis. With that said, the senior management acknowledged that this needs to change so that analysis is done in time. The following assertion speaks to this reporting process:

“With data and statistics and making sure that we are looking for trends in our farmers …” (participant 11).

He also added that:

“…but one of the major issues is that it is often we write the report for December from the previous season. And as soon as one season ends, the next season begins. So suddenly, as soon as the picking is finished, we're giving seed out and preparing for the coming year. So, there isn't a lot of time. And we haven't we don't do this very well or reporting of outcomes is really more of a jumping through the hoops or ticking the box exercise as opposed to real analysis. And I think that's been one of the things that we all agree is that we've been doing it now for so many years that actually analysing it,

you know, with data and statistics and making sure that we are looking for trends in our farmers. That's something that we really need to do…"(Participant 11)

The divergent findings on reporting shows alignment to the assertions made in the review of the literature, that reporting formats used by farmers and/ or field officers should be developed in a way that captures data in a consistent manner to enable easy processing and reporting (Gent, 2010), and that it is also important to identify the users of such data or information within the organisation (USAID, 2009; Zhang et al., 2016). Additionally, the literature has emphasised that agribusiness should develop information and reporting systems (dashboards) that help to manage outgrower farmers, which is evidenced by the CPC current reporting systems that are inefficient, therefore leading to outdated reporting (ibid.).

4.4.2 Challenges of managing outgrowers

4.4.2.1 Paper-based systems

Paper-based systems present a major challenge in managing outgrowers. It was mentioned that farming is now an information-intensive business (De Silva & Ratnadiwakara, 2008; Brugger, 2011). Moreover, managing outgrower farmers require information management related to farmer profiles, monitoring and traceability, transacting, and reporting. These activities generate a plethora of information, much of which are collected using paper-based systems. The following assertion affirms that mainly paper-based systems are used to manage farmer data:

"Most of the data is physically collected and managed… some of the challenges that we face is this delay of receiving information and disseminating information. Unless someone travels there is likely this discrepancy in recording manually and it takes them some time to recognise and rectify these discrepancies…"(participant 8)

"Paperwork is produced, or spreadsheets are produced at HQ by the Outgrower Operations Manager and that is sent out to the FEOs (field extension officer) who will capture the data manually and then record on the spreadsheets and those spreadsheets, either for seed, which is required loaned inputs all that is recorded manually on a spreadsheet, and that spreadsheet is then sent back to the HQ for computer input…. "(Participant 8)

Another respondent mentioned:

“What we've done is we have a paper-based system where visits are made to farmers and notes are taken on paper, that paper, those notes are then collated by whoever has done, done the project or done the visit in a report, so most of the team will do a field visit and then send a report about their field visit…. “ (Participant 11)

Additionally, a respondent said:

“The other way is our FEOs and the grinding team have got some exercise books which they write their daily activities and again apart from keeping records of farmers we have got a time book for our grinding team and by time book I mean a register which is being ticked every day when he reports to work and when he doesn’t report an x is being put against that date so these are some of the records that we have with our farmers…” (Participant 9)

Additionally, the findings also revealed that farmers also primarily use paper-based systems to keep a record of activities they conduct at their fields, including weeding, chemical and fertiliser application records. When the field supervisor visits farmers, they will transfer the records from farmer notebooks to their notebooks. Notebooks and forms are issued from headquarters to field supervisors who are on the ground and deal with farmers more often. Field and warehouse supervisors record activities from when they issue seeds to outgrowers to the point when outgrowers start to deliver their produce. Supervisors then report back to outgrower managers using the information recorded in the notebook for computer input. Thus, recapturing the data several times presents an opportunity for errors to be produced. This is evidenced by the following respondents’ feedback:

“He(farmer) record in his book as well…. “ (participant 1)

“…as I've mentioned, all farmers this coming season going forward, they are going to be receiving a pen and a book that they can record with the supervision of the FEOs what they are doing so, that is going to be also used as a managing system where all farmers will be required at the time of delivering their chilies, they will be required to produce their small books to just ascertain that all the activities which they were doing they're in compliance with adherence to the state regulations…. “(participant 8)

Additionally, a senior manager pointed:

”It is only this season where we agreed with CPC management to buy small exercise books for all of our farmers and a ballpoint, with these notebooks, we will be explaining

to the farmers that we want them to write everything which they do to the chilli field, when did he put down his seed,when did it germinate, what chemical did he use while the seedling was on the seedbed,what date did he transplant to the field, how long does it take for seed to germinate and also we want the farmer to write down, if he experience any disease he has got to write the type of disease and how he managed the disease and the time to start picking and he must record also rather than just being given a receipt he must record the number of kgs he delivered to the depot… " (participant 9)

Respondents also pointed out that paper-based processes are time-consuming, and these systems mean that farms must be visited physically to capture data, unlike with mobile technology use, where farmers can be monitored remotely.

"Some of paper-based systems are very tiresome. Some paperwork is time-consuming (time management)…" (participant 2)

The empirical evidence has shown that CPC mostly depends on paper-based systems to manage outgrowers and reporting that relates to grower quantity of produce delivered is reported to managers by warehouse supervisors through use of notebooks and receipt books. Moreover, management plans to grow the use of paper-based systems, rather than take advantage of mobile technology platforms. It was already noted that reporting processes are inefficient, and reports are received when the next growing season has already commenced, therefore farmers cannot benefit from the prior growing season reports. Findings by World bank (2017) show that manual paper-based systems are inefficient when managing farmers, thus amalgamating mobile technologies with complementary advanced technology could help to achieve better means of capturing farming monitoring and traceability data. Farmers' performance can then be enhanced through timely, directed support where needed most to minimise the chances of failure by a farmer. (Addison, Figuères, Owesiga, Muwonge, Nsimidala, Sezibera, Boyera, Besemer, Pesce, Birba and Muyiramye, 2020) and digital farmer profiles can increase efficiency in managing farmer related activities in real-time through providing targeted information to growers who require support, therefore, improving the quality of farmer agricultural production to maximise farm revenues and profits.

4.4.2.2 Communication problems

Communication problems manifested in several ways. The first being that some farmers don't show up to meetings, which results in farmers missing out on important information shared. Additionally, some farmers cannot read or write making it difficult for them to keep a record of chemicals they sprayed and dates the chemical were sprayed; or some

growers neglect their crops and do not follow instructions which result in them using the wrong chemicals or fertiliser on crops, and not adhering to timeframes resulting in them planting out late. It is important that farmers stick to timeframes, as delays can cause low productivity due to change of season and climate change.

The aforementioned problems emanated from the following respondents:

"When we call for a meeting, some farmers don't show up, some farmers can't read or write and also (some farmers fail to transplant on time resulting to a late crop…. Some farmers they don't follow instructions, for instance, let's say we instruct a farmer to spray a specific chemical, some farmers fail to follow that simple instruction and you find them spraying a chemical meant for cotton to a chilli crop. Additionally, you can ask a farmer to apply a certain amount of fertiliser, but a farmer can just decide to apply little fertiliser. …"(participant 6)

Another participant indicated that;

"Some of the farmers can't read or write , so when a field supervisor sends a message it won't help since the farmer can't read or write …. "(participant 6)

Another respondent mentioned:

"Some of the farmers do not comply with what you tell them to do, they tend to say they know it all but at the end of the season they fail because of listening to a simple instruction. Farmers usually use unauthorised chemicals. Farmers also do not comply to time frames set let's say you give them dates for seed sowing, some they do it before some even do it after the dates set and it becomes a late crop and since chili is a monitored crop, it needs time and structure of the seedbed that is done to control pests…. Some of the farmers are very negligent when managing their crop, they just leave it no weeding, no fertiliser application but at the end of the season the productivity level will be very low…" (participant 2)

Additionally, some farmers don't show up to their field when asked for a meeting or during scheduled field visits, resulting in a waste of time and cost for field supervisors and or Agritex officers who commute with motorbikes:

Sometimes you make arrangements with a farmer let's say can we meet in your field at such time and then you go there and he or she won't come …Sometimes moving from one field to another field takes long for instance to access 50 farmers you need probably the whole month and also it is costly in terms of timing let say you are using a motorbike;

you need fuel to take you there so that you can be able to reach each and every farmer's field and also information …. "(participant 1)

Moreover, CPC employs an approach during the seedbed phase where they encourage farmers to do seedling in groups for easy management and monitoring, some farmers resist as they don't find joy in working in groups. As stated:

"During the first few phases (seedbed phase) when we ask farmers to work in groups, some farmers resist to be in groups."(participant 3)

These communication problems have been addressed in the literature where Anderson and Feder (2007) found that traditional ways of delivering information in the agricultural space is inefficient and problematic, with no real-time monitoring of agricultural extension workers who are responsible for delivering farmer information (BenYishay and Mobarak (2013). Therefore, mobile technology can aid in the effort to increase productivity of farmers through the delivery of personalised/customised agricultural information to farmers at an affordable price and in a manner that is customised to their context and matches with relevant farmer current phase of the growing season. Mobile technology use by farmers can enable them to share information and knowledge among peers rapidly and efficiently, compared to face-to-face meetings or farm visits. Farmers can obtain information related to suppliers, markets, market prices for products, weather data and agronomy support to make informed decisions (Nyamba & Mlozi, 2012; Bhandari & Heeks, 2012; Carmody, 2013; Chhachhar & Hassan, 2013).

4.4.2.3 Manual transacting systems

The current manual transacting systems mean that warehouse staff record produce delivered by outgrowers in notebooks and triple cat cash receipt books. The first copy is given to the farmer, another is kept at the depot, and the third one is sent to headquarters for computer input and digital payment processing. Supervisors also report back to outgrower managers with paper-based information from or notebooks for computer input. The following responses show this practice:

"On records keeping as I told you that our grinding team has got a receipt book which is in triple cat this is one way of keeping the product records from farmers…." (Participant 9)

Another respondent added that,

“Like what I said, we have got our guys at the warehouse, they do take some recordings for what have been delivered and give you a slip. The other slip will remain at the warehouse, the other will go to the HQ for the payment to be processed then that payment goes into the farmer’s account…” (Participant 1)

Not only does paper-based transacting introduce the risk of errors, but also increases the opportunity for defaulting by outgrower farmers. From the inputs given by CPC to farmers on credit, the challenge is that some farmers can default and fail to pay back the credit, which results in the company losing money. As a respondent pointed out:

“Another challenge is some farmers end up failing to repay loans they take in the form of inputs. This year we have more than 12 farmers who defaulted because their crops were affected by too much rainfall that was received causing their chilli crop to dry…"(participant 7

Increasingly, mobile payment systems have replaced inefficient, unsecure and costly conventional ways of sending or receiving money (CTA, 2019). Several countries adopted digital mobile technology to provide access to market information via mobile phone, mobile payments, mobile banking and others. Mobile banking technology means smallholder farmers now have a higher chance of financial inclusion (access to credit) and improved access to inputs and output markets (Yao & Shanoyan ,2018). Access to funding, digitisation of transactions and payments, as well as farmer data analytics, can help smallholder farmers improve their access to finance from financial institutions and agribusinesses (Varangis, Kioko & Spahr, 2014; World Bank Group, 2019). Mobile technology therefore presents an opportunity for improved record-keeping and formalised systems for inputs credit and loans.

4.4.3 Mobile technology for managing outgrower farmers

CPC as an agribusiness entity is adequately aware and exposed to the potential use of mobile technology for its farming operations. All respondents were aware of the potential for mobile technology use within the outgrower management context, and some confirmed that they had been exposed to mobile technology use and mobile application use in the agricultural sector. To analyse mobile technology squarely, the awareness and current use of mobile technology and challenges of using mobile technology were explored, as extrapolated from the raw data.

More than 50% of the participants agreed that mobile technology can be deployed for all outgrower management processes. Most respondents showed positive belief in

deploying mobile technology, as they justified their positive responses saying mobile technology is not time consuming as compared to traditional systems; challenges raised by farmers can quickly be addressed and information can easily be conveyed/ disseminated to farmers without delays; it reduces costs associated with buying receipt books; it reduces the amount of work that comes with using paper-based systems; and information can be stored more securely. These sentiments are conveyed via the following responses:

"I think it is the logical way to collect information, it's a far more efficient way than sending notes back and forth. And if we can have it as a two-way communication, that any issue that the out grower might have we they can send a free message to somebody in our organisation and get a real time answer. I think that's huge. So yeah, I do think it's possible to deploy with all farmers and it's just changing different aspects of an app. You know, you obviously have to have the language Correct. You have to have the sort of questions correct. And there's one that is farmer facing, there's one that is Agritex is Officer facing, and there's one that's management facing, and also warehouse manager facing. So, each, each app has different parts, the one that the Agritex officer sees is different than the one that the farmer sees…"(Participant 11)

Another asserted the following:

"YES, because it is not time consuming, important information is easily and quickly spread to farmers, challenges are quickly addressed, it motivates farmers…"(Participant3)

Another added that:

"Information can be disseminated quickly without any delays, it reduces costs associated with buying receipt books, it also reduce the amount of work that come with dealing with paper-based system; Information can be stored more secure…"(Participant 6)

Some respondents focused on how their work can be facilitated more easily with mobile technology, focusing mainly on using technology for communication and information dissemination, while touching on the digitalisation data. While there are a number of information dissemination models available, the selected technology must enable agribusinesses to engage and interact with its growers using technology services that are relatively cost effective, can capture and push data in real-time (Zhang et al., 2016; Musungwini, 2016). Additionally, a suitable model must align to the education level and

skills match requirements for that technology (ibid.). Some respondents focused on the overall transformation of the way of work, as follows:

"Yes, to me I think it's a positive thing because globally we are going to a digitised world, so if you are to stay on paper work it means you are lagging behind, so I do encourage the digitised world but somewhere somehow…"(participant 4)
Another respondent commented as follows:

"Yes , of course mobile technology is good to be used by a farmer, but there is need of a person who should periodically visit to check successful implementation of mobile technology because some farmers might choose to ignore, so there is need for regular check …"(Participant 10)

Another indicated :

"Yes and no. 90%. Yes. 10% No…the 90% yes , we are moving with technology and for all learned and most average people they have access to hardware, or they will try to get some hardware since the world is moving forward & not stationary. So, my answer is Yes 90% we can…"(Participant 8)

The sentiments of these respondents are echoed by Musungwini (2018), who stated that modern trends challenging many agribusinesses includes digital transformation, which has seen an increase in the uptake of technology as a substitution of manual procedures with digital procedures. The following sections outline the current use of mobile technology within the CPC context.

4.7.3.1 Mobile Phone

As mentioned in the reviewed literature, mobile phones are valuable tools for communication for both farmers and agribusinesses. They facilitate the dissemination of information, monitoring of farmer activities, and seeking agronomy advice through voice calls and text messages (Nyamba and Mlozi, 2012; Tadesse and Bahiigwa, 2015). Additionally, literature has shown that adoption of mobile phones by farmers is driven by the fact that mobile phones are way better communication means as compared to other traditional means of communication, as they are easy to use, relatively inexpensive and tend to raise social status of individuals (Aminuzzaman et al., 2003; Anderson and Feder, 2007; Aker and Mbiti, 2010). The respondents revealed that mobile phones are better tools for communication as a way of monitoring or following up on previously assigned task to farmers. Thus, they use them for farm-related

activities for conveying a message or giving instructions to farmers through voice calls or text message. The following excerpts illustrate these findings:

“Whilst most of the information is captured manually there is some methods also where they will use cell phones to communicate with the FEOs….”(Participant 8)

Another respondent commented as follows:

“YES ,we use cell phones as the means of communication, communicating with my farmers and the manager on emergency cases… “ (Participant 3)

Another respondent mentioned:

“In some other cases we don’t visit the farmers always but we can make some calls to the farmers to save time asking them on what you have asked them to do …” (Participant 1)

Additionally another respondent added that ;

“We use phone calls to convey our messages to farmers…”(Participant 2)

This data affirms the findings in the literature that mobile phone functionalities, such as voice calls and text messages, are useful for disseminating information, monitoring farmer activities, and seeking agronomy advice due to their efficiency compared to traditional methods. This efficiency saves time and makes them particularly handy in emergencies (Nyamba and Mlozi, 2012; Tadesse and Bahiigwa, 2015). However, the empirical data did not address the ease of use, costs associated with mobile phone communication relative to traditional methods, and the potential increase in social status due to mobile phone ownership.

Mobile phone use for communication through voice calls and short messages plays a significant role in improving communication and ensuring information reaches where it is needed most in the outgrower-agribusiness ecosystem. In the CPC context, it is advisable to prioritize the use of voice calls or messages over traditional methods for improved and efficient communication. This can contribute to better-informed decision-making and, overall, improve farmer productivity.

4.4.3.1 Social Media

Social media relates to communication platforms that enables users around the globe to easily connect effortlessly and share content like text, images, videos and audio and

also engage in interactive discussions (Rahman, Abdullah, Selvadurai, Zakaria, Lyndon, Abidin,2021). Smartphones have become a game changer in improving communication through social media in most business sectors including the farming industry, as they have become the farmers' extended channel for communication, dissemination of information regarding crops and also gathering information regarding crop production (Qiang, Kuek, Dymond, Esselaar, 2011) . Literature has shown that the use of social media has benefited quite a number of smallholders to access information like market prices and also marketing their products there by reducing dependence on middle man services (Kamal, 2014; Nain, Singh, Mishra, 2019). The existence of social media use within the context of CPC as a farmer management solution is evidenced by the following excerpts;

"We also use group WhatsApp to convey message to farmers…" (Participant 2)

Participant 2, also added that;

"We also have a WhatsApp group chat platform whereby we tell farmers of any announcements, let's say today we harvest or transplant, we convey those messages through WhatsApp….(Participant 2)

Another respondent mentioned that;

Whilst most of the information is captured manually there is some methods also where they will use these social media platforms to communicate with the FEOs…."(Participant 8)

The respondents revealed that social media platforms, specifically WhatsApp is made use of for communication purposes , for example when making announcement and or following up on previously assigned task to farmers. The findings of the current study are consistent with those of Qiang et al. 2011 and Rahman and Abdullah et al. 2021 that social media plays a key role in communication in the farming sector as it can be used as a channel for disseminating information and/or conveying a message i.e. in the form of announcement to farmers.

4.4.3.2 Mobile banking App

Prior studies have provided insights into the importance of mobile banking for farmers, highlighting its potential for financial inclusion. This technology allows previously disadvantaged small-scale farmers to conduct digital transactions and access credit for securing farming inputs and accessing output markets (Yao & Shanoyan, 2018). Furthermore, mobile payment systems have been shown to address inefficiencies ,unsecured and high costs associated with conventional banking methods (Tsan, Totapally, Hailu, & Addom, 2019). Within the CPC context, participants indicated awareness of mobile banking technology, where it is used to facilitate payments to farmers via bulk payment systems linked to their mobile phone money transfer accounts (e.g., Ecocash). The following participants assert that:

"We also do mobile banking that links bank accounts and EcoCash…"(Participant 2)

Another participant mentioned that;

"When their money have been transferred to their bank accounts they can easily access their monies using their phones ..."(Participant 1)

Another respondent gave a detailed explanation of the bulk payments;

"At the end of the month all the receipts for that whole month are put together and sent to the HQ another one that had been sent to HQ the administrator in our area compiles a payment register for all farmers. Once that is done farmers are then paid their money

through the bank using bulk payment which allows the administrator to pay multiple people using one platform …" (Participant 8)

Another participant added that.

"We encourage farmers to apply for CABS bank cards so that their payments can be made into their accounts …" (Participant 6)

These results agree with the findings of the literature reviewed as it supports the financial inclusion of farmers so as to address inefficiencies, unsecured and costly conventional ways of banking (Yao & Shanoyan, 2018; Tsan, Totapally, Hailu, Addom, 2019; CTA ,2019). Participant 1 and 2 did indicate that while farmers payments are made into their bank accounts, farmers are encouraged to link their bank accounts with their cell phone banking i.e. EcoCash (a mobile phone-based money transfer), for easy transacting and access to their funds . Similarly, this affirms to previous study revealed in the literature revealed that, Vodafone's M-Pesa mobile money transfer services enable farmers in the remote areas of Kenya (Katitika community) to access safe, clean water through an innovative partnership between water pump manufacturer Grundfos and Vodafone affiliate Safaricom (Grundfos Pumps Limited, 2011; Townsend et al., 2019). While digital bulk payments is a new finding that was discovered from the empirical data, it links to the mobile banking as it makes the payment process for CPC much easier as multiple payments can be made at one go, which as a result saves time and less costly as compared to traditional payments.

These findings align with the reviewed literature, which supports the financial inclusion of farmers and aims to address the inefficiencies, insecurity, and high costs associated with conventional banking methods (Yao & Shanoyan, 2018; Tsan, Totapally, Hailu, Addom, 2019; CTA, 2019). Participants 1 and 2 indicated that although farmers' payments are deposited into their bank accounts, they are encouraged to link these accounts with mobile banking services, such as EcoCash, a mobile phone-based money transfer service, to facilitate easier transactions and access to funds. This is consistent with previous studies that highlight the benefits of mobile money transfer services. For instance, Vodafone's M-Pesa mobile money transfer services enable farmers in the remote areas of Kenya (Katitika community to access safe, clean water through an innovative partnership between the water pump manufacturer Grundfos and Vodafone affiliate Safaricom (Grundfos Pumps Limited, 2011; Townsend et al., 2019).

While digital bulk payments emerged as a new finding from the empirical data, it is linked to mobile banking as it makes the payment process for CPC much easier as multiple payments can be made at one go, which as a result saves time and less costly as compared to traditional payments.

4.4.3.3 Mobile Application

The reviewed literature has extensively described farmer mobile applications as bespoke internet software designed to facilitate the management and monitoring of outgrower farmer activities. These applications provide a foundation for resource allocation and agronomy support through the digital tracking of farmer performance (Asian Development Bank, 2015; USAID, 2018). Farmer mobile applications are also regarded as potential tools to enhance the efficiency of managing farmer-related activities in real time by delivering targeted information to growers in need of support, thereby improving the quality of agricultural production(ibid).

Empirical data reveal that some participants demonstrated the use of mobile applications to manage outgrowers. Specifically, they employed two applications "Earn As You Grow" (EAYG) and "Mobenzi". EAYG, a mobile application that CPC experimented with several years ago, has been noted in particular. The use of mobile applications within the CPC context to manage outgrowers is evidenced by the following excerpts:

“Yes, actually, I've used Earn as you grow which also had another part called SASA, but the EAYG was for the production side and SASA was for the accounts side…” (Participant 8)

Another respondent said:

“ Yes, I am aware of mobile technology used in the agricultural sector like one we have been using “Earn as we grow”, it helped us to gather data from the farmers that we can put together like there is no time-consuming, you can do things in situ rather than moving from one place to another, I can do my data whilst am at the warehouse and also our farmers once they deliver their chillies, I enter them on the mobile technology data and they can easily find out what they have delivered that day….”(Participant 1)

Another mentioned that said:

“Right. So, there's the first stage of the tech (Earn as you grow) where we capture the details about the farmer. And again, as I mentioned, it's location, it's the telephone number, ID number. So, all the basic information that we were capturing, before in terms of setting up, you know, our payment systems to them, but the idea was, we really wanted to have a system that we can watch in sort of real time. So, we collect that information. And then we have trainings, and we give farmers educational material and all the different parts of the growing process . And then we try to rate and encourage the farmers through the tech. And then another side of it manages the warehouse. So, when people come into the warehouse, they deliver Chilies, and it's an ability for the warehouse managers to keep track of, of how many bags and the different consumables that we have in the warehouse and making sure that we're up to speed with that.” (Participant 11)

Another respondent added that;

“We register farmers using phones, as I register here it reflects in the data base, let’s say at the headquarters in Harare or Bulawayo the system allows the information to be seen as soon as it has been uploaded “… (Participant 4)

The findings demonstrate that mobile applications are highly effective for capturing farmer data in real-time, significantly saving time and improving efficiency by streamlining the data flow from field agents to decision-makers. Additionally, the data indicates that mobile applications can track crop deliveries by farmers, as well as monitor production and consumables at the warehouse level. These findings are consistent with previous research by Anderson and Feder (2007), which highlights the inefficiencies and challenges associated with traditional methods of disseminating agricultural information. Anderson and Feder (2007) emphasized on the lack of real-time monitoring of agricultural extension workers responsible for delivering information to farmers, a problem also noted by BenYishay and Mobarak (2013). Consequently, the use of mobile applications in agriculture aligns with efforts to enhance farmers' productivity and efficiency by providing personalized and customized agricultural information directly to them.

Similarly, empirical findings align with previous research by the Asian Development Bank (2015) and USAID (2018), which found that mobile applications are regarded as efficient tools for managing farmer-related activities in real time. These applications

deliver targeted information to growers in need of support, thereby improving the quality of agricultural production. Furthermore, empirical data supports previous research, indicating that mobile applications facilitate the management and monitoring of outgrower farmer activities. This is achieved by providing a basis for agribusinesses to allocate resources and offer agronomy support through the digital tracking of farmer performance.

However, one participant indicated that the CPC decided to shelve the mobile application (EAYG) due to technical challenges. They continued using a paper-based system for the time being while the application is being further development. Participants mentioned that one reason the software was put on hold was that it had bugs, which made it difficult to use. This is evidenced by the following assertions:

"…We had just shelved this software for a while due to technical glitches. It's going through further development, but the EAYG was for the production side and SASA was for the accounts side"…(Participant 8)

This challenge in implementing mobile applications relates to remarks by Caine et al. (2015), May et al. (2015), and Aker et al. (2016) regarding the need for custom development of farming tools based on user requirements, hardware compatibility, technological abilities of smallholder farmers, and the necessity for developing user-friendly tools.

Interestingly, the data also indicated that farmer mobile applications can be used to take pictures, which can be uploaded and utilized either as a monitoring tool or for task completion verification. Although the reviewed literature did not specifically mention this feature, it appears to be useful for remotely managing farmers by providing proof of task completion. This is evidenced by the following excerpts:

"Say I am preparing nurseries. I just take photos using the application and send it. Say I need to compile some inputs per individual, I just enter it and they pick it, say its chemicals, fertilizers" …(Participant 4)

4.4.4 Challenges of using mobile technology in a CPC context

Previous sections have demonstrated mobile solutions that have the potential to better manage outgrowers, thereby enhancing their productivity, profitability, and sustainability. This section now addresses the limitations associated with using mobile technology in the context of CPC.

The researcher identified and classified these limitations into three broad categories: device-centred limitations, outgrower-centred limitations, and externally-controlled limitations. Together, these categories create a climate of disadvantage that this study aims to address through specific recommendations and remedial strategies.

Table 4.1 Outgrower challenges of using mobile technology

Device-centred limitations	**Outgrower-centred limitations**	**Externally-controlled limitations**
Cost of device (affordability) and Device compatibility	Device competency and General literacy	Expensive data costs
		Poor connectivity/ network
		Unreliable electricity (power cuts)

4.4.4.1 Device-centred limitations

Device-cantered limitations refer to the challenges associated with the mobile device itself, which can hinder the effective use of mobile solutions to improve the management of outgrowers. The following subsection addresses these aspects.

4.4.4.1.1 Cost of device (Affordability) and Device compatibility

In Zimbabwe, reliable, high-performance mobile devices are not prevalent available in the market. The market is dominated by counterfeit of original models, characterized by low quality and slow processors, which hinder the performance of most software. According to Zhang et al. (2016), several factors must be considered when adopting a mobile solution, with one crucial factor being the hardware suitability in the local context. To determine an appropriate mobile solution model, a study must be conducted and empirical data collected on the local context to ascertain whether the necessary infrastructure is available to support the technological requirements (ibid). Furthermore, agribusinesses need to engage and interact with growers using cost-effective

technology services for sustainability of the mobile technology solution. The existence of cost of device and device compatibility challenges within the CPC context to manage outgrowers is evidenced by the following excerpts;

"Also not every farmer has got a cell phone especially in these marginal areas…"(Participant 5)
Another respondent added that;
"And also, some farmers they do not have phones …" (participant 1)

Another participant added that;

"Thank you, a couple of challenges on the farmer's side their capability to obtain the right hardware …"(Participant 8)

The empirical data confirms previous research indicating the importance of identifying compatible hardware for use as a mobile solution in the local context before developing a technology model. Additionally, conducting upfront research to assess the availability and cost of mobile devices in the market is crucial for making informed decisions about adopting mobile technology (Zhang et al., 2016).

4.4.4.2 Outgrower centred limitations

These limitations pertain to the outgrowers' knowledge, skills, abilities, and literacy, which are subjective factors influencing their capabilities. These challenges revolve around the competency of outgrower devices and their general literacy skills. The following subsection addresses these challenges within the context of CPC.

4.4.4.2.1 Device competency and general literacy

Device competency refers to the outgrower farmer's ability to confidently utilize the features of a mobile device. Literacy refers to the ability to read and understand a language, specifically English, Shona, or Ndebele, which are the three main languages in Zimbabwe. Device competency problems manifest in two forms: first, when an outgrower farmer is illiterate (unable to read or write) but can receive calls; second, when an outgrower farmer cannot effectively operate a phone to benefit from mobile technology use. The aforementioned issues were identified among the following respondents;

The challenges as we have said earlier illiteracy among some of our growers …" (Participant 9)

Another participant indicated that;

"Some of the farmers can't read or write, so when a field supervisor sends a message it won't help since the farmer can't read or write …. "(participant 6)

The competency of these devices and challenges in general literacy have been extensively discussed in the literature. Caine et al. (2015) argue that to enhance the adoption of smartphones among smallholder farmers, it is essential to customize farming tools according to their specific needs and technological capabilities. Involving smallholder farmers in the development process of farmer management platforms is crucial as it ensures their ideas are considered and fosters a sense of ownership in the development team. This approach effectively addresses resistance to adopting new farmer management technologies. Furthermore, their participation incentivizes agribusinesses and farmer platform developers to create user-friendly tools (May et al., 2015; Aker et al., 2016).

4.4.4.3 Externally-controlled limitations

In as much as most identified limitations are internally oriented, the researcher also identified externally controlled limitations. These come across as unintentional factors that impede the effective use of mobile technology by outgrower farmers. These challenges include poor connectivity, expensive data costs and frequent power cuts.

4.4.4.3.1 Expensive data costs

Implementing cost-effective technology has been highlighted as a critical factor for successfully integrating mobile technology in the outgrower and agribusiness sectors (Zhang et al., 2016). Empirical data indicates that mobile data costs are prohibitively high in Zimbabwe, posing challenges for farmers who find it difficult to afford. This is substantiated by feedback from respondents:

"We do experience challenges like data costs" … (Participant 4)

Another respondent added that;

"The other challenge would be the cost of transmitting information between the sender and the recipient" … (Participant 8)

Another participant mentioned that;

Another issue is data is expensive in Zimbabwe …" (participant 1)

While CPC as a company can afford to purchase data and transmit information to farmers, the farmers themselves might not have sufficient data to receive such information. This issue is illustrated by the following respondent:

While CPC would be able to transmit information to the farmers, but the farmers might not have the funds to receive the information and that information is either lost or is not received timeously…"(Participant 8)

Prior studies have emphasized the importance of conducting research before implementing a mobile technology solution in the local context. This research helps in understanding various factors crucial to the successful implementation of a mobile solution, such as the ongoing costs associated with maintaining the solution (Caine et al., 2015; Aker et al., 2016; Zhang et al., 2016).

4.4.4.3.2 Poor connectivity (Poor Network)

Previous research has demonstrated that network infrastructure is a crucial factor for agribusinesses when evaluating suitable mobile solution technologies before developing a farmer management tool (Zhang et al., 2016). This is consistent with empirical findings indicating that inadequate network coverage presents a significant challenge. Moreover, in certain areas where CPC operates, the absence of receiving antennas for communication may necessitate field agents to travel to farmers in person to interact with them. This phenomenon is supported by the following respondents:

"The challenge as we have said earlier is poor network…" (Participant 9)
Another participant added that;

"Communication challenge, previously there was a major challenge of network sometimes you want to get in touch with another person in some area you ought to visit

that person face to face because making phone calls was just a challenge… "(participant 5)

Another participant commented that;

"Some areas where we are contracting to grow there might not have the receiving antennas for good communication …" (Participant 8)

It is crucial to address challenges such as these prior to developing and implementing mobile technology, as they can impede the effective adoption and utilization of mobile technology solutions (Caine et al., 2015; Aker et al., 2016).

4.4.4.3.3 Electricity power cuts

Frequent power cuts and load shedding has not only crippled the manufacturing sector but also the agricultural sector. Load shedding has become very much a reality for many Sub-Saharan African households and businesses, especially those in South Africa, Zimbabwe and Zambia. In recent times, load shedding has been a daily occurrence for most sub Saharan African countries (Energy Institute,2020). Outgrower farmers are affected in that there have not the wherewithal to charge their phones. Also network towers are affected when there is load shedding as they depend on electricity power to function . The above challenges are summed up by participants 1,2 and 5 11;

Frequent power cuts (load shedding) has severely affected not only the manufacturing sector but also agriculture. Load shedding has become a significant issue for many households and businesses in Sub-Saharan Africa, particularly in countries like South Africa, Zimbabwe, and Zambia. According to the Energy Institute (2020), load shedding has become a daily occurrence in most Sub-Saharan African countries.

Empirical data has revealed that outgrower farmers are particularly impacted by power cuts, as they lack the means to charge their phones during power outages. Additionally, network towers depend on electricity to operate, making them vulnerable during load shedding. Participants 1, 2, and 5 collectively summarize these challenges and this is evidenced by the following excerpts;

"No electricity to charge the phones or even your laptop…" (participant 1)

Another participant added that;

“Another challenge is power cuts …”(participant 2)

Another participant asserts that;

“And also, on that we have got problems of power cuts where we can go for a period of time without electricity and communication becomes a problem of which you will be forced to use other methods…. “(participant 5)

Empirical data has highlighted a challenge posed by electricity power cuts, which hinder mobile technology use and communication, resulting in some field agents to resort to traditional and less efficient communication methods.

4.4.5 Proposed Solutions to address current challenges:

Previous section has outlined the challenges that CPC currently face when managing its outgrowers using mobile technology. It is crucial to address these challenges for effective implementation of mobile technology in each region that CPC operates in, through empirical

data be collection per region to determine if the necessary infrastructure is in place to support the technology requirements , growers education level, and that skills match requirements for that technology, or whether training is required for the people who will be using the technology (Zhang et al., 2016).

Moreover, the researcher suggests CPC engage with network providers in Zimbabwe to negotiate a deal to improve mobile network strength in the areas they operate in (mostly rural areas) so as to address the issue of poor network. Further, the researcher suggests that CPC invest in the confidence of its outgrower farmers by capacity building. Such capacity building should incorporate sponsored training workshops and offer subsidized tablets and mobile scholarships for agricultural qualifications to improve farmers skills and knowledge. This will address challenges like incapability of farmers to secure hardware; lack of the know how to operate phones and illiteracy challenges. Lastly, to address the issue of expensive data for use to carry farmer related tasks on the phone, CPC can subsidies the data for its farmers through engagement with network providers to get discounted data for farmers.

The previous section has outlined the challenges currently faced by CPC in managing its outgrowers using mobile technology. It is crucial to address these challenges

effectively to facilitate the implementation of mobile technology in each region where CPC operates. This can be achieved through empirical data collection in each region to ascertain the availability of necessary infrastructure to support technological requirements, the educational levels of growers, and whether their skills align with the technological demands. Additionally, it will determine if training is necessary for the individuals who will be using the technology (Zhang et al., 2016).

Furthermore, the researcher recommends that CPC engage with network providers in Zimbabwe to negotiate improved mobile network coverage in the predominantly rural areas where they operate, thereby addressing the issue of poor network connectivity. Additionally, the researcher proposes that CPC invest in enhancing the confidence of its outgrower farmers through capacity building initiatives. These initiatives should include sponsored mobile technology related training workshops and offering subsidized mobile devices / tablets and agricultural qualifications, aimed at improving farmers' skills and knowledge. This approach will help overcome challenges such as farmers' inability to acquire hardware, lack of proficiency in using phones, and literacy issues.

Lastly, to tackle the problem of expensive data required for conducting farmer-related tasks on mobile phones, CPC could consider subsidizing data costs for its farmers through collaboration with network providers to obtain discounted data packages.

4.5 How can mobile technology be deployed to enable agribusinesses to manage outgrowers remotely?

The preceding sections presented an analysis of empirical qualitative data to show what information is required to manage outgrowers, challenges CPC currently experience with managing outgrowers with its current methods and systems, CPC's current mobile technology use and awareness among staff and management and lastly challenges experienced through use of mobile technology in the context of CPC.

The following sections will interpret and provide a discussion of the findings/results in light of the literature reviewed in Chapter 2, as well as explain any new insights into the research problem, providing a discussion of the current practices by CPC and its implications to the productivity, profitability and sustainability of outgrowers.

The section will conclude with a summary of the analysis presented as a revision of the initial conceptual framework that guided the data collection. The refined conceptual framework can be viewed as a generic framework resulting from this study. Based on

this framework, measures to improve productivity, profitability and sustainability of outgrowers will be suggested.

4.5.1 Deployment of mobile technology:

In the context of this study, the deployment of mobile technology involves the use of various mobile devices, including mobile phones (encompassing both voice and short message service (SMS) enabled phones and smartphones), tablets, and laptops or desktops. These devices receive information through internet-based mobile applications, email, or WhatsApp for managing outgrowers (Caine et al., 2015; Zhang et al., 2016).

The literature reviewed, and empirical findings of this study highlight the importance of selecting the appropriate mobile technology model and deploying it effectively for managing outgrowers in agribusiness. The deployment of mobile technology in agriculture is described as a process requiring due diligence for effective implementation rather than a simple task. A preliminary study is necessary to understand the various factors that need to be considered and addressed before adopting or deploying a model for effective outgrower management (May et al., 2015; Zhang et al., 2016; Aker et al., 2016).

Moreover, the findings indicate that it is crucial to examine both internal and external factors that may impact the successful deployment of mobile technology. These factors include the literacy levels of potential users, farmers' capabilities to use the technology, their ability to acquire hardware, and the operating and maintenance costs associated with the technology, among others.

4.5.1.1 Deployment of Mobile technology: Management of farmer profile

The management of farmer profiles involves capturing fundamental data about growers, their farms, and business activities by agribusinesses to create comprehensive farmer profiles. These profiles enable agribusinesses to better understand their farmers, grasp their needs, and deliver targeted information and resources through mobile solutions. For example, through the management of farmer profiles, agribusinesses can determine the geographical locations of their farmers and decide on the appropriate quantities of seeds, tools, or financial support needed based on the size of their fields (USAID, 2009; USAID, 2018).

Empirical data from this study demonstrated that paper-based systems for managing farmer profiles lead to delays in the dissemination and receipt of information. Respondents indicated that discrepancies and gaps in manually recorded data are likely unless someone actively verifies the information, resulting in further delays in recognizing and rectifying these issues. This finding corroborates existing literature suggesting that paper-based systems are inefficient, time-consuming, and prone to delays and data gaps among stakeholders involved in managing farmers, leading to incomplete data and delays in decision-making (Cadavid et al., 2018).

The implications of using paper-based systems by agribusinesses in managing farmer profiles extend to negatively impacting the productivity, profitability, and sustainability of outgrowers. Productivity suffers due to incomplete data and delays in communication between agribusinesses and outgrowers, hindering timely support delivery. Delayed allocation of resources and agronomic support can adversely affect crop yields, thereby reducing farmer profitability and potentially jeopardizing the sustainability of outgrowers.

Adopting mobile technology can mitigate these challenges through digital management of farmer profiles using specialized farmer management applications like EAYG (Earn As You Grow). Despite earlier attempts by CPC to implement EAYG, challenges were encountered, prompting a return to a paper-based system. If the reported bugs and challenges can be resolved, EAYG holds promise for CPC in effectively managing its farmer profiles and enhancing operational efficiency.

4.5.1.2 Deployment of Mobile technology: Monitoring and traceability

The monitoring and traceability process pertains to periodically collected data used to assess farmers' performance, which serves as the basis for resource allocation and agronomy support where needed most, achieved through tracking farmer performance. Traceability, on the other hand, involves recording and disseminating crop data across the food supply chain for food safety and quality purposes (Henson & Reardon, 2005; Maertens & Swinnen, 2009; The World Bank Group, 2019).

Empirical data shows that monitoring and traceability data are captured using a paper-based system, specifically through notebooks. Farmers record field activities such as transplanting dates and chemical and fertilizer applications, among others, in these notebooks. Field supervisors then visit farmers to transfer these records into their own notebooks and make additional observations. Subsequently, supervisors report this information to outgrower managers for computer input. However, this repetitive data

recapture process is prone to typographical errors and causes delays in reaching top managers for decision-making. Moreover, the process is time-consuming because supervisors must physically visit each farmer, unlike the efficiency of remote monitoring using mobile technology.

Findings also reveal that as part of CPC, to ensure sustainable and productive operations for outgrowers, free seeds are distributed well ahead of the season. This practice allows farmers ample time to prepare without incurring additional costs for seed collection, as CPC delivers seeds to each village at no charge.

Furthermore, empirical findings indicate that CPC management plans to expand the use of paper-based systems in the upcoming season by distributing notebooks to all its growers for data monitoring. However, promoting such an approach contradicts the efficiency goals of primary industry processes, as traditional paper-based systems are considered inefficient. The World Bank (2007) supports this notion, recommending that agribusinesses adopt hybrid systems that combine traditional and digital methods, transitioning toward a more digitally oriented future. Various mobile technology options are recommended for managing outgrower farming processes, including a downloadable CPC bespoke farming app and the WhatsApp interface (Addison et al., 2020).

To address current challenges faced by CPC, deploying a customized mobile farmer management application for monitoring and traceability data capture among outgrowers is proposed. Applications like EAYG, designed for smartphones, enable real-time data capture, thereby enhancing efficiency in delivering actionable insights to decision-makers for prompt assessment of farmer performance and support decisions. For instance, small-scale growers can input data such as crop varieties, planting/transplanting dates, fertilizer and pesticide usage, and harvest dates into these applications. This data can then be centralized for analysis and shared with relevant stakeholders, aligning with the benefits of mobile technology deployment, as highlighted by the World Bank (2017). These advantages are also consistent with findings by Muto and Yamano (2009), who emphasize that mobile technologies reduce irregularities, improve record-keeping, and save time through enhanced data processing speed.

4.5.1.3 Deployment of mobile technology: communication

Communication has proven to be the lifeblood of outgrower management within the context of this study. It was found to be indispensable across all facets of farming,

manifesting through various channels such as reporting, meetings, one-on-one consultations, and phone calls. Participants in the CPC revealed that communication serves multiple crucial roles: disseminating management information to outgrowers, training them in agricultural best practices, providing advice from field supervisors, conducting meetings, and offering feedback.

Current communication practices with outgrowers, however, face significant challenges. These include absenteeism from face-to-face meetings, resulting in farmers missing critical information and making ill-informed decisions that adversely affect productivity, yield, and profitability. Furthermore, some farmers' illiteracy complicates their ability to maintain essential records of monitoring and traceability data throughout the season, such as recording chemical applications and transplant dates. This lack of data availability hampers field supervisors' ability to provide agronomic advice, contributing to reduced productivity, lower yields, and financial losses, ultimately threatening the sustainability of these farmers.

The deployment of mobile technology presents a promising solution to these challenges. By utilizing mobile phones and social media platforms, personalized agricultural information can be delivered to farmers affordably and tailored to their specific contexts and current phases of the growing season. This approach ensures that farmers who miss physical meetings or group trainings can still access crucial information via SMS or platforms like WhatsApp. Additionally, for illiterate farmers, CPC can facilitate communication through voice calls to capture necessary data on their behalf. Introducing USSD codes further enables farmers to report issues or request agronomic advice, establishing a robust two-way communication channel between CPC and its outgrowers.

These proposed digital solutions align closely with findings by Muto & Yamano (2009), which highlight the transformative impact of mobile technology on smallholder farmers' productivity and sustainability. They emphasize that timely communication facilitated by mobile phones can ensure farm activities are conducted efficiently and on schedule, minimizing delays and maximizing desired outcomes. Moreover, literature underscores that mobile phone usage enhances communication and facilitates the efficient distribution of crops from smallholder farmers to consumer markets, providing crucial information on price, variety, quality, and quantity that empowers farmers to make informed decisions (Martin & Abbott, 2011; Okello et al., 2012; GSMA, 2013; Ogbeide & Ele, 2015; Chhachhar et al., 2016; AgDevCo, 2017).

In conclusion, leveraging mobile technology not only addresses current communication challenges in outgrower management but also holds immense potential to enhance agricultural productivity, sustainability, and market integration for smallholder farmers.

4.5.1.4 Deployment of Mobile technology: Payments, Transacting and Funding

This section examines the processes related to payments, transactions, and funding within CPC's operations. Specifically, it explores how payments are made to farmers, the transactional procedures involved, and the steps taken to finalize payments (including delivery recording and receipting). Additionally, it outlines the funding procedures for farmers and the repayment processes involved.

Outgrower Managers indicated that CPC currently employs a manual transaction system. Warehouse staff record the produce and harvest delivered by outgrowers in notebooks and triple cash receipt books. The first copy of these records is given to the farmer, the second is kept at the depot, and the third is sent to headquarters for digital input and payment processing. Supervisors also submit paper-based reports to outgrower managers for subsequent computer entry. This study clearly shows that CPC relies heavily on conventional methods involving extensive paperwork, archiving, and record filing.

The researcher strongly recommends that CPC leverage either its internal IT department or external IT experts to develop a dedicated online mobile application. This application should encompass a wide range of functionalities, including farmer profiles, payments, transfers, and beneficiary management. This recommendation aligns with findings from CTA (2019), which identified that mobile payment systems have replaced inefficient, insecure, and costly conventional methods of financial transactions.

Additionally, empirical evidence reveals that farmers receive input loans in the form of physical inputs provided by the company on credit, to be repaid later upon harvesting. Records for these input loans are currently managed using a paper-based system and are only digitized once data reach headquarters.

While there has been digitalization in payment processing and input loan management starting from the headquarters level, previous processes were managed manually using inefficient paper-based systems. Paper-based transactions introduce the risk of errors. Additionally, the need for repeated data entry before final payments at HQ makes the data vulnerable to typos. Moreover, this entire process causes delays in payments and is time-consuming due to redundant data entry across different hierarchical levels.

Consequently, delayed payments can strain relationships between agribusinesses and farmers, negatively impacting productivity and sustainability, as timely payments are crucial when working with outgrowers.

As suggested by Addison et al. (2020), amidst the COVID-19 pandemic, field officers in the agrarian economy must shift from a Fixed Frame Mindset (FFM) to being more innovative, creative, and proactive. Therefore, the deployment of mobile technology should encompass not only outgrower farmers but also backend managers and supervisors through mobile applications that interface administratively with outgrower mobile applications. Such systems and software should be developed to transmit every delivery entry in real-time to a central repository for recording and processing final payments, facilitated by integrating the backend mobile solution with a third-party banking financial services company for end-of-month payments. Furthermore, the system should generate an electronic receipt sent to farmers via SMS or WhatsApp, alongside a hardcopy receipt as proof of delivery. This unified application should include functionalities for managing farmer input loans as well.

The same farmer management application can feature a function to electronically deduct amounts paid by farmers toward loan repayment, issuing electronic receipts via SMS or WhatsApp. In developing this platform, insights from the Mobenzi digital application, mentioned by some respondents, can serve as a guide due to its functionalities in managing farmer yield delivery, payments, and input loans.

In light of the above discussion, the deployment of mobile technology to manage outgrower farmers brings numerous advantages. Examples of such mobile technology solutions include replacing inefficient, insecure, and costly conventional methods of sending or receiving money (CTA, 2019). This enables payments to suppliers of inputs and receipt of payments from product buyers using mobile services, eliminating the need to visit a bank for withdrawals or deposits, thereby securing farmers' funds in their mobile money wallets (Deloitte, 2012; Econet, 2015; World Bank Group, 2019). According to the agribusiness study conducted by the IRIS Center (2010), timely payments are crucial when working with outgrower farmers as they foster trust and build strong relationships between agribusinesses and farmers. Similarly, digital transactions with farmers, as noted by Stringfellow (1996) and the World Bank Group (2019), enhance profitability and ensure sustainable outputs by leveraging speed, accuracy, and reduced costs associated with accessibility and paperwork.

4.5.1.5 Deployment of Mobile technology: Training & Workshops

Training and workshops are considered pivotal in promoting good agricultural practices among outgrowers, enhancing their skills and performance, and ultimately improving productivity and the quality of produce (Goldstein & Ford, 2002).

The data revealed that CPC conducts physical training sessions throughout the growing season and follows up with one-on-one field training to evaluate farmer performance. Furthermore, CPC hires field extension officers (FEOs) who are exclusively dedicated to chili cultivation. These officers provide specialized support and advice to chili farmers. Typically, government extension officers are responsible for supporting farmers in irrigation schemes, but they often become overwhelmed by the high number of farmers, leading to delays in providing timely assistance. By hiring dedicated extension officers, CPC addresses the inefficiencies and delays associated with public services, ensuring timely agronomy support.

Current training practices at CPC align with existing literature, which suggests that for improved productivity, agribusinesses should deploy field extension officers to provide agronomy support and training on chemical and fertilizer application, crop management, and harvesting techniques (Ogbeide & Ele, 2015).

Moreover, data shows that some farmers do not attend trainings, resulting in them missing out on important information. Additionally, some farmers do not show up for meetings or scheduled field visits, causing a waste of time and resources for field supervisors and Agritex officers who travel by motorbike to the farmers' fields.

As technology continues to advance, it is essential for the farming sector to keep pace in order to reap the benefits. Mobile technology for training outgrower farmers has the potential to enhance teaching and learning by enabling knowledge sharing without the constraints of space and time, fostering communication skills, and promoting participatory learning (Sanga, Mlozi, Haug, & Tumbo, 2016; Abidin & Tho, 2018). Implementing mobile technology for training can help address challenges currently faced by CPC through the development of farmer management applications that work on tablets or smartphones. These applications can include a training section where literature related to crop growing procedures can be updated in local languages to ensure farmers fully understand the training modules. Visual aids, such as videos and pictures, can be used to demonstrate procedures, making the training more engaging. At the end of each training module, assessment questions can be included to ensure

the farmer has understood the material. Additionally, farmers should be able to seek clarification via calls or social media (e.g., WhatsApp) if they do not understand certain aspects of the training module. Providing training in this manner can improve productivity and sustainability, as every farmer will have access to the training modules and literature to guide them in making informed decisions at any time. Improved farmer productivity can also lead to increased profitability.

According to Criyagen (2016), one of the most effective mobile solutions is the development of offline learning packages in various formats, such as videos, PowerPoint presentations, and Word documents. Agricultural mobile applications can offer diverse practice and learning packages for growing various crops. These packages can be provided in different formats, including farming practice videos, news articles, and well-referenced literature. Moreover, the packages can be made available in several local languages to avoid miscommunication and ensure the knowledge reaches a wider audience (Criyagen, 2016).

4.5.1.6 Deployment of Mobile technology: Reporting

Reporting relates to a process where captured data is processed and analyzed to give it meaning for the purpose of reporting and making decisions based on the reported data. Reporting encompasses all outgrower processes, including information dissemination, payments, and training (Mell and Grance, 2011; World Bank, 2017).

Outgrower managers and operations managers interviewed indicated that reporting methods vary depending on the position held within the company. For instance, top managers report to executives or other managers through meetings and digital written reports. In contrast, lower-level staff use handwritten (paper-based) reports, verbal reports, and sometimes pictorial reporting, as well as meetings with either outgrower farmers or executives. These reporting procedures often utilize mobile devices through apps like WhatsApp, audio calls, images, and group calls.

Moreover, the Executive Director revealed that current practices at CPC rely heavily on paper-based systems, leading to delays in information dissemination, inefficiencies, and the need to recapture data multiple times, making it vulnerable to typographical errors. Current reporting practices are mostly "tick-the-box" exercises rather than details visual analytical reports. These issues have been identified in the study as significant challenges to the reporting process, which are substantially alleviated by using digital tools such as mobile devices, tablets, and laptops.

While there is evidence of digitalized reporting at the top managerial level, such as pre-developed Word and Excel reporting templates, lower-level staff still rely on inefficient paper-based systems for reporting. Therefore, it is crucial that competence and access to mobile tools are extended to lower levels. This is supported by Mell and Grance (2011), who argued that agribusinesses should strongly consider adopting hybrid approaches that combine both conventional and digital methods. Once the business becomes proficient at this level, the focus can shift to implementing a complete transformation to modern digital technologies, such as cloud-based software, which can integrate all processes, systems, and structures into one server. Such a server can manage, analyze, report, and store vast amounts of data, making it accessible to farmers, researchers, agricultural policymakers, agribusinesses, and field officers to facilitate interaction and ensure productivity, profitability, and sustainability (Mell & Grance, 2011; World Bank, 2017).

4.5.2 General Framework

In the literature review chapter, the researcher presented a problem conceptualization in the form of a diagram. The diagram depicts the processes involved in the management of outgrowers, the data that is required from outgrowers or shared with outgrowers by agribusiness for better management and recommended mobile technologies that can be used to achieve improved efficiency and effectiveness for these processes and the proposed relationship to improving sustainability, profitability and productivity through adoption and deployment of mobile technology to facilitate these processes.

Within this section, a refined framework has been developed based on the previously proposed conceptual framework in Chapter 2 and the empirical data analysis findings. Figure 4.4 below presents an updated conceptual framework specifically designed for the management of outgrowers by agribusiness. The diagram delineates the key processes involved in outgrower management, the requisite data collection, recommended mobile technologies, their corresponding outputs, and areas for improvement in relation to sustainability, profitability, and productivity facilitated by mobile technology applications.

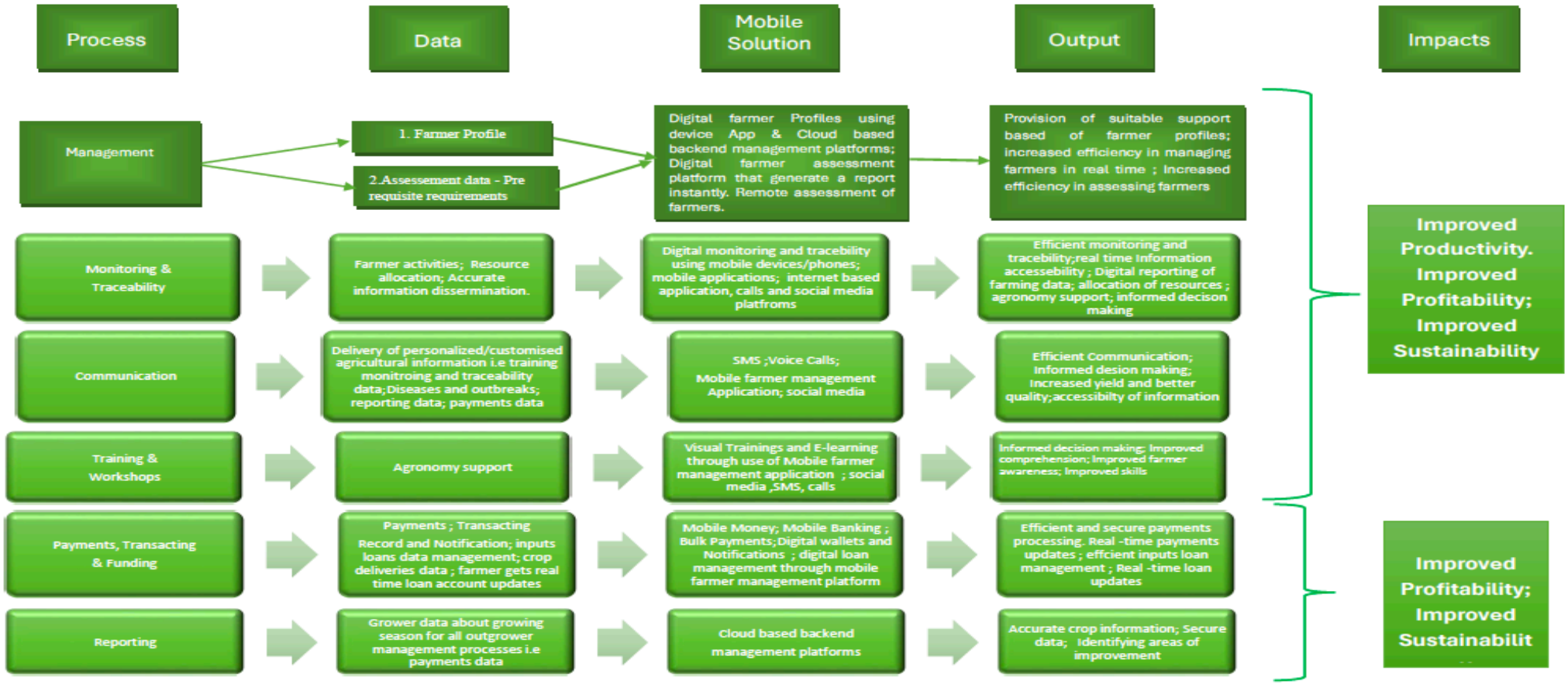

Figure 4.1 Conceptual Framework

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The previous chapter focused on data analysis, interpretation, and presentation of the findings from the empirical data collected through face-to-face, semi-structured interviews. The chapter also gave a graphical presentation of the refined framework developed based on the empirical findings of the study.

This chapter marks the tail end of the research by presenting a summary of the research findings, providing research conclusions and recommendations for future research, and notwithstanding the experienced limitations of this research from start to end. The chapter begins with a holistic overview of the research, highlighting the initial problem statement, the research aims and objectives, the purpose and importance of the study, the implications of the literature, the underpinning conceptual framework and the parameters of data analysis. Subsequently, the chapter gives actual research conclusions expressed as theoretical and practical contributions, factors inhibiting the use of mobile technology by agribusinesses and factors enabling the use of mobile technology by agribusinesses. Lastly, the chapter highlights and outlines the research limitations, recommendations, and implicit prospects for future research.

5.2 Overview

The integral focus of this study was to explore the use of mobile technology to better manage outgrowers of agribusinesses. The main research aim was then supported by sub-objectives, which were to determine what information is required for managing outgrowers by agribusinesses and how mobile technology can enable agribusinesses to manage outgrowers better.

Literature was reviewed, and empirical data was collected to explore the potential of mobile technology in managing outgrowers by agribusinesses in Zimbabwe. A conceptual framework was developed based on the literature reviewed in chapter two, and later, the framework was refined based on the empirical data findings.

In the context of Zimbabwe, agricultural sectors play a pivotal role in socio-economic development, contributing close to 17% of the GDP and providing employment to the majority of the population. Among other players, outgrower schemes are said to play a vital role in contributing to the betterment of the agricultural sector of Zimbabwe, thus

improving food and nutrition security in the country and contributing to the country's total export earnings, among other factors (FAO, 2017). With mobile technology taking all fronts in quite a number of industrial and economic sectors, the agricultural sector needs to adjust to keep up with the ever-changing world of technology to reap all the benefits of mobile technology. With that said different players in the outgrower system need to adjust to mobile technology to benefit from it.

In this study, The Chili Pepper Company (CPC) in Zimbabwe was used as a case study to explore the potential of mobile technology in agribusiness managing outgrowers. This resulted from the underutilisation of mobile technology in the agricultural space, specifically for agribusinesses and outgrowers management to improve productivity, profitability and sustainability. This backdrop formulates the problem statement while catapulting the purpose of this study to inquire how agribusinesses and the subsequent outgrowers can tap into this potential of maximally utilising mobile technology. While some previous studies and literature address the need for the use of technology to optimally manage information within the agricultural sector, there is limited empirical data available on mobile technology use by agribusinesses in managing outgrowers, specifically, and how this phenomenon can be approached pragmatically.

Eleven interviews were conducted using purposive non-probability sampling, intentionally targeting the director of the company, operations managers, regional managers, outgrower managers, agricultural extension officers and field supervisors. The raw data was analysed manually using a Microsoft Excel template for qualitative data analysis. This data was collapsed and reduced into themes, which were detailed as the main findings in the previous chapter. It was quite remarkable that the bulk of the findings in the raw data was a true to near-true reflection of the main highlights in the research literature review and conceptual framework

The study revealed that mobile technology has a place in the management of outgrowers by agribusiness as it can be deployed /used in almost every outgrower management process for effective and efficient management of outgrowers to improve their productivity, profitability and sustainability. As such, a framework was developed to guide agribusinesses when implementing outgrower mobile technology managing platforms. The framework defines the processes involved in managing outgrowers, data to be captured, mobile technology solution to be used, areas of improvement (output) and overall impact benefit of mobile technology use based on each outgrower management process (productivity, profitability and sustainability). However, it was

found that some external and internal factors may hinder the successful digital management of outgrowers remotely.

5.3 Research Outline

5.3.1 Chapter 1

The first chapter introduced the research problem and gave a background to the study. It also presented the research problem statement, aims and objectives, research questions, significance of the study, assumptions, definition of key concepts, and delimitation of the research and its limitations.

5.3.2 Chapter 2

The second chapter gave a literature review of the current status of research on farmers' use of mobile technology to improve productivity, profitability, and sustainability. The chapter also explored literature on outgrower processes, information required in managing outgrowers, mobile technology use in outgrower management and deployment of mobile technology to manage outgrowers by agribusiness. The literature review provided an evaluation of the knowledge base upon which this study was founded. Several writers and scholars were used to give a clear picture of the concepts. The chapter further identified existing literature gaps in relation to the related research problem under study. Lastly, the chapter wrapped up with a conceptual framework to sum up the current status of the research and guide the collection, interpretation, and analysis of the data.

5.3.3 Chapter 3

Chapter 3 provided a detailed outline of the research design and methodology to attain the research aim and objectives. The chapter gave a description of the research paradigm, research design, population, participants, research approach, research methods, target population, sampling techniques, data sources, research instrument, data collection and analysis techniques, quality assurance, reliability and validity issues, and ethical considerations and research limitations.

5.3.4 Chapter 4

The chapter focused on data presentation, analysis and a discussion of the findings of data collected in relation to the literature and conceptual framework to develop a refinement of the conceptual framework. The findings were presented for each research question.

5.3.5 Chapter 5

This chapter summarises and concludes the research and provides recommendations for further research. The following section explains the main findings of this research, which guided the refinement of the general conceptual framework.

5.4 Contrast and Balance of Digital and Non-digital Framework of Out grower Management

The empirical findings of this research indicated that before the widespread use of mobile technology in farming. All farming procedures were done manually, and there was an excessive use of paperwork, manuscripts, and books. It also involved a lot of travel for most field officers, who had to travel in either cars or motorbikes to visit the out-grower farmers. Sending and receiving messages also took time because of the distances between the outgrowers and field supervisor / agritex officers. The outgrower manager conceded that while farming was/is still manageable, *"it's rather slow, like cutting a huge Mopani tree with a blunt axe."*

In the question of whether or not the CPC staff partially used mobile technology in their execution of duties, the response from all eleven interviewees was YES. The response to this question is the bridge between digital and non-digital frameworks in outgrower management. The responses from all eleven participants indicated that mobile technology is indeed a game changer as it enables faster communication, better record-keeping, quicker payment mechanisms, better logistical planning, and better resource allocation, among other things. These findings point to the conclusion that despite the increased use of mobile and digital technology, together with a myriad of applications that are used to manage outgrower farmers, in practice, many other processes and functions in managing outgrowers remain manual and non-digital. This results from limitations such as poor literacy levels, incompetency to use mobile devices by out growers, poor network and poor signal.

5.5 Challenges for implementing mobile technology

The literature review indicated that deploying mobile technology for managing outgrowers by agribusiness is a rather complex process that requires assessing several matrices and factors before adopting or developing a mobile technology system. Hence, one must understand the potential inhibitors of successful mobile technology implementation beforehand. The literature implied that one has to look for the following factors that include, but are not limited to, choosing the right information dissemination model to manage outgrowers effectively; looking at the required information infrastructure, farmers' capabilities; operating and maintenance costs of the system; pre-assessment exercise to check if the model will suit the local context (environment) and if data captured can be pushed in real-time; if required infrastructure is in place to support the technology requirements; if technology to be adopted or developed match with the education level of people who will use it (skills match requirements for that technology), and lastly the need to train the people who will be using the technology.

The empirical data showed some similarities to the literature review, namely that the following challenges could influence implementing mobile technology for managing and facilitating outgrowers. These include mobile phone data being expensive and incapability by farmers to acquire mobile devices (operating and maintenance costs of the system), lack of the know-how to operate phones (skills of users not matching requirements for that technology), having poor network and power cuts or no electricity to charge phones (lack of required infrastructure in place to support the technology requirements).

Additionally, the study revealed that some farmers are illiterate (cannot read or write). This is another challenge that can inhibit the successful implementation of mobile technology since these farmers cannot report in the form of written content and comprehend information received in the form of written content. Also, refection of false information by devices was found to be another challenge. The study explained that some mobile devices have very poor cameras, so when farmers take pictures of an affected plant by diseases to report to field supervisors / agritex officers, the image produced will be inadequate, and as a result, makes it difficult for the field supervisor / agritex officer to recognise that disease and offer agronomy support to the farmer.

5.6 Factors enabling the use of mobile technology by agribusinesses

The research findings established a dual classification of enabling factors. The first classification contained **push factors,** which refer to factors that force agribusiness to use mobile technology to manage outgrower farmers. **Pull factors** are those factors that attract agribusinesses to use mobile technology to manage outgrower farmers.

Push factors include efficiency, global and regional trends, the drive for profit and productivity, the drive for enhanced operations, and sustainability. Global trends have also shown a shift in digital transformation. Cloud technology, big data, the Internet of things, software as a service, artificial intelligence, and robotics now characterise the global village. Over the past decade, we have seen the third industrial revolution change the game in digital technology. A shift from mechanical and analogue electronic technology to digital electronics/ technology like mobile technologies. This has forced many industries to adjust to the new technology. The agriculture sector and CPC as an agribusiness are no exception to these push factors. This has forced CPC to adopt mobile technology in parts of its outgrower management processes.

Empirical evidence from the study has revealed very positive perceptions by participants of mobile technology's ability to achieve improved productivity and profitability for growers while harnessing their livelihoods. Participants shared some of the pull factor benefits that come with mobile technology, including efficient and effective managing of outgrower farmers through the use of mobile technology; less workload on managers since no manual computer input will be required from them; easy and quick communication through calls that will allow quick addressing of problems remotely; quick dissemination of information through digital means, without one having to travel long distances to provide the information; better traceability and monitoring to adhere to food safety standards that have become increasingly regulated around the world as a means to mitigate food-related scandals and outbreaks. Additionally, new knowledge and skills are acquired through adopting new technology. Lastly, agribusiness keeps up with the ever-changing world of technology and benefits from it.

The advent of COVID-19 also came across as a strong push factor to the use mobile technology because mobile phones and tablets allowed physical reality to be conveniently replaced by virtual reality.

On the other hand, the pull factors included the availability of mobile phones among agribusiness staff and outgrower farmers. The availability of three major mobile network

companies in Zimbabwe, namely ECONET, NETONE and TELECELL, that cover most urban areas well and are working on improving network infrastructure in rural areas for improved reception are also sufficient pull factors. The excessive delays caused by the use of manual copies and physical meetings are also very strong pull factors to the adoption of mobile technology.

5.7 Deployment of Mobile Technology

Empirical data revealed that more than 50% of the participants were in agreement that mobile technology can be deployed for all outgrower management processes. Most respondents showed positive belief in deploying mobile technology, as they justified their positive responses by saying mobile technology is not time-consuming as compared to traditional systems; challenges raised by farmers can quickly be addressed, and information can easily be conveyed/disseminated to farmers without delays; it reduces costs associated with buying receipt books; It also reduces the amount of work that comes with dealing with the paper-based system; Information can be stored more secure; enables keeping up with global trends to benefit from the technology; it's a far more efficient way than sending notes back and forth; two-way communication can be attained and real-time data sharing.

However, a few respondents disagreed with the rest of the participants, who agreed that it's possible to deploy mobile technology for all outgrower management processes due to external factors like poor networks in rural areas where most farmers are based and farmer illiteracy.

5.8 Theoretical Contributions

The theoretical contributions of this research are strongly rooted in the literature's non-empirical findings, empirical findings and refined conceptual framework. This research presents findings on mobile technology used by agribusinesses to manage growers. Findings revealed that mobile technology could change the game in managing outgrowers if outgrower management processes are digitalised. This research has addressed the existing literature gap and contributed to the theoretical body of knowledge by exploring mobile technology used by agribusinesses to manage outgrowers in the context of Zimbabwe, specifically regarding the Chilli Pepper Company.

Additionally, the theory contribution of this research study was a model (framework) that was developed based on both empirical and non-empirical research findings. Research

findings (conceptual framework) revealed that improved productivity, profitability and sustainability could be achieved if key outgrower management processes can be digitalised in the form of mobile technology to address inefficiencies associated with traditional systems. The processes highlighted in the framework that need transformation to digitalisation include pre-assessment of outgrowers/ irrigation schemes; farmer profile management; communication; monitoring and traceability; payments, funding and transactions; inputs loan management; meetings without growers; outgrower diary management; reporting; and training and workshops.

Any agribusiness, including CPC, would gain tremendously because the aforementioned factors brought with them the benefits of increased yield and better product quality, efficiency in collecting grower data, enhanced corroboration of farmer activities from seedbed to harvesting, better profitability, better broadcast of information about the disease, pest tracking, and storage, dedicated farmer profiles, centralised information dissemination to outgrowers via bulk SMS and the various socials like WhatsApp and enabled visual communication via videos and photo sending. This theoretical undergirding reflected in the conceptual framework objectively validates the findings of this study because, when compared, they stand in equal splendour.

5.9 Practical Contributions

The theoretical relevance of this study finds its expression in the practical implications as detailed in the raw data and the eventual themes collapsed from the same raw data. The research provided guidelines that agribusiness managers can use to understand how mobile technology can help them manage outgrowers and improve their productivity. Additionally, the study provided a model/ framework that agribusinesses, including CPC, can use to enable them to implement the technology.

A spectrum of time gave a clear outline of the practical contributions of this study to the agricultural ecosystem, as shown in Figure 5.1. The time spectrum starts with the past, looks at the present and then projects the present to the future. The past is the time of the pre-digital landscape. This was a time of feudalism, subsistence farming in an African setting with manual tools made of wood and iron. This time, agriculture couldn't even be commercialised because of limited yield and traditional agricultural procedures that allowed crops to be grown for family and community sustenance. The present, however, saw the introduction of industrialised equipment, machines, hybrid seeds, pest control chemicals, and fertilisers, among other implements, to better the yield per hectare. In this framework, CPC and many other agribusinesses were birthed to begin

commercialising this sector and expand their operations by subcontracting outgrower farmers. At this time, mobile technology has become a game changer, moving from traditional systems to more modern and digitalised methods. From the present comes the future, which is characterised by artificial intelligence, robotics, and mobile applications custom-made for the farming of crops, running the irrigation automatically, spraying automatically, planting, and harvesting automatically. This is a stage that CPC has yet to reach and aspires to achieve in the near future.

This study has, therefore, been able to demonstrate the differences between past, present and future implications of technology relative to CPC as an agribusiness. This fulfils the purpose of this study in that it weighs in on the potential mobile technology has to improve the present, referring to the past while strategically forecasting future goals of modifying methods in compliance with the trending digital technologies.

Figure 5.1 Time to time significance of the evolving thought on mobile technology

Source: Adopted from field notes

This study has also shown that there is a huge potential for using mobile technology to manage outgrower farmers based on countering the challenges encountered in the past.

The major conclusion was that the significant problems and challenges faced by CPC and its outgrower farmers could not be solved if they remained at the same level they were when they created them. This implies that a paradigm shift is inevitable and change management is unavoidable. Failure to do so will be five steps forward and ten steps backwards, taking you back to where you once began, and the cycle will continue. However, to break this cycle, CPC must be given a chance to change, be versatile in adopting new technologies, and even benchmark what is happening in neighbouring countries regarding the use of mobile technology to manage outgrower farmers.

Since CPC operates within the sub-Saharan agricultural ecosystem, this study has become an eye-opener to sister agribusinesses, commercial farmers, and small-scale farmers regarding their potential to tap into various agricultural technologies to their

advantage. Similarly, the findings of this study give the Department of Agriculture an eagle eye on an agricultural problem that can easily be resolved by better government policy, intentional government willingness and intentional government funding. The use of mobile technology, according to this study, can also enhance agriculture entrepreneurship in that most outgrower farmers are, in fact, small-scale farmers who grow crops not just for consumption but to sell to Agri-markets and commercial farmers.

5.10 Recommendations

The researcher recommends that CPC design a dedicated digital outgrower management platform for managing its growers. In essence, CPC must not rely solely on Android-based applications, basic applications like Word and Excel, and basic social apps like WhatsApp. Rather, they should design and invent a bespoke chilli outgrower management platform.

In addition, the researcher suggests that CPC invest in the confidence of its outgrower farmers by capacity building. Such capacity building should incorporate sponsored training workshops, CPC-branded tablets and mobile devices, and scholarships for agricultural qualifications to improve farmers' skills and knowledge.

Moreover, CPC can also create educational hub centres where its farmers can get educated on mobile technology use and have free access to Wi-Fi for research purposes.

CPC can also incentivise outgrower farmers by offering rewards to outgrowers with the highest yields. These rewards can range from as little as Wi-Fi/data bundles to as big as a tractor for ploughing. This would increase competition and the motivation to do things correctly because of the momentum to win a prize or a reward.

Some field officers indicated that most outgrower farmers are very poor, and as a result, they focus more on growing their staple crops and some traditional cash crops that don't give returns as much as chillies can. CPC should systematically mentor its outgrower farmers so that they transition from subsistence to commercial contractors. They can do this by helping farmers to get loans from banks using historical yields produced and sold to CPC to show banks that they have a source of income. This will, in turn, increase yields, resulting in increased earnings for these outgrower farmers.

The researcher strongly believes that the recommendations, if endorsed by the CPC, will prevent post-harvest losses and improve the outgrower livelihoods while keeping

the CPC at bay from making losses. Small to medium agribusiness companies such as CPC are therefore challenged with the task of balancing between profit orientation and outgrower livelihood.

5.11 The Research Limitations and Future Research

The study was conducted on one organisation as a case study. As such, the results are limited to one organisation; therefore, they cannot be generalised beyond the context of the case study. Also, the study was limited to the farming industry; thus, the findings cannot necessarily be extended to other sectors.

The researcher failed to interview everyone who he had scheduled a date and time to interview. Of the 13 people the researcher expected to interview, 2 participants cancelled due to unexpected circumstances, leading to cancelled interviews. Therefore, this might have implicated the depth and breadth of the findings.

Five of the interviews that were done had significant sections answered in Shona, which is the most spoken language in Zimbabwe. This resulted in the researcher transcribing the audio into Shona and then translating the Shona transcribed sections into English. This was quite a slow and cumbersome task that took more time than was expected by the researcher. Additionally, the researcher used Otta Ai, a speech-to-text transcribing software. While the software worked so well with interviewees with a good Anglo-American accent, it also did so poorly for interviewees with a Shona accent. This resulted in further editing of the transcripts that Otta Ai generated. Most sentences and words were misrepresented, and incorrect and physical editing was inevitable, thus exacerbating the time costs of this study. As such, the researcher had to work long hours to complete these tasks, given the limited time required to conduct data analysis. Working long hours results in fatigue, and a fatigued person is highly likely to miss or make mistakes. With that said, the resulting limitation is that the researcher might have missed or misinterpreted important information that has a bearing on the accuracy of the analysis.

Most journals and publications on mobile technology use in farming and agribusinesses were published outside Zimbabwe, with a few sources from Zimbabwe. At the same time, such data sources were necessary to bring out the literature's implications for this study. They, however, were not sufficient to provide the real architecture of the Zimbabwe agribusiness setup and mobile technology use.

On the other extreme, some of the participants also wanted to showcase their pride and expertise to the researcher, which resulted in a lot of digression and probing to sieve the response to the question. This resulted in very lengthy interviews, some way over one hour long. This had a knock-on effect of time-consuming translation, transcribing, interview content editing and proofreading for coding. As such, the researcher had to work long hours, sometimes fatigued and as previously mentioned in previous paragraphs, the chances that a fatigued person can make mistakes are high. So as a result, the researcher might have missed or misinterpreted important information that has a bearing on the accuracy of the data analysed.

The second research question that guides the study “How can mobile technology be deployed to enable agribusinesses to manage outgrowers remotely?”was answered based on the insights from the first research question, which is very limiting.

Lastly, this research lacks qualities of quantitative research since a qualitative approach was used. The qualitative approach relies on non-numeric data and lacks what a quantitative approach can offer, which is measurable statistical data presented in numeric data to conclude facts and reveal different research patterns (Denzin and Lincoln, 2003).

It is therefore, recommended that future researchers consider doing a replica of this study but at a regional level sub–Saharan region). Additionally, future research could consider research that addresses how mobile technology implementation challenges can be addressed for the smooth management of outgrowers by agribusinesses in the sub-Saharan region. Further, future research should consider the effectiveness of mobile technology in managing agribusiness outgrowers in the context of the sub-Saharan region. These recommended future research studies could address some of the limitations of the study highlighted previously so that the Southern African region can benefit from this research and farming can possibly boost the economies of the area as a whole.

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APPENDICES

Appendix A Ethical Clearance

Cape Peninsula University of Technology

P.O. Box 1906 • Bellville 7535 South Africa •Tel: +27 21 4603291 • Email: fbmsethics@cput.ac.za
Symphony Road Bellville 7535

Office of the Chairperson Research Ethics Committee	FACULTY: **BUSINESS AND MANAGEMENT SCIENCES**

The Faculty's Research Ethics Committee (FREC) on **20 October 2020**, ethics **Approval** was granted to **Ozasala Moyo (218300891)** for a research activity **M Tech: Business Administration** at Cape Peninsula University of Technology.

Title of dissertation/thesis/project:	**The potential for mobile technology use by agribusinesses to manage outgrowers: A case of the Chilli Pepper Company, Zimbabwe** Lead Supervisor (s): Ms L Harker

Comments:

Decision: APPROVED

	**21 October 2020**
Signed: Chairperson: Research Ethics Committee	**Date**

Clearance Certificate No | 2020FOBREC808

Appendix B Permission to Conduct Research: Chilli Pepper

The Chilli Pepper Company
37 Lewisam Avenue,
Chisipite,
Harare,
Zimbabwe

Tel: +263 242 49 6621
Fax: +263 242 49 6621
Vat: 10057032

September 22, 2020

I, Dr. Ferrell V. Osborn, in my capacity as the Executive Director of The Chilli Pepper Company, hereby give consent for Ozasala Moyo, a Master's degree student at the Cape Peninsula University of Technology, to collect data at The Chilli Pepper Company as part of his research study requirements for his Master's of Technology in Business Administration. The student has provided me with literature that explains the nature of the research, what it involves, and the type of data to be collected.

This consent does not grant the researcher the right to interview individual staff members as part of this study. The student must obtain consent directly from each staff member if he wishes to interview them.

Additionally, the company name may or may not be used as follows: **Thesis**: Yes; **Conference Paper**: No; **Journal Article:** Yes; **Research Poster**: No.

If anyone has questions or concerns regarding this consent letter, please contact my office at +263 (0) 242 496621 or email me at loki@elephantpepper.org.

Date; 22 September 2020

Dr Ferrell V. Osborn
Executive Director
The Chilli Pepper Company

The Chilli Pepper Company

Cape Peninsula University of Technology

Faculty of Business and Management Sciences

Ethics Informed Consent Form

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

Category of Participants (tick as appropriate):

Staff/Workers	**X**	*Teachers*		*Parents*		*Lecturers*		*Students*	
Other (specify)									

You are kindly invited to participate in a research study being conducted by **Ozasala Moyo** from the Cape Peninsula University of Technology. The findings of this study will contribute towards (tick as appropriate):

An undergraduate project		*A conference paper*	
An Honours project		*A published journal article*	
A Masters/doctoral thesis	**X**	*A published report*	

Selection criteria

You were selected as a possible participant in this study because you are:

a) An employee of The Chilli Pepper Company
b) Working at the company for at least 2 years; and are aware of the outgrower management activities and/or interact with outgrowers.

The information below gives details about the study to help you decide whether you would want to participate.

Title of the research:

The potential for mobile technology use by agribusinesses to manage outgrowers: A case of The Chilli Pepper Company, Zimbabwe

A brief explanation of what the research involves:

This study aims to explore the use of mobile technology to better manage outgrowers of agribusinesses. Primary data will be generated through conducting face-to-face interviews with The Chilli Pepper Company management and employees.

It is envisaged that this research will help to develop a model/ framework that can be used to guide the implementation of mobile technology to better manage outgrowers. The research will provide guidelines that can be used by agribusinesses managers with small holder outgrower schemes to understand how mobile technology can help in the management of outgrowers.

For one to participate in this study he/she must be 18 years or older. Participation is voluntary and if you are not willing to participate there is no penalty or loss of benefit to which you are entitled as an employee of The Chilli Pepper Company.

The interview should take not more than one hour (60 min). All the information will be used for academic purpose only and will be treated with maximum confidentiality. Your responses will only be used for the purposes of this research.

Procedures: Interview

If you volunteer to participate in this study the following will be done:

1. Describe the main research procedures to you in advance, so that you are informed about what to expect;
2. Treat all interviewees with respect by arriving on time for all the interview schedules and well prepared;
3. Conduct an introduction with the interviewee in order to break ice;
4. All the interviewees will be asked for permission to record the interviews and also take some note where applicable;
5. In a case where there is no clarity, the interviewees will be allowed to ask for confirmation or clarity of words/sentences/phrases to ensure accuracy of the data collected;
6. Participants will be told that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs;
7. Participants will be given the option of omitting questions they do not want to answer or feel uncomfortable with;
8. Participants will be told that questions do not pose any realistic risk of distress or discomfort, either physically or psychologically, to them;
9. At the end of each interview all the interviewees will be thanked for their time and information provided for this study;
10. Participants will be debriefed at the end of their participation (i.e. give them a brief explanation of the study).

You are invited to contact the researchers should you have any questions about the research before or during the study. You will be free to withdraw your participation at any time without having to give a reason.

Kindly complete the table below before participating in the research.

Tick the appropriate column

Statement	Yes	No
1. I understand the purpose of the research.		
2. I understand what the research requires of me.		
3. I volunteer to take part in the research.		
4. I know that I can withdraw at any time.		
5. I understand that there will not be any form of discrimination against me as a result of my participation or non-participation.		
6. Comment:		

Please sign the consent form. You will be given a copy of this form on request.

Signature of participant	Date

Researchers

	Name:	Surname:	Contact details:
1.	Ozasala	Moyo	Mobile: +27 64230 1109

Contact person: Ozasala Moyo	
Contact number: +27 64 2301109	Email: ozzymyo@gmail.com

INTERVIEW QUESTIONS

Interview Guide for The Chilli Pepper Company Management and Employees

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My name is Ozasala Moyo. I'm a master's student at Cape Peninsula University of Technology studying towards a master's degree in Business Administration. I am conducting research entitled: The potential for mobile technology use by agribusinesses to manage outgrowers: A case of The Chilli Pepper Company, Zimbabwe. It is envisaged that this research will help to develop a model/ framework that can be used to guide the implementation of mobile technology to better manage outgrowers. The research will provide guidelines that can be used by agribusiness managers with small holder outgrower schemes to understand how mobile technology can help in the management of outgrowers. Feel free to give whatever answers you deem appropriate. There's no right or wrong answer. Every answer shall have a special contribution.

For you to participate in this study you must be 18 years or older. Participation is voluntary and if you are not willing to participate there is no penalty or loss of benefit to which you are entitled as an employee of The Chilli Pepper Company.

The interview should take not more than one hour (60 min). All the information will be used for academic purpose only and will be treated with maximum confidentiality. Your responses will only be used for the purposes of this research.

All responses will be used for academic purposes only and the confidentiality clause is honoured.

Section A: Basic data

1. Gender: Male ☐ Female ☐

2. Age: 18 -25 ☐ 26 – 35 ☐ 36- 45 ☐ 46 -55 ☐ 56 and above ☐

3. How many years have you been working for The Chilli Pepper Company:

2-3 years ☐ 4-5 years ☐ 6-10 ☐ above 10 years ☐

4. Position Held: Manager ☐ Supervisor ☐ Employee ☐

Section B: Outgrower management and reporting processes

1. Explain the processes for managing outgrowers.
2. Explain the challenges of managing outgrowers.
3. Explain the systems and methods used for managing outgrowers.
4. Explain the challenges experienced with the systems and methods used for managing outgrowers.
5. Outline the data and/ or information that is required to optimally manage outgrowers.
6. Explain how you ensure that outgrowers operate sustainably, productively, and profitably.
7. Explain the reporting outcomes after the grower season.

Section C: Mobile Technology

1. Are you aware of mobile technology use in the agricultural sector?
2. Have you been exposed to using mobile technology within the agricultural farming context?
3. Are you aware of any applications of mobile technology within the agribusiness-outgrower context?
4. What do you think are the challenges that will influence implementing mobile technology for managing outgrowers and facilitating outgrower processes?
5. Do you think it is possible deploy mobile technology for all the outgrower management processes?
6. What is your perception about the use of mobile technology to manage outgrowers?