An investigation into the use of digital technology in promoting agribusiness development in Lesotho: The case of Leribe and Thaba-Tseka districts

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DECLARATION

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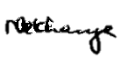
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Key terms

Digital technology use, agribusiness, technology, digital technology, development, Lesotho

DEDICATION

This thesis is dedicated to my late friend Majara Mopeli, I know how much education meant to you, how you could have pursued your education, specifically agriculture. May your soul rest in peace. I will never forget your support through my academic journey. I dedicate this thesis further to every girl who does not believe in themselves, those who are facing challenges in their education; there is time for everything, trust the process and do not give up.

“For everything there is a time, a season and time for every matter under heaven....” (Ecclesiastes 3:1-8)

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ABSTRACT

This study investigated how digital technology, as a new endeavour of agribusiness, contributes to the development of agribusiness globally and in Lesotho; thus, it fills the gap in previous studies. It was conducted in Leribe and Thaba-Tseka districts, Lesotho, with a study population of 5 506, using a mixed-methods approach, through a questionnaire, to a randomly selected sample of 400, as well as two focus groups of eight participants each, and 12 key informant interviews, as the population. Qualitative data were analysed using thematic analysis, while a statistician analysed the quantitative data with the Statistical Package for Social Sciences (v 29.0). Based on the research findings, the most commonly used digital technologies are mobile phones and computers, with a significant impact on the promotion of agribusiness in Leribe and Thaba-Tseka districts, and Lesotho in general. This is due to the costs of digital technology, lack of access to credit, absence of government financial support, and characteristics of their agribusinesses, in addition to insufficient digital skills, as well as inadequate infrastructure and electricity. The study further revealed the potential digital technology benefits for agribusiness and how not having access to digital technology impacts agribusiness development in Leribe and Thaba-Tseka districts. The study concludes, while there is familiarity with digital technologies in agribusiness, these businesses influence each other to adopt technology, where digital technology use by agribusiness solely depends on government initiatives, programmes, policies and training that foster technology use in agricultural value chains, as well as infrastructure such as electricity and broadband. Farmers, extension workers and agricultural officers lack ongoing training technology use, as well as resources to combat climate change. The study, therefore, recommends climate change policies to keep farmers in the value chain; it recommends financial support for farmers and for agribusinesses to employ skilled workers as well as skills transfer between government's relevant institutions and agribusinesses.

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LIST OF ABBREVIATIONS AND ACRONYMS

AfCFTA	African Continental Free Trade Agreement
AI	Artificial intelligence
AIS	Agricultural Information Service
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
DoI	Diffusion of Innovation
FAO	Food and Agricultural Organisation
FMARD	Federal Ministry of Agriculture and Rural Development
GDP	Gross Domestic Product
GEM	Global Entrepreneurship Monitor
ICT	Information, Communication, and media Technologies
IFAD	International Fund for Agricultural Development
ITA	International Trade Administration
ITU	International Telecommunication Union
IoT	Internet of Things
LEWA	Lesotho Electricity and Water Authority
MAFS	Ministry of Agriculture and Food Security
NGO	Non-government organisation
OECD	The Organization for Economic Co-operation and Development
SA	South Africa
SME	Small and Medium Enterprise

SSA	Sub-Saharan Africa
SPSS	Statistical Package for Social Sciences
UN	United Nations

CHAPTER 1
RESEARCH PROBLEM AND ITS SETTING, RESEARCH QUESTIONS AND OBJECTIVES

1.1 INTRODUCTION

Agribusiness is a term used to describe agriculture and business, becoming significant in the 21st century (Rahman and Hossain, 2023). This is because agriculture has been a dominant sector in many of the poorest countries in the developing world since 1965 (Sahi 2022). However, regardless of the role agriculture has played in creating employment and securing food over the years, it is also clear agribusiness and agriculture are experiencing a decrease in magnitude towards this contribution, particularly in least developed countries such as Lesotho. As a result, it has increasingly become necessary to produce agricultural products that match the demands in markets as technology evolves, with Kozera-Kowalska (2025) showing agribusiness includes all activities that utilise agricultural raw materials, encompassing both food and non-food sectors. In addition, due to the critical role digital technologies play in agriculture, smallholder agriculture in particular; the industry has experienced increased attention geared towards harnessing its potential, to ensure the agricultural sector is improved, specifically in developing countries (Nat, 2018).

Agribusiness development is one of the most important efforts made by agricultural agencies to improve the well-being of farmers. The World Economic Forum (WEF) states digital technology for agriculture empowers farmers, enabling the use of technologies such as mobile phones, to gain access to real-time, customised, and actionable agricultural information. This could revolutionise how communities ensure improved livelihoods. Therefore, with restrictions faced by many agricultural extension officers concerning in-person visits to farmers, initiating digital adoption could positively impact the income gap in rural areas (WEF, 2020).

As with many developing countries, more than 80 percent of the Lesotho population’s livelihood depends on subsistence agriculture, either in rearing animals and/or through crop farming (Mekbib, Olaleye, Adesola, Mokhothu, Johan, Tlai, and Taddese, 2012; Rantšo, 2016a). Smallholder farmers dominate the country's agricultural production, according to the

International Fund for Agricultural Development (IFAD), with livestock contributing 4.4 percent of Lesotho's Gross Domestic Product (GDP), while crop production contributes 1.9 percent to the rural economy (IFAD, 2018). Consequently, Warwimbo (2017) argues Lesotho's agricultural contribution to GDP could be enhanced by improving agricultural operations and through achieving value addition to agricultural products by farmers, such as agribusiness. Improved operations will pave the way for economic growth, improved technical skills, and structural transformation, thus highlighting the need for innovations in agribusiness.

This research investigated digital technology use for agribusiness development and promotion in Lesotho, with the focus on agribusinesses in the Leribe and Thaba-Tseka districts. The goal of digitalisation is to maximise automation of all production stages, thus improving production in the food value chain (Ashalatha and Rao, 2023). The study, therefore, sought to answer several questions regarding digital technology use for agribusiness development promotion in Lesotho, in addition to investigating the digital technology values and impacts on agribusiness and agricultural productivity, as well as policies in place to promote agribusiness development in Lesotho and the challenges they pose.

1.2 BACKGROUND

The history of technology use in agriculture proves technology use contributes to development of the sector. The introduction of agriculture intensification through technology was based on chemical inputs and fossil energy, which involved significant financial investments in agriculture and are more feasible in industrial and emerging countries such as China, India and Brazil, than in developing countries, resulting in increased production (Temple, Chiffoleau and Touzard, 2018).

In Africa, the development of agribusiness through technology is not a new phenomenon. Elorm and Egbo (2024) show that agricultural technologies have changed much over the years, where some have been more successful than others and many technology companies are still developing new technologies to assist agriculture at every level. Sinha (2023) further points out that agricultural production, in recent years, is increasingly dependent on technology advances and policy for agriculture development, all aimed at enhancing productivity. On the one hand, Zylbersztajn (2017) found economists approached agriculture and production mostly through

the lenses of markets and prices until the 60s. Moore (2010), on the other hand, determined although agriculture was confined to the level of subsistence farming in days gone by, it has now, however, become a multinational business.

Since its independence in 1966, Lesotho has struggled with its agricultural development (Eckert, Hill and Mokotjo, 1990). According to Machebelele, Mosebo, and Eckert (1992), when Lesotho gained independence in 1966, crop production contributed approximately 60 percent of the country's agricultural output value, with livestock providing roughly 40 percent. In cropping, Lesotho increased marketed surplus, farm production, and agribusiness; as a result, the country was internally self-sufficient in basic food. Before 1973/1974, the marketing of crops, livestock, and their products, as well as the supply of agricultural products, rested largely in the hands of private regulators (Machelebe and Mokitimi, 1992).

Over the past 20 years, Lesotho has constantly been on a long process of political, economic and social reforms, to improve the business environment, promote economic growth and reduce poverty in the country through agriculture, as one of the important sectors that employs a large population in Lesotho (Central Bank of Lesotho, 2012)

The National Strategic Development Plan 2012/2013-2016/2017 states Lesotho intended to promote investment in the agro-industry and development of agribusiness, to increase value addition and market integration. The Government of the Kingdom of Lesotho (GOKL) identified agriculture as one of the productive sectors for job creation and poverty reduction under its 2018-2023 National Strategic Development Plan (International trade administration (ITA), 2024). Additionally, the United Nations (UN) Food and Agricultural Organization (FAO) (2018a) further pointed out food producers in rural areas are hindered from participating in the local economy, constrained in pursuing entrepreneurial activities, and limited in hopes of raising their income; subsequently, the rural people are stuck in a vicious cycle of poverty.

Reva (2019), furthermore, shows agribusiness in Lesotho remains rudimentary, with little growth or development over the years. This results from various challenges, for example, most farmers are involved in the subsistence cultivation of cereals, yet the country does not have a competitive advantage in this sector, due to the lack of mechanisation and limited digital skills (Reva, 2019).

Mojaki and Keregero (2019) further indicate farmers had, to date, achieved neither agricultural information nor appropriate learning. The key challenges include the limited flow of information knowledge, use of new technologies, and resources among actors in the technology–delivery–utilisation system (Barakabitze, Kintinfi, Sanga, Shabani, Philipo and Kibririge, 2015). This inhibits the adoption and use of digital services by these subsistence farmers, leading to limited success of agribusinesses in promoting economic development.

Noteworthy opportunities are, nonetheless, indicated by digital technology development for agribusiness in the conventional agricultural extension that could result in relevant information and support for small-scale farmers; thus, enabling a positive response to food security and market development. These opportunities arise before, during, and after production on the farm and stem from the impact digital agriculture has on the entire agri-food value chain. Prospects include e-commerce platform interactions, e-extension services, and systems such as warehouse receipting and food traceability, along with farm equipment rental or sharing applications. Benefits from these opportunities include improved supply chain management, reaching new export markets, and optimised, as well as traceable, food systems (Shepherd, Turner, Small and Wheeler, 2018).

To remain competitive, agricultural producers need rapid access to emerging technologies; hence, the study examined how digital technology could facilitate farmer participation in agribusiness and systems such as warehouse receipting and food traceability, along with farm equipment rental or sharing applications. This study assumed there may be benefits from these opportunities.

1.3 STATEMENT OF THE PROBLEM

Mohlehli and Rantlo (2016) find agribusiness in Lesotho lagging in technology use, therefore, the poor use of technology constrains agribusiness development in Lesotho, because it results in lack of access to communication. This, in turn, has the potential to empower agribusinesses with timely knowledge, reducing transaction costs, and appropriate skills for increasing their farming productivity. As per a recent United Nations Conference on Trade and Development (UNCTAD) (2018) report, Lesotho has just entered the digital era and is not yet fully prepared for it in a way that can lift the entire population out of poverty. However, countries such as

Russia (Kundius and Pecuh, 2019), and Ghana (Atanga, 2020) use a variety of digital technologies, including information technology (IT), which has expanded agribusiness opportunities. Therefore, according to these studies, digital technology can significantly boost agribusiness, create more employment and facilitate economic development for Lesotho.

Melia (2019) illustrates that new digital technologies are expected to hugely impact developing countries, assisting with provision of real-time information to farmers in remote areas and enabling farmers in isolated locations to trade internationally. Despite the possibilities and the results achieved in other countries, several factors may constrain the adoption of digital technology in Lesotho, such as poor infrastructure (Motseki-Mokhothu, 2018), limited access to capital (Motsoari, Cloete, and Van Schalkwyk, 2015), low literacy among agribusiness owners (Mohlehli and Rantlo, 2016) and lack of access to markets remains a challenge for farmers (LENA 2026).

Outdated policies also do not address the current issues of agriculture and agribusiness, such as digitisation of agriculture to utilise technology. As a result, the World Bank (2016) shows Lesotho's agribusiness suffers from low levels of productivity and commercialisation. Consequently, the study explored the possibilities of agribusiness and how advancements in digital technology could offer agribusiness opportunities to utilise knowledge, markets, and information, in order to improve the agribusiness in Leribe and Thaba-Tseka districts, as representative of a large number of agribusinesses nationwide.

1.4 RESEARCH QUESTIONS

- Which policies are in place to promote agribusiness development in Lesotho and what challenges do they pose?
- What are the past and present efforts and strategies in digital technology use for agribusiness development in Lesotho?
- How does the characteristics of agribusiness in Leribe and Thaba-Tseka districts impact digital technology use?
- What are the challenges and their effects that influence digital technology use in Leribe and Thaba-Tseka districts?

1.5 RESEARCH OBJECTIVES

The overarching objective of the research was to investigate digital technology use in promoting agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

- To examine the status and extent of existing policies concerning agribusiness development promotion in Lesotho, with specific reference to the districts of Leribe and Thaba-Tseka;
- To investigate past and present efforts and strategies in digital technology use for agribusiness development in Lesotho and the impact on agribusiness development;
- To assess how the characteristics of agribusinesses impact digital technology use in the Leribe and Thaba-Tseka districts;
- To explore the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

1.6 SIGNIFICANCE OF THE STUDY

The significance of the study stems from minimal growth and development of agribusinesses, despite digital technologies aimed at accelerating growth worldwide, by increasing production and exposing farmers to global and regional markets. Furthermore, Lesotho continues to gain little to nothing from various agricultural trade deals; therefore, this study sought to provide insights and new knowledge and understanding into the current debates on digital technology use and how technology fosters trade for participation in trade agreements for agribusiness development.

Several studies concerning technology use in agriculture and challenges constraining agribusiness have been conducted in Lesotho; however, there is no specific study that investigates digital technology use by agribusiness in Lesotho; therefore, the study sought to fill the gap in the literature. This study will motivate agribusinesses and farmers to adopt digital technology for their agribusinesses, in order to produce and participate in markets, regardless of the characteristics and location of their businesses. The study findings will be disseminated among scholars to contribute to further studies of other countries, because the profile of rural areas in many underdeveloped countries is more or less similar. The study will also help policy

makers to formulate appropriate policies on digital technology adoption to boost agribusiness in Lesotho and other under-developed countries.

1.7 DEFINITIONS OF KEY TERMS

According to Leedy and Ormrod (1980), key terms are defined to determine whether the researcher has carried out what was posed in the research problem; therefore, each definition must interpret the term as it is used in the research project.

The key terms used in this study are defined to provide clarification of their context in the study

Agribusiness: In this study, agribusiness refers to any commercial activity involving agricultural goods that adds value, fosters production process synergy, imports and exports agricultural products, and redistributes items from wholesalers to retailers and eventually, to consumers (Rahman and Hossain, 2023).

Digital technology: In the context of this study, digital technology includes a wide range of technologies, tools, services and applications using various types of hardware and software, they incorporate the use of computers, digital television, radio, as well as mobile phones (Rice, 2003). In a broader sense, it comprises processing agricultural commodities, packaging and distributing them as marketable products, in addition to the related services (supplying fertilizer, seed and equipment) and, by extension, all agricultural production systems (Balineau, 2019).

Development: Development, as a concept in this study, refers to the application of various economic measures that utilise available resources to instigate economic growth and improve the quality of people's life, as an individual or group process that involves changing from one state to another (Rabie, 2016).

Technology: Is defined as products, including software, based on scientific knowledge (Hadidi and Power, 2020). Egie and Sharif (2025) describe technology as the application of knowledge for practical purposes used to improve the human condition, veterinary practices or to carry out other socio-economic activities. The intelligent production of new tools, including conceptual and ideational ones, for dealing with problematic situations, allows these tools to also be used in enhancing production in several sectors, such as agriculture and agribusiness (Hickman,

2001). In the context of this study, technology is referred to as human-made, because as Biro, Haslam and Rutz (2013) point out, technology can be natural or human made.

Technology adoption. The choice to acquire and use a new invention or innovation Hall, Khan and Jones, 2002), which has a positive a positive impact on the personal and professional life of individuals and on organisations over a period of time (Hadidi and Power 2020), is referred to as technology adoption.

Agribusiness development: In the context of this study, agribusiness is defined as the process that creates the conditions for the fulfilment of agribusiness potential, in this setting, developed agribusinesses are expected to drive consistent and sustainable growth and compete in international trade (FAO, 2018b).

1.8 THESIS OUTLINE

The research consists of six chapters; each chapter contributes significantly to the study, as summarised below.

Chapter One: The research problem and its settings, research questions, and objectives
The chapter presented the research problem setting: background to the study and general introduction to the study, followed by research questions answered in the research, aligned to the research objectives the study hoped to achieve. The significance of the study and its contribution were highlighted, regardless of other studies undertaken on the same topic.

Chapter Two: Literature Review
In this chapter, a critical review of the literature on definitions of agribusiness, agribusiness trends, agribusiness development, and an overview of the state of agribusiness in Lesotho, globally and in other African countries, is offered, in addition to definitions of digital technology and its key features that influence technology use. Furthermore, barriers and conditions in digital technology use are detailed, along with a review of technological and agricultural theories, in relation to agribusiness development.

Chapter three: Research Methodology
In this chapter, the research philosophy, paradigm of the study and the methodology adopted for the study is set out. Techniques used for sampling, population, data collection tools and data

analysis tools are also discussed. The chapter further provides a detailed description and justification for the analysis tools and tests; for instance, how the tests contribute to answering the research questions and how the tests will be used to analyse the data and ethical matters of the research.

Chapter four: Presentation of quantitative and qualitative results

This chapter submits the results of analysed data in the form of themes for qualitative data, tables and graphs for quantitative data, as well as analysis with literature.

Chapter Five: Findings and interpretation /Data analysis

The analyses of quantitative and qualitative data are presented in this chapter. Qualitative data were analysed using thematic analysis (TA), followed by an extensive analysis using the literature review and comparison with theory. Quantitative data gathered by questionnaire items were analysed by a statistician using the Statistical Package for Social Sciences (SPSS) (v 29.0).

Chapter Six: Conclusions, recommendations and suggestions for further research

This is the final chapter of the study, comprising a detailed summary and extensive overview of the study, in order to confirm, extend and challenge the existing study, as a discussion on the implications of the theory, practice and policy. It also provides a brief summary of the introduction, research objectives, methodology and literature review, before summarising key findings, as well as recommendations.

1.9 CHAPTER CONCLUSION

The first chapter introduced the topic of study, its background and the problem statement, with the study significance explained and a brief review of literature on agribusiness, its development and the contribution of technology adoption and use to the agricultural sector in Lesotho through agribusiness development.

The next chapter offers an in-depth review of relevant literature, it will cover the historical overview of agribusiness and digital technology adoption in developing and developed countries, the state of agribusiness in Lesotho and globally, global agribusiness, as well as new agribusiness development trends, the role of agribusiness in the African Continental Free Trade Agreement (AfCFTA), and the link between agribusiness and digital technology, along with challenges faced by agribusinesses in technology use in Lesotho and relevant theories.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

According to Variyamparambath (2019), a literature review helps the reader to understand the research done by others, similar to the proposed study, and will aid the current study, because it answers the research questions, provides an overview of the research problem, engages in theory development, and evaluates theory or evidence, in addition to examining validity and accuracy (Ebidor and Ikhide, 2024). This chapter presents a review of the literature concerning the objectives and research questions, focused on the following headings: agribusiness, agribusiness development, innovation, and technology, as well as digital technologies. The literature review also examined two major theories underlying the study, namely modernisation theory and diffusion of innovation (DoI) theory. Finally, a summary of the entire review concludes the chapter.

2.2 HISTORICAL OVERVIEW OF AGRIBUSINESS AND DIGITAL TECHNOLOGY ADOPTION IN DEVELOPING AND DEVELOPED REGIONS

While farmers frequently simply lacked the capital to invest in commercial products, even had they wanted to, prior to the Second World War in particular (Weber, 2018), they continued in the tradition of taking on new technologies and adapting those to "toothier" purposes (Anderson, 2005). Nonetheless, with an excess supply of agricultural commodities in world markets in much of the post-World War era leading to low profitability in agriculture, a major concern of agriculture and agribusiness in developed nations became focused on increasing value (Sunding and Zilberman, 2001).

The continued development of agribusiness led to both physical and intellectual innovations, with Nielson, Meng and Hakobyan (2018) stating the upside of technology adoption is evidenced in the domestic trajectory of yields and production between 1992 and 2016, when the internet took over in the mid-1990s. Deichmann, Goyal, and Mishra (2016 cited in Mikhailov, Camboim, Reichert, and Zawislak, 2022) added the rapid adoption of digital technologies

dramatically reduced search costs incurred by farmers and traders, and hence, assisted in overcoming important constraints in the context of limited infrastructure.

Digital technologies have become an integral part of all spheres of human life and an unavoidable backbone of business (Hrustek, 2020). Furthermore, Quayson, Bai and Osei (2020) stated advances in digital technology have impacted the entire food chain, from suppliers of input products to customers. In addition, in many developing countries, smartphones are considered to be commonly used, in order for technologies to generate knowledge and offer access to information, extension services, market linkages, and distribution networks, as well as financial resources, and other inputs (Aker, 2010; Deichmann *et al.*, 2016, cited in Mikhailov *et al.*, 2022).

2.3 CONTRIBUTION OF AGRIBUSINESS INAFRICA'S ECONOMY

Agriculture, including agribusiness, plays a vital role in growth and development in Africa (FAO, 2016). According to the Alliance for a Green Revolution in Africa (AGRA), approximately 70 percent of the continent's population depends on agriculture-related livelihoods (AGRA, 2017). In addition, agriculture holds the key to broad-based economic growth, poverty reduction, and food security in Sub-Saharan Africa (SSA), due to the importance of the sector for SSA economies, the extent of rural poverty, and the dependence of 50 million small farms on agricultural income (Schaffnit-Chatterjee, Lanzeni and Hoffman, 2014). In addition, agriculture is thought to receive increased attention from national governments and international development partners, thus, interest in agricultural development should be spread beyond on-farm production, to include all aspects of the value chain, particularly for high-value commodities (Babu, Manvatkar and Kolavalli, 2015).

In the context of developing regions such as Africa, agriculture plays a vital role in the economic development of nations (Maiga, 2024). On that basis, Wright and Stigliani (2013) believe there is a greater need to understand the processes that underlie entrepreneurial growth. This issue can be traced back to Juma (2015), who highlighted the need for African countries to pursue policies that offer a wider outlet to more prevalent and diversified use of fertiliser, digital technology, and high yield resistant seed in varieties, should they need to scale up their agricultural productivity.

From a scholarly perspective, the literature identifies factors determining the success of agribusiness development and farming innovations (World Bank, 2016), labour markets, and seasonality (Ellis, 1998). Accordingly, there is a need for a mechanism to link black commercial farmers to markets and an integrated supply chain. On the one hand, connecting these farmers to the fresh produce markets will require the use of digital technologies. On the other hand, Simelane (2015) states enhancing entrepreneurial competence and capacity of the farmers appears to be very problematic; subsequently, educational processes are needed for the farmers to develop entrepreneurial skills in their agricultural business.

Mibey (2015) additionally emphasises that agriculture offers much attractive business, therefore, the transformation of the agricultural sector towards money-seeking endeavours will contribute to change in perceptions of society and the public regarding entrepreneurship. However, another key barrier to smallholder participation in high-value marketing opportunities arises from business orientation, identifying, solidifying and exploiting opportunities to sell to modern buyers, which require a certain entrepreneurial quality (Bingen, Serrano, and Howard, 2003).

2.4 STATE OF AGRIBUSINESS DEVELOPMENT IN LESOTHO

The UN (2023) report shows Lesotho's agricultural economy is characterised by stagnant agricultural productivity; this is a result of several challenges such as low use of farm machinery (Lesotho Bureau of Statistics (BoS), 2021), climate change (Otto and Verschuur, 2021) and technology (Mohlehli and Rantlo, 2016), while Nkholise (2020) determined a large number of promising technologies are already available. Nevertheless, Lesotho has not maintained the pace of growth with commercialising subsistence agriculture, as achieved elsewhere (Mokhethi, 2015; Rantšo, 2016a; Wickle, 2015).

The most significant challenges in Lesotho for both farmers and agribusiness, are the lack of a functioning market, irrigation, poor production by smallholders, and weak linkages within value chains (World Bank, 2018a, b). Wickle (2015) further added the absence of equipment or technology to utilise land productively is a problem for many small farmers, with tractors and other mechanised equipment relatively uncommon.

2.5 AGRIBUSINESS DEVELOPMENT IN OTHER PARTS OF THE WORLD

Tijani, Alawode, Gafar and Kolade (2017) state the perspective of sustainable agribusiness growth and development in Nigeria makes proper identification of agricultural sector constraints highly imperative. Oni (2013) identified the challenges underlying agribusiness sector development, including policy framework, political commitment, agricultural technology and infrastructure deficit, among others. The Federal Ministry of Agriculture and Rural Development (FMARD) states, in order to put Nigeria's agricultural sector on the path of growth, actions are required to solve the inability to meet domestic food requirements and export quality products required for market success, with a view of boosting agricultural production that will, eventually, impact significantly on agribusiness development (FMARD, 2016).

Tersoo (2014) adds the synergy between agribusiness and commercial activities offers great potential for development of the poor rural majority in Nigeria. This is unlike Denmark, where agriculture and agribusiness have been characterised by a high market share for cooperatives and strong international competitiveness. For decades, Danish cooperatives and agribusiness have developed and strengthened their structure, competitiveness, and market power, and farmers from other countries, whose agribusiness sector is less developed, can copy or learn from the Danish experiences (Hansen, 2011).

Sohane and Sinha (2019) highlight the rapid proliferation of digital infrastructure in the current decade in India, along with an increased thrust from the ‘Digital India’ initiative movement, have led to an easy reach of internet-based technologies to those at grassroots. In a study conducted in Bihar, and Punjab in India, Pandey, Khan and Kumari (2019) found agricultural growth in Punjab has been dominated by technological change and diversification, while in Bihar; the growth has been dominated by technological change and diversification towards horticultural crops. Reduced internet rates, along with rapidly increasing data speeds, have provided a better connect with the farming community, while offering services in a more customised way.

The way services were provided involved regular enabling of two-way communication between the researchers and the farmers, through video conferencing for training farmers from remote

locations, digital story telling through online streaming services, and promoting farm advisory services through the WhatsApp application. In addition, farmer friendly compact discs (CDs) were developed containing videos on new agricultural technologies and success stories of farmers, as well as dedicated community radio for the farmers, and offering online courses for entrepreneurship promotion among the farmers (Sohane and Sinha, 2019, p. 69-70).

In Punjab, agricultural growth came primarily from technological change and price increases. Additionally, in the context of efforts made by the Pakistan Government regarding access to technology, Pakistan was the first and the largest agricultural web portal that provided a platform where the farmer community could connect, sharing ideas, experiences and information in both English and Urdu (Government of Punjab, 2017). This was reported to have improved access to information, while it also enabled people to better defend their interests and articulate their needs, in addition to assessment of future agricultural technology for rural development, and ability to influence the decision-making process (Chapman and Tom, 2002; Tripp, 2001). This has, in turn, led to numerous new opportunities for agribusiness development (Gandi, 2017).

2.6 STATE OF GLOBAL AGRIBUSINESS DEVELOPMENT

Globally, agribusiness activities are understood to be economic or entrepreneurial activities that focus on the agricultural sector, for both developing and developed countries. Babu and Shishodia (2017) asserted agribusiness plays an important role in maintaining food security; however, there has to be productivity in agribusiness activities, including a level of competition.

In developed countries such as America, many farmers practice urban farming, as they are then closer to potential customers, even with limited land availability. Further to this, urban farming activities are carried out by adding a touch of rural names, resulting in tourism potential in urban and rural areas (Harrington, 2018).

In terms of digital technologies, Gabriel and Gandorfer (2023) show agriculture is, on the one hand, also experiencing dynamic and diverse developments in the digitalisation of operations, therefore, farmers in mid- and Western-Europe have access to an increasing number of digital applications and precision agriculture technologies (Maloku, 2020). On the other hand, Thompson and Gyatso (2020) find agricultural productivity in SSA continues to lag the rest of

the world, due to a lack of farm mechanisation and innovation. Tsan, Totapally, Hailu and Addom (2019) indicate digital technologies are, nevertheless, utilised in Africa, with nearly two–thirds farmers using digital tools in countries such as Kenya.

2.7 AGRIBUSINESS DEFINITIONS

The definitions of agribusiness have differed from time to time; the following sections thus discuss how different scholars have described agribusiness over the years.

Davis and Goldberg (1957) described agribusiness as the total activities of all operations involved in the manufacture and distribution of farm supplies, production operations on the farm, and the processing–distribution of commodities and items made from these activities. This definition best describes agribusiness in Lesotho; because according to Mohlehli and Rantlo (2016, pp. 1677-1682), Lesotho's agribusiness sector comprises the business activities performed "from farm to fork". Moreover, Mpiti and De la Harpe (2015) mention that the majority communities rely on agritourism as the main source of household income, since Lesotho is constituted of mainly rural areas. Despite these activities, Makhetha, Liphoto, Mahamo, Manong, and Mokhethi (2020) mention Lesotho continues to face high unemployment and poverty levels, due to rarity of resources and lack of financial support.

Zylbersztajn (2017) critiques that, in the definition, previous work treated agriculture as an isolated sector and interdependent system from other industries, not understood in the form of markets. Furthermore, Mweberi (2020) opines this definition is farm-centric, as the farm has now undergone an evolution caused by different factors, including globalisation, information, communication technology, and exponential population growth, among other exigencies, resulting in a new conceptualisation and framing of the term.

Manikas, Malindretos, and Moschuris (2019) highlight that today, some farms are shrinking in size due to their inability to transform themselves by entering markets and utilising new technologies, therefore, they fail to link and rationalise their value chains to become economically viable. In addition, the world is now in the era of supply chain competition, where organizations no longer act in isolation as independent entities, but participate as a supply chain to create value delivery systems more responsive to fast-changing markets, as well as more consistent and reliable (Christopher, 2005; Pandey and Garg, 2009).

In a major study, Fani, Ukpe, Oben, Dzever, Obekpa, Nde and Martin (2021) contend agribusiness is comprised of not only farming but also all other industries and services that connect farmers to consumers. In this regard, Matuszerwski (2021) mentions food hubs serve as a connection between the farmer and the consumer in many North-East countries, increasingly providing opportunities for many farmers. In contrast, in Lesotho, smallholder farmers find it difficult to participate in commercial markets due to a range of institutional constraints, such as poor infrastructure, lack of market transport, dearth of market information, and insufficient expertise on grades and standards (Rantlo, Tsoako and Muroyiwa, 2020).

Downey and Erickson (1987) posited that agribusiness includes all those business and management activities performed by firms that provide inputs to the farm sector, produce farm products, and/or process transport, finance, handle or market farm products. In agreement with this definition, Kanianska (2016) mentions economic growth in developed countries has recently been accompanied by a shift of land from agriculture to industry, road networks, and residential use. In developing countries, in contrast, with specific reference to Africa, Kirsten, Dorward, Poulton, and Vink (2009) point out most African agricultural production is still done by smallholders, resulting in stagnant agricultural production and a complex and difficult commercialisation-linking of farm producers to commercial markets. The stagnation, as explained by Connolly (2014), is as a result of the high costs in establishing and operating a business and transporting goods across borders, which is a serious barrier to growth.

Esterhuizen (2006) contends agribusinesses remain resistant to change; however, agribusinesses have now increasingly come under pressure to adopt new concepts of more consumer- and supply–chain-oriented ways of doing business. The European Commission (2017) adds resistance to change makes it more difficult to mobilise people to participate in developmental processes and take advantage of opportunities created.

Edwards and Shultz (2005) describe agribusiness as a dynamic and systemic endeavour that serves consumers globally and locally, through innovation and management of multiple value chains, which deliver valued goods and services derived from the sustainable orchestration of food, fibre, and natural resources.

Rama (2004) mentions agribusiness enterprises have limited resources and the quest for sustainable international competitiveness leads them to use resources in an ever more rational

way. Adeogun, Adebayo, Akintunde, Likoetla, Letela, Sethabathaba and Shea (2025) show farmers in Lesotho are pronounced to have limited resources that constrain their potential to use technology due to challenges such as weather patterns. Concerning innovations, Balkrishna and Deshmukh (2017) highlight that farmers are using social media, because it can connect with agribusinesses and agricultural experts over a geographical distance. However, Krishman (2014) believes there are many marketing tools available, making it important for the grower to adopt the one more suitable to his production unit and style or else to adapt his production to the market demand.

In Lesotho, Akintunde and Oladele (2019) argue agriculture faces a challenge in accessing the market for agricultural products. Rantšo (2000) adds peasants produce traditional crops such as sorghum, maize, beans, and so forth in Lesotho; nevertheless, these agricultural products lack accessible markets in the rural sector, because there are scarce agro-industries and most are located on the periphery of urban areas. To address the problem of poor access to markets, an Organization for Economic Co-operation and Development (OECD) report recommends substantial investment in the transport infrastructure, in order to enable moving produce from production units to the market (OECD, 2007a, b; 2008).

After Lesotho gained independence in 1967, the Agricultural Marketing Act (Lesotho Agricultural Marketing Act of 1967) was passed, which aimed to control and improve the production, preparation, processing and marketing of agricultural products and the marketing of agricultural supplies. In 1996 the Marketing Act of Lesotho was introduced, however, it resulted in smallholder farmers being deprived of output markets because of the ceased control boards (FMARD, 2016), although the policy is now in favour of smallholders.

Rantlo *et al.*, (2020) mention for farmers to compete in markets, there is a need for the agricultural marketing Act to include the use of digital technologies in agribusiness as a marketing strategy. Reva (2019) nevertheless mentions, consequent to improving agricultural commercialisation, the Lesotho Government is trying to attract investment in primary agriculture, the Market Centre in Ha Tikoe, and agro-processing, to benefit farmers with a detailed assessment of demand, buyer sourcing strategies, and a programme to upgrade them to better meet formal market requirements.

According to Chait (2014), agribusiness refers to agriculturally related businesses, including warehouses, wholesalers, processors, as well as retailers, and more. Haggblade, Hazell and Reardon (2010) add, with increasingly productive modern agriculture, the need for food processing enterprises increases. Nonetheless, this definition is limited to developed economies, because Weatherspoon, Cacho and Christy (2001) mention agribusinesses in developed markets may be motivated to internationalise through globalisation, when there are opportunities to exploit technologies that improve productivity and processing.

Magdoff, Foster and Buttel (2000) support this, highlighting that agribusiness firms began to develop industrial factory-style production systems and contractual integration arrangements, when the United States (US) recognised farming tends to not be profitable and key to corporate profitability was to cheapen the cost of obtaining raw food products. In these, decisions regarding how to produce crops are increasingly being taken care of by large agribusiness.

This contrasts with developing economies, where the economic performance of individual countries plays an important role in determining their food processing industries and exports (FAO, 2004). For instance, in a study conducted in Malawi, Mercer (2011) discovered the lack of a suitable transportation network, such as roads and railways, hampers the distribution of raw materials and movement of finished products to market. This problem is compounded by poor storage or warehousing facilities and access to affordable shipping; consequently, roadside stands may be the only marketing outlet for producers, resulting in producers selling their products to brokers at a low price.

Lesotho still stands in stark contrast with neighbouring South Africa (SA), where production, processing and distribution of food are carried out by commercial producers and agribusiness firms (World Bank, 2017). This is attributed to SA having a well-developed infrastructure that enables it to be a major producer and exporter of agricultural products (Bonsu and Ntloelibe, 2019). In contrast, George (2014) asserts Lesotho lacks a developed food industry; therefore, this has implications for the growth of agricultural-related businesses.

According to Schmitz, Moss, Schmitz, van Kooten and Schmitz (2022), the agribusiness sector includes all farms and firms involved in producing, harvesting, packing, and processing, as well as preserving, distributing, marketing, and disposing of food and non-food agricultural products. These authors classify the mentioned activities into categories, namely: agriculture, processing,

trade and transport, as well as food services, hotels, and inputs. According to the ITA, Lesotho–country commercial guide (2022), most agribusinesses in Lesotho have a low production capacity to supply the entire country; subsequently, the gap is met by imports from SA in agricultural production, such as poultry. Reva (2019) shows a lack of certainty in the market that prevents specialisation in value crops, which can be sold in supermarkets, as well as fresh produce aggregators and agro-processors.

2.8 DEFINITIONS OF DIGITAL TECHNOLOGY

Bellon-Maurel, Brossard, Garcia, Mitton, Termier and Barbier (2022) explain digital technology was first used in agriculture approximately 50 years ago; as a result, the definitions of digital technologies have varied from time to time. The following section discusses how different scholars have described digital technologies over the years.

As explained by Loebbecke (2006), digital technologies comprise all technologies for the creation, processing, transmission, and use of digital goods that can be summarised under the term information, communication, and media technologies (ICT). Prior to ICT, information and communication have always mattered in agriculture, with farmers seeking information from one another. ICTs now allow farmers to better access critical information, such as pest and disease reports, weather conditions, and market prices (Kamande and Nafula, 2016).

Lesotho, similar to many states on the African continent, recognised the (ICT) sector as a key accelerator for development (Maphephe, 2014). Nonetheless, Anyoha, Chikaire, Godson Ibeji, Ogueri and Utazi (2018) state the ICT advancements provide an opportunity for developing countries such as Lesotho to harness and utilise information and knowledge to improve agriculture. However, Baird and Hartter (2017), Duncombe (2014) and Krone, Dannenberg and Nduru (2016) argued ICTs in agriculture have always been associated with negative impacts, such as inter-community conflicts and inequalities. Hackford (2021) highlights digital technology is designed in a way that contributes to the unequal distribution of its benefits among small- and large-scale farmers. A study conducted by Bolarinwa and Ashimolowo (2011) shows a discordant manner of ICT use fostered conflicts between communities, which resulted in the displacement of youth farmers from agricultural areas and low production.

Fitzgerald, Kruschwitz, Bonnet and Welch (2014) understand digital technology simply as social media, mobile, analytics, or embedded devices. In the context of agriculture, Balkrishna and Deshmukh (2017) illustrate social media is very useful in agricultural marketing; as a result, there has been an increase in mobile phone use for agriculture all over the world (Akintunde and Oladele, 2019).

In Lesotho, mobile networks have increased the country's telephone density from one to 96 percent in the past 16 years (Morgan-Jarvis, 2015). Specifically, Kemp (2021) mentions there were 536 000 social media users in Lesotho in 2021. Added to this, Banda and Farhat (2018) stated a farmer in Lesotho reported social media works better than traditional media such as radio, while Vincent, Cull and Freeland (2009) found mobile phones also had an additional spin-off benefit, in that they improved basic literacy among farmers.

Cudjoe (2015) highlights that, contrary to the past, a standard mobile device has, nonetheless, upgraded from being merely a two-way pager, to being a mobile phone, with a few new functions, namely: Global Positioning System (GPS) navigation device, an embedded web browser, and an instant messaging tool. Therefore, most farmers are often excluded in benefiting from technology, due to insufficient digital skills, access to electricity, mobile networks, as well as high costs (Cebiso, 2022), which impact mobile phone use.

The OECD (2018) defines digital technology as progress in the management of digital content, with the help of ICT, for example, the internet, data analytics and mobile technologies. According to Mapeshoane and Pather (2016), Lesotho is faced with many technological challenges, ranging from poor science and technology, a technically inadequate workforce, and the high ICT costs, to lack of ICT policies (Olatokun and Ntemana, 2015). Nonetheless, Quibria and Tschang (2001) argue the internet is not the only means of disseminating market information to the rural poor and suggest establishment of information centres that provide the rural population with access to a variety of services, including information, with a well-established, physical infrastructure and human capital. However, the Technical Centre for Agricultural and Rural Cooperation (CTA) (2016) further argues radio plays the most significant role of any communication technology in the transfer of information in African countries, since the spoken word on broadcast radio is the principal means of information transfer where literacy rates are low.

Brunori, Branca, Cembalo, D'Haese and Dries (2020) explain opportunities from digital technologies in agriculture comprise improving yields, as well as increasing resource efficiency and, therefore, farm income, along with improved access to market and consumers, while at the same time reducing detrimental effects on the environment. Kremer and Houngbo (2020) mention the potential digital agri-specific technology applications have to transform the agricultural sector in developing countries, by helping farmers increase their yields and incomes, regardless of the spread of digital technologies in agriculture.

Schmidt and Cohen (2013), furthermore, determined lower transactional costs result where digital technologies are present. This offers a new opportunity to provide smarter services, which changes the nature of economies of scale for business, making international competition fiercer. New digital platforms provide services that enable direct access to information regarding product markets, therefore, reducing reliance on traditional intermediaries and better aligning production with demand, to reduce risk as well as waste (OECD, 2019a).

Conversely, Kwet (2019a, pp. 3-26) argues digitalisation could be a new form of colonisation taking shape in the political, economic and social space of the global South. Farmers could gradually become dependent on western technologies "designed in the technology ecosystem for profit and plunder"; as a result, poorer countries are overwhelmed by readily available services and technologies, leaving them with no choice to protect their people from exploitation (Kwet, 2019b). Furthermore, Lenz (2021) finds digital infrastructure and devices, such as blockchain or smartphones, not only require large amounts of energy but also natural resources (digital waste). Accordingly, there is growing concern these technologies will exacerbate environmental consequences and serve as fire accelerators, counteracting the goals of environmentally sustainable development (WBGU, 2019).

The environmental impact, as Stapple-Harris, Elliot, Droemann and Bengo (2020) show, comprises actions that produce the physical devices, cables and servers that make up the internet, made from a wide array of materials that all need to be extracted from the ground, requiring large-scale mining operations to dig, shatter and explode the earth. Rappitsch (2017) adds the key component of cell phones is tin, which results in both social and environmental harm caused by tin mining. However, Liu, Gailhofer, Gensch, Köhler, Wolff, Monteforte, and Williams (2019) argue digital technologies may, in many respects, help alleviate pressures on

the natural environment and biodiversity, since ICT-enabled solutions help monitor biodiversity and ecosystem services.

The term “digital technology” refers to the set of intelligent and innovative technologies, such as big data analytics, the Internet of Things (IoT), and cloud computing, that make it possible to achieve connection, communication, and automation (Dana, Salamzadeh, Mortazavi, and Hadizadeh, 2022). According to Gill, Chana and Buyya (2017), regardless of the importance of ICTs in the agricultural sector, providing services through computer–based services necessitates enhanced technologies to fulfil today’s modern agriculture requirements. These include processing large amounts of data, speed, data storage, and reliability, as well as for resources used in computer-based systems to be used efficiently (Gill *et al.* 2017).

To solve the problem of existing agriculture systems, there is thus a need to develop a cloud-based service that can easily manage different agriculture-related data types, based on different domains. Elijah, Rahman, Orikumhi, Leow and Hindia (2018) showed the IoT empowers farmers with the decision-making tools and automation technologies that seamlessly integrate products, knowledge and services for better productivity, quality and profits.

As Variyamparambath (2019) explains, cloud computing is the technology that connects many IT back-end tools to people, including network, storage space, server space, and other services, with the help of internet connectivity, in a way independent of the resource and location. The author further determined the Green Revolution, through the use of nitrogen fertilisers, had devastating impacts on the environment, such as lack of oxygen in water. However, after the arrival of new technologies, such as improved computing through cloud-based nitrogen usage advisory services, farmers were assisted in the field with regard to not using excessive nitrogen in the field.

Despite the importance of cloud computing, Dalvi and Kumbhar (2014) established that farmers in rural areas are unable to take advantage of cloud computing technology benefits, due to the high network coverage cost. This supports findings by Symeaonaki, Arenities and Piromalis (2017), which highlight the main constraint is linked to the requirements of cloud computing services in constant and high-speed network connectivity.

2.9 LINK BETWEEN DIGITL TECHNOLOGY AND AGRIBUSINESS

Over the past decades, actors in agriculture have recognised digital technology as a means to improve agriculture, for smallholder farmers in particular, as they expect services to enhance their production and livelihood. As farming changes, rapidly changing technologies capture, manage, communicate and use information in digital form for some farms, with these changes dramatically transforming the way farming and agribusiness are done across the globe, specifically on large commercial farms (Nielson *et al.*, 2018). For example, digitally-enabled marketplaces for agricultural products (e-platforms) can potentially shorten agricultural value chains, provide new markets, reduce transaction costs, and offer small and medium enterprises (SMEs) new business opportunities (Pearce, 2022).

For agribusinesses, digital technologies can assist in making production more transparent, operations easier to monitor, and supply chains more efficient (Loukos, 2020). Furthermore, Murphy and Carmody (2015, cited in Mann, 2018) emphasised the double movement of profits to producers and global corporations, resulting in digital technologies.

From past pandemics the world has experienced, it has been shown quarantines negatively impact economic activities and economic growth (Ardnt and Lewis, 2001; Bermejo, 2004; Hanashima and Tomabe, 2012), while agricultural activities are also affected (Burgui, 2020). Although many challenges have been imposed by the Covid-19 pandemic global lockdowns, digital technologies are, nonetheless, proving to help address several of these in agribusiness (Muyiramye and Addom, 2021), with many interactions and transactions moving online, allowing farmers to remain socially distanced and implement prescribed Covid safety measures.

2.10 KEY DIGITAL TECHNOLOGY FEATURES THAT INFLUENCE AGRIBUSINESS DEVELOPMENT

Okano (2017) explains, as an internet-based technical infrastructure, the IoT enables item and service interchange, in addition to the global supply chain network. Banga (2019) specifies the features of Big Data, cloud computing and AI, furthermore, contribute to global value chain expansion, through the creation of efficiencies in production, planning and product development, as well as logistics.

Where agribusiness is concerned, digital apps, websites and other ICT tools allow producers to share content with customers in a fast, low-cost manner (Rahman, Tootoonchi and Monahan, 2011). In addition, direct applied digital technologies, mobile phones and the internet have also increased price transparency in agricultural markets.

GRAIN (2021) argues although digital technologies are made to work for farmers, consumers and farm workers, technology does, however, not develop in a bubble; it is shaped by money and power. With specific reference to Big Data, Riahi and Riahi (2018) point out this type of technology requires specific and increasingly sophisticated computer storage and analysis tools. Ndubuaku and Okereafor (2015) further highlight some challenges SSA countries face in the use of the IoT technologies, such as network capacity and poverty rates. The authors further mention the cost of components required to support capabilities, such as sensing, tracking and control mechanisms, needs to be relatively inexpensive in the coming years for IoT adoption to grow in Africa. López–Vargas, Fuentes and Vivar (2020) suggest using inexpensive technologies to achieve IoT dissemination in developing countries as a main requirement, since developing countries do not have sufficient resources and are, subsequently, unable to access modern technologies (Garrity, 2015).

Jin (2017) highlights that digital platforms are not value neutral but reflect the value system of the proprietor, which Nzomo, Mwangi, Matu-Mureithi, Muchiri, and Rutenberg (2020) state, in essence, means when Africa relies on digital platforms built by foreign entities, they will be working under the originating countries' value system. The authors further find the percolation of digital platforms and their prominent role in the agribusiness ecosystem could alienate the majority rural Africans from benefiting, due to the digital divide created by human capital, in terms of the lowest digital skills prevalent in most African countries.

2.11 PREVIOUS AND PRESENT TECHNOLOGIES FOR AGRIBUSINESS DEVELOPMENT IN LESOTHO

Literature shows the development of agribusiness in recent years depended on production before digital technology; different innovations have been used for agriculture and agribusinesses in Africa and globally. For instance, Ogundari and Bolarinwa (2018) state agricultural innovations were introduced gradually, in packages, over the years; in the 1960s, where these innovations

focused on the production of crop varieties to transform agricultural practices. However, Turner (1978) points out, although Basotho was producing and trading large quantities of wheat, the missionaries introduced innovations in agriculture in the 1850s, which shifted the use of handmade to cow-pulled ploughs, and the rate of innovations accelerated substantially in the 1860's to 1910's, with an increase in production. Rantšo (2016a) added Lesotho had also adopted Green Revolution technologies and tractors to increase crop and animal production in the 1960s and 1970s.

The Green Revolution is explained by Spanne (2021) to refer to a transformative 20th century agricultural project that began in Mexico and extended to Asia and Latin America, and later, Africa. This has resulted in plant genetics, modern irrigation systems, and chemical fertilisers and pesticides being used to increase food production and reduce poverty and hunger in developing countries, as well as the improvement of animal husbandry (Sonnenfeld, 1992; Leaf, 1980).

For agribusinesses, the Green Revolution laid the foundation for a subsequent era of genetically modified crops, globalisation of agriculture and even greater dominance of agribusiness giants in the food system, which Saha and Schmalzer (2016) believe, in the eyes of the US creators, the Green Revolution was not merely a set of agricultural technologies designed to increase crop yields but also an ideology with an explicit socio-political strategy. Should farmers around the world be raised from poverty through technological improvements to agriculture, they might be less likely to seek solutions less palatable to united interests.

Rantšo (2015a) finds the Green Revolution, however, often failed to solve the problems related to high levels of poverty, inequality, and inequity, while Douglas (1999) argues Green Revolution technology would not succeed in Lesotho, due to climate and soil types, particularly in the mountainous areas of Lesotho. Years later, the Lesotho BoS (2022) reports the country's production in crops, such as maize and wheat, has declined in recent years, due to low adaptation to high-yielding technologies and climate change (Johane, Makama, Rizvi, Asanjor, and Nkhabutlane, 2021).

Although Wright and Sih (2010) emphasise the use of innovations to increase farm yields and improve farm produce quality, studies show agribusiness development is now highly dependent on international trade, by connecting global markets to developing-country producers and

consumers, both through exports and imports (UNCTAD, 2014). According to Vorobiova, Krupskyi and Stasiuk. (2023), digital technologies such as artificial intelligence (AI) technologies and blockchain significantly change the ways of conducting trade, for example, market access and creative distribution of goods and services. Nevertheless, there is little literature on digital technology application for agribusiness development, other than ICT, in Lesotho. Therefore, this study investigated the use of digital technologies as an innovation for agribusiness development in Lesotho and how these technologies impact food production, as well as trade, to contribute to existing knowledge.

2.12 ROLE OF DIGITAL TECHNOLOGY IN AfCFTA FOR AGRIBUSINESS DEVELOPMENT

Mweberi (2020) asserts trade among African nations is said to be the lowest globally, as a result, this has a bearing on agriculture and agribusiness development. The AfCFTA is a longstanding vision of the African Union to foster deeper economic integration and socio-economic development on the African continent, to create a single market for goods and services (Okebie, 2017). Therefore, Kanyangoga (2021) maintains AfCFTA-specific provisions will directly benefit agricultural and agribusiness in Africa and will help implement, which includes removing technical trade barriers; specifically, digitalisation on everything across agriculture value chains.

The Food and Agricultural Organisation (FAO) and International Telecommunication Union (ITU) (2022) confirm digital platforms with authentic data on food demand and supply are an important tool for facilitating international trade; these are particularly helpful considering the different weather and climatic conditions throughout the continent, as well as seasonality of food products. However, Senoko (2022) illustrates, regardless of Lesotho depositing its instruments of ratification, it has little to no gain from the AfCFTA, due to the country's limited capacities, such as internal issues of governance, lack of technological and infrastructural capacities, along with its politics. Therefore, for Lesotho to realise the potential of AfCFTA for wider markets, for both farm inputs and agricultural products, digital technology must be used. Nonetheless, to participate successfully in AfCFTA, Lesotho needs policies and strategies that will align with the AfCFTA objectives, while farmers need to be encouraged to adopt digital

technologies they can afford, suitable for their infrastructure, to develop their businesses and remain competitive.

2.13 NEW AGRIBUSINESS DEVELOPMENT TRENDS

Hassanzoy (2019) mentions new agribusiness trends are: Trade barriers, changing demographics, population growth, and increasing international competition, as well as productivity evolution, and changing technological and regulation systems.

2.13.1 Trade Barriers

Trade is the concept of exchanging goods and services between two people or entities, while international trade is the concept of such exchange between people or entities in two different countries (Samuel, Alawode, Fawehinmi and Tijani, 2017). Trade is further explained by Mghenyi, Dankers, Thurlow and Anyiro (2022) as an essential part of agribusiness. According to Rodrik (2007), on the one hand, trade allows developing countries' firms to access technologies essential for improving their productivity and competitiveness, which will generate growth and employment opportunities, including for the poor. On the other hand, Hampton, Fromm and Nyhodo (2007) highlight the difficulty for developing countries, particularly SMEs, regarding how to reach international markets and benefit from trade.

In the case of Lesotho, asparagus cultivation was one of the rural development strategies meant to assure economic prosperity, by incorporating the peasantry into the capitalist economy or international market (Rantšo, 2000). However, Rantšo (2000) further shows Lesotho asparagus growers failed to participate in international trade, as the growers and processors could not compete with farmers who used sophisticated technology. The author further emphasises one of the factors that led to the closure of the asparagus cannery in Lesotho, was that producers from poor countries occupy a low position in the world market. Therefore, for Lesotho to succeed in agro-processing, digital technology use should be a priority.

According to Samuel *et al.* (2017), new management techniques have been introduced to agribusiness activities, facilitating the integration of domestic markets, thereby providing abundant opportunities to farmers and trading partner countries to supplement shortages in food and other agricultural commodities. Nonetheless, a common problem in agriculture is the variety of trade and domestic policies to intervene in agricultural markets, while tariffs are used

less frequently (Schwartz, Magiera, and Mervenne, 1988). Consequently, Samuel *et al.* (2017) point out and explain the following problems agribusiness faces in international trade:

Loss of bargaining power: Large farmer-processor ratios, due to substantial numbers, diminish prices farmers could obtain in the market, thus the concentrated market is an important contributor to the erosion of farm income, while increasing the profits of agribusiness firms. Farmers lose flexibility in enterprise choice, since they cannot adjust their production mix to benefit from opportunities for other incomes, due to contractual agreements in agribusiness.

Agricultural dumping: Murphy and Hansen-Kuhn (2020) describe agricultural dumping as the practice of exporting commodities at prices below the cost of production, which creates an unfair trading advantage for exporting agribusiness firms, by depressing international prices and eliminating market opportunities for producers in other countries.

2.13.2 Changing Demographics Population growth

As explained by Karim (2013), population increase in many parts of the world has a consequential effect on agricultural resources, since an excessive growth of population can drastically minimise agricultural land throughout the world.

2.13.3 Increasing international competition

The agribusiness marketing chain typically consists of a primary market, where farmers sell their products to wholesalers, from where the products are sold to processors and retail markets; from which consumers buy finished goods (Walton and Grishin, 2018). However, agribusinesses not only have to compete in domestic but also in global markets. In Lesotho, the wool and mohair sector is affected by global competition, because the Lesotho sector faces challenges due to weaknesses that include poor standards of wool and mohair, which is a result of poor shearing methods (Khotso, 2020) and sub-optimal management of critical public assets (shearing sheds, sheep, and goat studs for improved quality). Therefore, Lee (2022) maintains the appropriate shearing technology makes it easier for shearers to stay in the trade for longer.

Sinngu and Antwi (2014) revealed countries need to invest more in factors that cannot easily be duplicated by competitors, in order to beat competition. The IFAD identifies such factors to

include skilled labour, capital and infrastructure (IFAD, 2022); for this study, technology use for the sector can improve the standards of wool for international competition in Lesotho breeds.

The global market for wool and mohair is undergoing a sizeable shift towards responsible production standards (IFAD, 2022), furthermore, dealing with business in a highly digital, competitive world limits chances of exports for wool and mohair farmers, therefore, digital technology use by wool and mohair farmers will assist access to global markets, thereby improving production for contribution in the global food chain. The farmers choose one of three options available to them, (1) sell through traders, (2) sell through brokers, or (3) go to the auction and sell to the buyers. Therefore, ICT use would provide Lesotho farmers with more options in the global market, such as China, as opposed to depending on SA as their main market. In support, Nkamisa (2020) shows SA exports wool and mohair to China, because China is the biggest wool importer (Research and markets, 2023).

2.13.4 Competitiveness

Competitiveness could be defined as the progress and productivity, or even the superiority of being different, by progressing, producing, and using tools such as mobilising capital, employment, technology and knowledge (Nikolić, Bajramovic, Ognjenovic, Lalic and Uzunovic 2011; Peres and Viana, 2012). It is the ability to maintain and expand target markets by concentrating on activities aimed at qualitative characteristics of both products and competitors. In Lesotho, IFAD (2022) discovered farmers continue to complain of limited market access in terms of low prices, outlets and low returns, despite the developed and competitive farming value chain in the sheep wool business.

To improve their competitiveness, agribusiness must integrate new technologies (Baierle, Siluk, Gerhardt, Michelin, Junior, and Nara, 2021). To remain competitive in the agricultural sector, Dayal Saraswat (2023) suggests re-engineering farm products using advanced technologies to enhance visibility and boost their ability to respond to major disruptions and variables within their domestic, regional, and global supply chains. This shows, for Lesotho to be competitive in the agribusiness sector, the adoption of digital technology should be prioritised, because the country generates similar products, produced even by SA.

Using digital technology will, therefore, advance production in agribusinesses and develop the sector further. This also means when Lesotho fails to remain competitive, it will rely on importing agricultural products from SA as a neighbouring country, instead of exporting to SA, said to be the most modern, productive and diverse agricultural economy on the continent (SA Country commercial guide, 2023).

Major contributors to agribusiness development are depicted in Figure 2.1 and discussed below.

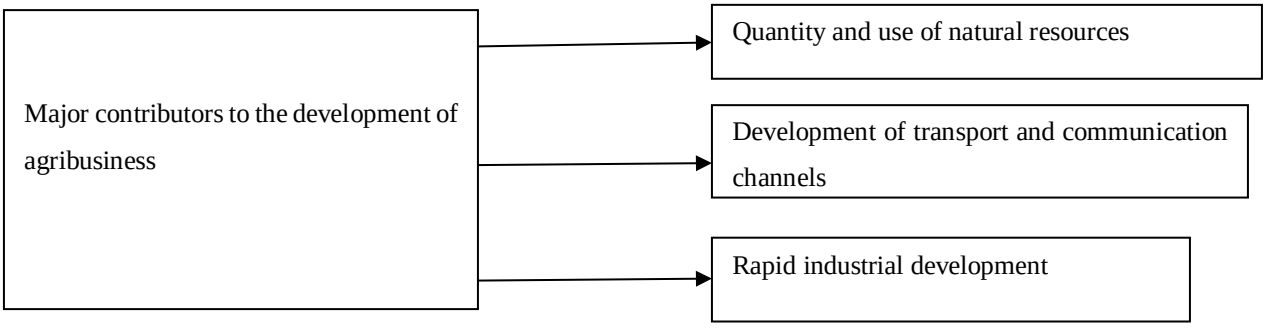


Figure 2.1: Major contributors to agribusiness development

Source: Lee (1976)

2.13.5 Communication systems

Agriculture relies heavily on transportation and communication as depicted in Figure 2.1 (Lee, 1976), however, in many remote farming villages in developing countries, access to communication is significantly more restricted (Kayumova, 2017), with farmers consequently unable to improve their commercial viability. Some effects of insufficient or lack of communication systems are highlighted as wasteful agricultural practices and insufficient productivity (Yila and Thapa, 2008; Kassam, Friedrich, Shaxson, and Pretty, 2009). This lack reflects the inability of developing countries to be innovative, therefore, without effective communication systems, farmers experience challenges in developing their agribusiness, which may influence digital technology use for increased opportunities.

Maphephe (2013) mentions infrastructure in Lesotho is currently low, with accessibility to telecommunication services for approximately three percent of the entire population through telephone landlines and almost 20 percent for mobile phones. Lesotho still has a long way to go in this regard; Basotho farmers, as well as consumers (both local and international), need effective modes of communication to trade. In other words, for Lesotho to realise the benefits

ICTs offer, the country needs modern and efficient infrastructure that allows the delivery of telecommunications, broadcasting, computing and information services, such as the internet, mobile cellular communications and digital television and radio (ICT policy for Lesotho, 2005). These will provide Basotho farmers the opportunity to trade on both local and international levels, with the help of social media platforms, as well as applications on mobile devices.

2.14 INFRASTRUCTURE

A recent OECD report (2022) details digital and analogue infrastructure remain significant enablers of digital technology use in agriculture. Transport services are also noted by Kayumova (2017) as important prerequisites for farmers and other agribusinesses to secure market access; therefore, transportation infrastructure decreases the effects of physical distance decay, by enabling physical and virtual travel. The benefits of infrastructure for businesses are enormous, particularly for small and start-up businesses, for instance, smallholders in Lesotho still find it difficult to participate in commercial markets due to poor transport infrastructure (Rantlo *et al.*, 2020).

The recent Lesotho Country Report (ITA, 2022), in addition, specifies one hurdle business in general has to overcome in Lesotho, is sourcing electricity. The remote parts of Lesotho remain underdeveloped and under-serviced, due to poor infrastructure, which makes it difficult, if not impossible, for certain services to be delivered. Without electricity, farmers in these areas are unable to refrigerate their produce, or own mobile phones that enable communication. In this regard, Choi, Dutz and Usman (2021) show closing the gap between available and affordable infrastructure for digital technology increases adoption, growth and development among users.

The benefits of infrastructure in agribusiness development are limited to developed countries, because as Kanamaru (2005) mentions, the promise of recurrent cost budgets is often not kept in developing countries, due to financial problems, which means projects are planned by community organizations to maintain and manage the infrastructure themselves, without depending on the state. Sefika, Mavetera, and Mavetera (2013) mention developing infrastructure is a low priority for the government in Lesotho, while there is also a lack of private sector interest in exploiting the potential of rural areas. As a result, rural areas are neglected,

which leads to further degradation of the quality of life of rural occupants, particularly those who depend on agriculture for survival.

Infrastructure in Lesotho is, additionally, relatively undeveloped, with poor coverage and low-quality services, owing to low per capita incomes and government fiscal limitations (PPIAF and World Bank, 2005). This echoes findings by Serage (2000), who determined most Lesotho agricultural activities are remote, have to contend with poor roads, and are far from the market centres. However, Tanga, Monaheng, Matobo and Abie (2014) believe road improvements in the rural areas of Lesotho may lead to higher land values and more intensive land use, where the same road infrastructure may also lead to agricultural production, increased and expanded use of modern agricultural tools, machines, and inputs, as well as modes of transportation.

2.15 MARKET ACCESS

Oyinbo, Chamberlin, Abdoulaye and Maertens (2022) assert the lack of market access has a significant effect on the success of entrepreneurs in general. Hampton *et al.* (2007) hold that identifying new markets is one of the great challenges for small-scale agribusinesses in developing countries, in particular, international markets require a certain level of competence for SMEs. As a result, Reddy (2007) mentions farmers lack access to overseas markets, where they can sell their products at higher prices and purchase cheaper inputs and better technologies.

SMEs and local farmers gain international customers through tourism. This seasonal trade is the only time they hike their prices to obtain more returns. However, Rantšo (2000) states poor smallholders are willing to participate in the market, when the working conditions are conducive to everybody and when they subsequently realise the potential benefits from market transactions. Todaro (1989) suggests there must be some enabling incentives, for example, credit and capital, inputs such as fertiliser and irrigation facilities, and marketing outlets that will motivate the peasants to participate in generalised commodity production.

In a study conducted in Lesotho, Nkholise (2020) reveals the reason emerging farmers in Lesotho cannot improve their livelihoods, is due to difficulties in timeously accessing both markets and market-related information. Nevertheless, the World Bank (2022) highlights when the use of modern technologies in Lesotho increases, production also increases, along with market access and livelihoods. Additionally, Motseki-Mokhothu (2018) opines use of the

internet can assist Basotho to access information and enable them to sell on the net. This echoes findings by Yunus (2007), who stated technology can help integrate the poor by expanding their markets through e-commerce - only when properly applied, allowing people in the poorest countries to work directly with consumers in the developed world. The problem is that poor people are, however, typically more concerned with when their next meal will be, as opposed to going to the world markets.

UNCTAD (2019) reports Lesotho's e-commerce legislation and regulations are weak, with the country lacking most key regulations necessary to ensure online trade. The benefits of using technologies in business are endless; most developing countries are disadvantaged in this regard and have to continue with old methods of production and trade. The global markets have, moreover, become more accessible through the use of applications and easy money transactions via mobile phones, unfortunately, these advances are limited to certain populations.

2.16 LIMITED INVESTMENT

Although investors are the prime movers of agribusiness development (Nishimura, 2003), (Nishimura, 2003), Havemann, Negra and Werneck (2020) emphasise the necessity for wide range of investments, across the diverse set of agricultural systems and stakeholders. To create and expand agribusiness development opportunities in Africa, investment from both the public and private sectors is required, while banks and developmental financial institutions must be willing to amend their strict lending policies and criteria so that entrepreneurs can invest money in agribusiness industries (Lekgau, Matlou and Lubinga, 2017) .Hence, there is a need for well-coordinated support structures from both government and private sectors such as banks and companies, for example, Vodacom or Econet, to assist with much-needed resources such as financial assistance and digital technology infrastructure, in particular for those operating in rural and remote areas. This will set an increase in motion in local production and local economies independent of central governments.

West and Haug (2017) and Thompson and Scoones (2009), furthermore, show smallholders can themselves make investments in their agriculture. However, Rosenzweig and Binswanger (1993) argue, for farmers, the investment reflects their risk aversion, where poor farmers accept lower returns in exchange for lower risks, while rich farmers can afford to accept higher risks

on seeking higher returns; this results in higher rates of farm investments, particularly among those with large firms. Therefore, Amadasun and Mutezo (2022) suggest enterprises need to leverage modern market strategies as technologies and harness their capabilities through market-driven strategies to increase innovative production activities and linkages to the market environment.

One of the challenges facing Lesotho, is the lack of investment in agriculture and the resulting lack of income-generating activities (Rocchi and DelSette, 2016), leading Basotho farmers to face constraints in their development that require external assistance and for the future. However, more Basotho resort to subsistence farming to feed their families, as opposed to supplying the markets (Wikle, 2015). This type of farming is cheaper, since it requires less labour and manual farming tools can be used due to its small-scale nature. The investment in agriculture would motivate such farmers to venture into commercial farming to supply the markets within Lesotho.

2.17 GLOBALISATION OF ECONOMY AND LIBERALISATION OF INTERNATIONAL TRADE

Globalisation has brought many changes that affect small-scale agribusinesses in developing countries (Hampton *et al.*, 2007) because, as Motseki-Mokhothu (2018) mentions, it deals with trade, capital movement, movement of labour and the spread of technology. Precisely, agribusiness enterprises are still facing some external and internal problems, particularly in developing countries, which include the extremely strict import regulations imposed by some developed countries that pose obstacles to entering the international market (Nishimura, 2003). These regulations include tariffs in the agricultural sector; tariffs are greater than the manufactured goods sector (Hoekman and Nicita, 2011). Kindness and Gordon (2001) argue farmers in remote areas (either remote because of physical distance from markets or because of poor roads) are, additionally, almost always poorly served by agricultural traders and are often obliged to accept seemingly unattractive prices for their produce.

Hallaert, Cepeda and Kang (2011) found electricity appears to be the main constraint to trade expansion of developing countries, followed by transportation problems and access to credit. For instance, Hunter and Mokitimi (1990) showed wool and mohair trading in the 1920s and

1980s was difficult in Lesotho, because traders could not establish permanent trading, due to transport constraints and capital requirements; as a result, they bought and sold small quantities. Nevertheless, Mokhethi (2015) states, although Lesotho still needs to diversify the geographic destination of its trade, the country should, in this globally competitive world, have the capacity to process high-quality agricultural products such as wool and mohair, as well as other raw materials highly required in the global markets. An example is asparagus, previously exported massively by Lesotho; therefore, digital technology use would result in high exportation levels and easy access to global markets.

In this regard, however, Nkholise (2020) and Phakela (2019) showed the Lesotho government restricted wool and mohair trade in 2018, stipulating no one was permitted to trade in wool and mohair without a license obtained from the Ministry of Small Business, Cooperatives and Marketing; unless the wool and mohair are prepared, brokered, traded and auctioned in Lesotho. These regulations, consequently, deprived key stakeholders in the wool and mohair value chain of higher earnings. Should farmers have had access to global markets through technology use, they would not be completely deprived of participating in markets, because they would have access to various markets, instead of only selling to government brokers. Therefore, Motseki-Mokhothu (2018) mentions markets become open for all goods, even though developing countries have limited goods to sell in the world markets, with Lesotho specifically exporting less wool and mohair, while prices are determined by the buyer.

De Janvry and Sadoulet (2002) argue the competitive global business environment causes most businesses to experience increasingly difficult challenges; the first challenge is the rate of change in new products, new technology, and change in customer preferences, which has increased dramatically. However, technology use will enable farmers to remain competitive and change products to fit customer preferences, because there are digital technologies such as AI, blockchain and robotics used in agri-food processing, packing and distribution. Therefore, this study investigated technology use by agribusinesses in Lesotho, to explore how technology has been used to remain competitive in the globalised economy.

2.17.1 Factors that contribute to agribusiness competitiveness

Kennedy, Harrison and Piedra (1998) found the sources of competitiveness were technology, input costs, production economics, and product quality, as well as enterprise differentiation, advertising, promotion, and external factors. Competitiveness also results from large differences across countries in the quality of products they produce and export (Hallak, 2006), which indicates the worth, regardless how many agricultural products (particularly crops such as cereals and fruits) and differences in product quality reduces, in the global and regional markets, as well as trading with their neighbouring country. For instance, due to the quality of products Lesotho produces, when compared to SA as a neighbouring country, Lesotho has become an importer of agricultural products, as opposed to exporting; therefore, this has impacted the development of agribusinesses negatively.

2.17.2 Demand conditions

The nature of agricultural demand varies greatly regarding different classes of commodities (Thompson, 1916). Martinez and Stewart (2023) show most farm products were sold as commodities on open markets in the 20th century, however, many consumers now demand a wide product and food assortment. These changing demands, influenced by technological advances and other changes in the economy, offer agribusinesses new competitive opportunities. Furthermore, as agricultural growth and the change from production-based to integrated economic, environmental, and social goals progress, there is an emerging need for technology adoption (Sparrow and Traoré, 2018).

As stipulated by Dlamini, Kirsten and Masuku (2014), the demand conditions are, therefore, to include local consumer sophistication, adoption of products, and concern on ethics, size and growth of the local market, among others; however, this also shows farmers need to remain updated regarding the latest market trends and choose crops with a high market demand. While the wool and mohair demand in local and global markets is very high, to reach international market standards for such mass production and quality wool and mohair, local farmers in Lesotho will, nonetheless, need new advanced technologies for wool and mohair processing to meet market demands.

Marinchenko (2021) confirms the agricultural production level today is determined by the degree of production intellectualisation, modern technology availability and automated technical equipment of a new generation, along with appropriate information and instrumentation provision. Samhungu and Danelan (2023) state, for horticulture, farmers are encouraged to grow and sell their products in centres where they will be bought by formal retail outlets, to be sold within the country, instead of importing from SA. This is done to promote the development of agribusinesses; however, it does not promote Lesotho's competitiveness in global markets. Furthermore, digital technology use could develop horticulture in processing and packing, because as the Lesotho country-commercial guide (ITA, 2021) shows, Lesotho does not have processing and packing facilities for horticulture products.

2.17.3 Related and supporting industries

According to Kyfyak, Verbivska, Alioshkina, Galunets, Kucher and Skrypnyk, *(*2022), agribusiness is a sector of the market economy, including industries related to agricultural production as a single complex. Dlamini *et al.* (2014) add this refers to the availability of local input providers, producers, distributors, and marketers, along with financiers, the associated costs of inputs, credit and all the other firms that provide goods and services to the agribusinesses. A study conducted by Zhang, Fan and Qian (2005) illustrates these industries fundamentally change the agribusiness landscape, in improving labour productivity, crop and animal yields, product safety, as well as the commercialisation level, and eventually, their income, as a result influencing technology use.

2.17.4 Role of Government

The impact of government is stated by Dlamini *et al.* (2014) to include the effects of the tax system, trade policies, and administrative regulations; moreover, the government plays a vital role by influencing these regulations, which could be either positive or negative. In Lesotho, agricultural markets are fully controlled by the government, which prohibits the farmers from interacting with foreign traders and controls how the farmers access export markets; there is thus double taxation in this sub-sector and insufficient market infrastructure, particularly information (Mokhethi, 2015). Nonetheless, Dahlman (2007) found communication technologies such as phones make it faster to negotiate and conclude trade deals, consequently,

it influences competitiveness. This indicates governments need to design trade and tax policies that will enable farmers and agribusinesses to trade globally and regionally, while also allowing local producers to import technology goods necessary for production.

2.18 CHANGING TECHNOLOGICAL AND REGULATORY SYSTEMS

Regulations are sets of rules that constrain the actions of economic agents intending to achieve social goals such as safety, job security, or health (Divanbeigi and Saliola, 2017). Firms in agriculture are more sensitive to regulations, with high costs of compliance, and are, consequently, more prone to avoiding them by remaining or becoming informal (Loayza, Servén and Sugawara, 2009). Nevertheless, similar to manufacturing firms, farming businesses benefit from secure property rights, efficient taxation, increased access to finance, and the balanced entry and operational standards offered by a supportive investment climate (Divanbeigi and Saliola, 2016).

As Dannson (2004) explains, many agribusiness laws and regulations change frequently or are inconsistently applied, causing firms to expend considerable time and effort to comply or negotiate ways around them. However, Makosholo (2005) highlights there is no organised marketing system for agricultural products such as fresh fruits. Subsequently, there is little growth of the sector and less income for the farmers.

Digital technologies in the agriculture sector are, therefore, designed in a way that enhances the transfer of information and ideas to market information, which can be easily accessible and adopted in Lesotho; for instance, using social media as a marketing tool (Lekhanya, 2013). Additionally, Deng (2023) finds Big Data can help the agricultural products' online marketing platform with branding construction.

2.19 PRODUCTIVITY EVOLUTION

The ultimate goal of agribusiness lies in meeting the food needs of the population, mainly through its production (Kyfyak *et al.*, 2022). Agricultural production, as Mustashkina, Karpova, Makarov and Khannanov (2020 point out, has specific features that dictate the widespread use of digital technologies. Adoption rates vary by farm size, as well as the rate of productivity (McFadden, Njuki and Griffin, 2023), which confirms findings by Paltasingh and Goyari (2018) that bigger farms have higher productivity levels.

Rakotsoane (2022) suggests agricultural productivity in Lesotho can be improved through technology use, such as ICT, to enhance productivity and generate more income. Nevertheless, while digital agriculture tools are not new, the development pace appears to be increasing (Glaros, Thomas, Nost, Nelson and Schumilas, 2023). In compiling several studies on trends in agricultural productivity in various regions of the world, Alston, Andersen, James and Pardey (2010) concluded agricultural productivity has slowed down in many parts of the world.

2.20 LESOTHO'S PAST AND PRESENT GOVERNMENT STRATEGIES IN TECHNOLOGY USE

Previous technology development efforts have, according to Mhlanga (2004), been hampered by the absence of a consolidated national policy, however, increased competitiveness in the global business sector compels Lesotho to formulate and adopt strategies for technological change. Therefore, new digital technology policies are needed that will support and foster agribusiness development through digital technology use.

The Agricultural Information Service (AIS) Annual report (2004) states the AIS in Lesotho was established under the Department of Field Services of the Ministry of Agriculture and Food Security (MAFS). The AIS has two main functions: First, disseminating agricultural information to support agricultural development and second, serving as public relations unit of the MAFS. The division produces agricultural information posters, newsletters, video lessons, and magazines, as well as colour slides, field campaigns, and farm radio broadcasts, including news articles for broadcast over Lesotho National Broadcasting Services (AIS, 2004).

The Enhanced Integrated Framework funded development of the Lesotho National Export Strategy (2021-2025) was formulated with technical expertise from the international trade centre and focuses on three priority sectors with high potential for export growth – horticulture; textiles and apparel; and light industry (Samhungu and Donelan, 2023). However, Lio and Liu (2006) show, notwithstanding these efforts, digital technology is highly dependent on infrastructure. Based on this assertion, digital technology use by agribusinesses will be a challenge in Lesotho, due to limited digital infrastructure.

2.21 AGRIBUSINESS DEVELOPMENT IN LESOTHO

As reported by Maliehe (2014), when the missionaries arrived in Lesotho in 1933, they encouraged Basotho to produce exclusively for the market and linked the spreading of the gospel with commerce. In 1873, Basotho exported approximately 100 bags of grain, as well as other products such as wool and mohair (Ferguson, 1990). Furthermore, when the first World War sustained high prices in wool and grain, Basotho were able to take advantage of this, since maize and wheat production were particularly vigorous. Subsequently, wheat exports in 1919 were a record of 256 bags, with 100 000 bags of maize exported in 1928 (Murray, 1980).

Gill (1993) adds that new technology allowed more land to be cultivated and the amount of land under cultivation grew remarkably, resulting in high agricultural productivity, which placed Basotho in a position to market the agricultural surplus in the foreign market (Rantšo, 2015a). The author further mentions grain produced by Basotho farmers faced tariffs in the SA market in the decade that followed, leaving farmers with a limited choice of marketing agricultural produce in the domestic market.

Ntoi (2007) mentioned although Lesotho has limited agricultural potential, the country does, however, have the potential to develop horticulture, commercial agriculture and related agribusiness (Framework, 2012). Therefore, under these circumstances, the use of digital technologies has the potential to increase the agricultural potential in Lesotho, when farmers and agribusinesses adopt technologies. The World Bank report (2019), nonetheless, stresses the challenges in the agriculture sector include outdated farm technologies, farm management practices and limited technical expertise.

In recent years, several innovative agribusinesses enterprises have been launched in Lesotho, for example, slaughtering operations, vegetable production schemes, and fruit orchards (World Bank, 2011). Nevertheless, unlike most African economies, Lesotho never experienced agribusiness development on a large scale; smallholder agriculture is characterised by labour-intensive tasks and the limited use of improved technologies, which compromise the productivity of the sector (Grassi, Landberg and Huyer, 2015).

The World Bank (2018a, b) reports full-time commercial farmers remain few, and specialised agribusiness firms are equally scarce, because commercially intensive farming mostly involves

large resource inputs and a high level of mechanisation. This corroborates research by Mibey (2015), who adds agriculture, as with any other entrepreneurship entity, requires start-up capital - a crucial element without which business cannot commence – therefore, agribusiness in Lesotho is considered in its infancy, since most of the produce sold comprises raw materials.

Mokone (1999) and Tshabalala (2003) indicate one of the key problems in agribusiness development over the past years in Lesotho, was mainly due to poor agricultural information services. Tshabalala (2003) revealed most farmers in Lesotho are aware of the available information services and their right to use any information service. However, Maleka, Akintunde and Mojaki (2019) mention, regardless of their awareness of these technologies, a few farmers such as the emerging young and educated farmers, use the internet, tablets, web portals, and offline multimedia, as well as video conferencing, because of their literacy levels and ability to afford these products and services. Tshabalala (2003) further adds that farmers continue growing the same crops every year, because of the lack of information, thus degrading the soil and leading to the loss of productivity and, consequently, decline in yield, with the direct impact of lack of information being minimal use of technology.

2.22 AGRIBUSINESS CONTRIBUTION TO LESOTHO'S ECONOMY

According to Rantšo (2000), the economy of Lesotho is predominantly subsistence-based, where agriculture generates part-time employment for approximately 80 percent of the rural population. The ITA (2025) further mentions the majority Basotho depend on agriculture for their livelihood yet, despite absorbing the highest labour percentage, agriculture accounted for only 21 percent GDP in the pre-drought year of 1990. Motsoari *et al.* (2015) point out the agribusiness sector in Lesotho is underperforming, mainly due to the inability of smallholders to move from traditional agriculture to more scientific and technology-based methods and processes.

Bloomer (2009) finds the inability of smallholders to improve their technology use is attributed to income generation in Lesotho rural areas having traditionally relied on remittances from urban Lesotho and SA. Nonetheless, Rantšo and Ralitjeleng-Mahlelebe (2023) mention retrenchments in SA have resulted in a decline in remittances and the inability to invest in agricultural production, which has, therefore, been a contributing factor to reducing agricultural

yields. Furthermore, Makosholo (2005) suggests Lesotho's agriculture needs significant support to remain a primary source of income and food security for the rural poor.

Rantšo and Seboka (2019) refer to measures the Lesotho government took to encourage block farming and employment of modern techniques in addressing poverty, even though there is no plan on how to achieve that. Moreover, Nhemachena, Matchaya and Nhlengethwa (2016) mention agricultural performance remains poor; however, it remains the main source of income, since production in Lesotho continues to be rain-fed, with fewer marketing options. The African Development Bank (AfDB) (2013) adds Lesotho also has limited human capacity to implement adaptation programmes.

2.23 CHALLENGES OF DIGITAL TECHNOLOGY

Notwithstanding the positive contribution of digital technologies in agribusiness, Shenglin, Simonelli, Ruidong, Bosc and Wenwei (2017) argue the potential of digital technology cannot be realised without coordinated efforts from humanitarian organisations, governments, industry, and civil society organisations, as well as academics. According to the World Bank (2017), non-government organisations (NGOs) and donors in Lesotho provide services for agricultural development by introducing new technological innovations. Specifically, the FAO in Lesotho has been instrumental in supporting farming households, providing essential agricultural inputs, technical support and management practices to improve farmer outputs (FAO, 2019). Nevertheless, in the absence of such efforts, Shenglin *et al*. (2017) illustrate the negative impacts, with the following scenarios as example:

- When the internet delivers scale economies for firms, but the business environment inhibits competition, the outcome could be an excessive concentration of market power and the rise of monopolies, preventing future innovation;
- When the internet automates many tasks, but workers do not possess the skills technology requires, the outcome will be greater inequality, rather than greater efficiency.

With specific reference to agriculture, the lack of qualified staff represents the biggest concern and challenge for farmers, as digital equipment and machines require specific skills and competencies, with some high technology machines being expensive and difficult to maintain (Anitei, Veres and Pisla, 2021). In Lesotho, low agricultural productivity is a result of a

challenge in accessing credit for commercial agriculture, weak rural infrastructure and poor government rural development policy, resulting in the scarce use of technologies for communication and trading (Akintunde and Oladele, 2019). Anitei *et al.* (2021) suggest solutions to these challenges, namely: government investments, specialised training, lower cost of technologies and easier access to digital farming programmes.

2.23.1 Digital infrastructure

Greenstein (2019) explains digital infrastructure supports a range of innovative businesses in the sharing economy, social media, mobile information services, and electronic retailing, as well as ad-supported media. García Zaballos, Iglesias and Adamowicz (2019) add digital infrastructure enhances agricultural sustainability and improves food security. However, the OECD (2019b) reports the capacity to create value in the agricultural sector food systems using digital technologies not only depends on infrastructure, but also on the regulatory environment and institutional arrangements which, together, govern access to and use of digital technologies in the agricultural sector. Many countries in the world, particularly in SSA, nevertheless, still lack digital infrastructure and accessible and affordable connectivity, as well as internet coverage (World Bank, 2024a). In addition, Shenglin *et al.* (2017) argue, even where there is digital infrastructure, as technology evolves with time, the digital infrastructure also needs to be visible, for instance, telephone users are migrating from 3G internet to 4G for advanced internet use.

Jin (2017) believes digital platforms are not value-neutral but reflect the value system of the proprietor. In essence, as Mweberi (2020) argues, this means when Africa relies on digital platforms built by foreign entities, they will be working under the value system of the countries where digital platforms originate, thus alienating the majority of rural African agribusinesses from benefiting, due to the divide created by a lack of digital skills, because they are the lowest in most African countries. Moreover, Ajena (2019) asserts the promises of digital technology are mainly addressed to conventional, industrial-scale agriculture, allowing them alone to thrive, at the expense of smaller operations.

2.23.2 Limited access to funding for digital initiatives in agriculture

Despite the potential of digital tools to transform agriculture in Africa, the agricultural sector is not prioritised for digitalisation funding, as explained by the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) (2021/2022). As a result, Mhlanga and Ndhlovu (2023) show farmers are unable to obtain finance to invest in digital technology; therefore, organisations and agribusinesses will be unable to deploy and scale up digital technology and solutions without funding Mudzengi, Gandiwa, Muboko, Mutanga and Chiutsi, 2021). The involvement of private organisations and NGOs through funding could be very important in ensuring digital technology use in Lesotho, as highlighted by Mhlanga (2004). The lack of funding for agricultural activities in Lesotho limits the development of agriculture in Lesotho, which constrains diversification, modernisation, as well as marketing.

Abdulai, Tetteh Quarshie, Duncan and Fraser (2023) highlight digitalisation for smallholders is highly dependent on NGO and private sector projects; however, there is a need for clear policies and strategies for agriculture. This includes all farmers, regardless of their location, as well as the private sector that could be used as an advocacy tool to push for funding in the agricultural sector (Abate, Abay, Chamberlin, Kassim, Spielman and Tabe-Ojong, 2023). Therefore, this shows the government needs to commit to ensuring agricultural policies and strategies are aligned with the conditions necessary for the provision of funding for agribusinesses. Most importantly, farmers and agribusinesses in all population segments need to be aware of funding opportunities for their agribusinesses and the conditions that make funding possible, to enable digital technology use for their businesses. This can be achieved by investment in reliable production/financial data regarding rural households engaged in agriculture, as Moyo (2013) pointed out.

2.24 APPLICATION OF DIGITAL TECHNOLOGIES IN AGRIBUSINESS

Cebiso (2022) opines business today cannot function properly without digital technology; agribusiness not being an exception. Şahin and Topal (2016) add information technologies lead to continuous development in all areas through innovations. Bronson and Knezevic (2016, cited in Mikhailov, Camboim, and Reichert, 2019) emphasise the digital revolution has been

transforming agribusinesses worldwide. In addition, Marinchenko (2020) asserts the agricultural production level today is determined by the degree of production intellectualisation, modern technology availability, automated new generation technical equipment, along with appropriate information and instrumentation provision.

In contrast, Durowoju (2017, cited in Jesa and Lekhanya, 2022) described technology as an external force, complex for businesses to predict, which subsequently leaves managers and owners perplexed regarding how to effectively plan for the transformation to digital technologies, particularly in SMEs, where investing in technology is deemed quite pricy and costly to manage.

According to Trendov, Varas, and Zeng (2019), adoption of digital technologies varies from country to country; nonetheless, digital agriculture in developing countries lags developed countries. Wolfert, Ge, Verdouw, and Bogaardt (2017) and Klerkx, Jakku and Labarthe (2019) explain this is due to the agricultural systems of developing countries often not being capable of digital transformation, which is more evident in the least developed countries. Furthermore, one factor contributing to the modernisation and better performance of the agro-food industry is the adoption of digital information technologies (Walter, Finger, Huber, and Buchmann, 2017).

Digital technologies currently in use in the agro-food sector primarily include the mobile phone, digital radios, satellites, and drones, as well as social media platforms including Facebook, Twitter and Instagram, according to the CTA (2016). These technologies have now penetrated all segments of the agricultural value chains, from reproduction to commercialisation and consumption, as shown in Table 2.1 below.

Small-scale farmers, however, usually face more difficulties in achieving proper digital technology use, due to higher profit margins than large–scale producers; attributed to lack of information, insufficient connections with the target market, and high transactional cost (Markelova, Meinzen-Dick, Hellin and Dohrn, 2009). Digital platforms contribute to a reduction of these disadvantages, particularly by connecting farmers directly to consumers without intermediates (Zeng, Jia, Wan, and Ghuo, 2017).

Table 2.1: Digital technology use and function in agribusiness

Digital technology type used in agribusiness	Function
Drones	Crop spraying helps farmers to maximise their yields (Kalamkar, Ahire, Ghadge, Dhenge and Anarase, 2020). Drones allow seed planting in areas where tractors and people do not have access, thus erasing without trace, specific limits in agriculture (Anitei *et al.*, 2021). Drones perform visual control in monitoring crop fields, managing irrigation and determining the amount of crops planted, as well as productivity in the field (Nuraddin, 2025).
Blockchain	Provides a transparent distributed way to perform and record transactions among different untrusted parties (Karaduman and Gülhas, 2025)
Artificial Intelligence (AI)	Increases productivity to crop harvests, facilitates planting process and provides a commercial platform for farmers to communicate (Srivetbodee and Igel, 2021). Has the potential to predict and detect extreme events including natural disasters (Nuraddin, 2025)
Big data	Boosts productivity and expands markets (Anitha Mary, Popov, Raimond, Johnson, and Vijay 2022).

Mobile Phones	Harnessing digitalisation opportunities for rural development from lessons learnt in German–funded rural development (Teja, 2019).
Sensors	To analyse soil and plant health, as well as gather valuable data used for yield prediction (Basnet and Bang, 2018, cited in Mikhailov *et al.*, 2019). Identifying how digital technologies are being applied in agribusiness value chains Collect data from crops, livestock, therefore, farmers can keep track of their crops (Anitha *et al.*, 2022)

Source: Researcher's own illustration

The different digital technologies, with some tabled above (Table 2.1), combine to generate several categories of tools for agricultural production according to USAID (2017), such as the following:

- The precision of agriculture: Aerial images and sensors connected to the IoT provide geo-referenced information that allows differentiated handling of lots within the farm, with applications of inputs and water according to needs.
- Digital financial services: These include mobile platforms for monetary transactions, payments, credit, and microcredit, along with digital currencies, among others.
- Data-based: Agriculture uses different tools and approaches to obtain, analyse and translate data into actionable, timely and context-specific information for farmers. This category includes tools such as early warning alerts and those that allow decisions based on environmental and climate information.
- ICT-enabled extension: Increases the coverage and accuracy of advisory services through mobile applications, SMS messages, and videos to improve technical capacities and automated assistants or chatbots, among many other tools for knowledge exchange.

Owing to the benefits of digital technology in agriculture, many farmers and agribusiness are highly encouraged to use digital technology, and farmers are drawn to the need to use them. Anitha *et al.* (2022) show many agribusinesses have benefited from advancements of digital technologies such as AI. However, several authors have also illustrated the disadvantages of the above-mentioned digital technologies (Table 2.1) in agriculture.

First, as established by Pathak, Kumar, Mohapatra, Gaikwad, and Rane (2020), drones are costly, particularly when bought in large quantity, based on features and sensors necessary for executing its intended use, for example, imaging sensors, and software and hardware tools. Yawson and Frimpong–Wiafe (2018) describe drones as unmanned aerial vehicles (UAVs), without pilots, as they are controlled remotely by humans or fly automatically through embedded software-controlled flight procedures. Second, online coverage is another disadvantage, as it is mostly unavailable in arable farms. Third, the fact technology tools are weather dependent and demand strong and continuous network connectivity (Anitha *et al.*, 2022). Last, farmers have to acquire the skills and knowledge to operate, for instance, image processing software, or employ/contract highly skilled personnel conversant with the analysis software.

Owade (2018) also mentions the major obstacle for access to the IoT among farmers is the internet connection that is not capable of streaming big data, as well as the costs of IoT technologies. Moreover, Rajagopal, Thangaraj, Mansingh, and Prabadevi (2021) add most farmers are illiterate and have no or minimal technological knowledge, therefore, they will need to spend excessive funds on costs to utilise technology.

Fox and Singe (2022), nevertheless, highlight the above-mentioned applications are currently in wide use in developed and emerging market countries in other regions. Farms in Europe are shown to have adopted digital technology such as sensors all over, gathering data on weather, soil composition, plant conditions and machinery (EIP-AGRI 2015, cited in Calvet, Falcao and Thom, 2022) In addition, Fox and Singe (2022) further mention most African farmers do not use many contemporary technologies, other than using mobile phones to connect suppliers and traders.

2.25 CHARACTERISTICS OF DIGITAL TECHNOLOGIES USED IN AGRIBUSINESS IN LESOTHO

2.25.1 Mobile Technologies

As Wai, Ng, Chiu, Ho and Lo (2016, cited in Avery, 2019, cited in Avery, 2019) explained, mobile technologies include both the device and the software in the device. A mobile device is any portable electronic device such as smartphones, tablets, and eBook readers. Mobile technologies help to improve access for smallholder farmers to information, inputs, markets, and finance, as well as increasing productivity, while reducing operational costs (Ibanga, 2022). Singh, S. (2018) states the most omnipresent tool for ICT is mobile phones. These can also be deployed to complement or reinforce other information sources that can help farmers in their agribusiness, improve agricultural productivity and ensure sustainable development (Ogunniyi and Ojebuyi, 2016).

Lesotho fares well in terms of mobile penetration, with 78.8 percent Lesotho residents owning a mobile phone (Gillwald and Mothobi, 2017). Qiang, Kuek, Dymond and Esselaar (2012) identified some smartphone advantages over low-end mobile devices, which include a touch screen, a wider user base, convenient delivery of instant information, and affordability, along with the ability to deliver personalised information to owners, as well as voice communication support. Therefore, mobile phones have revolutionised many rural people's lives, including the small-scale farmers (Padhy, Reddy, Raj and Pattanayak, 2022).

Mojisola (2007) confirms the use of mobile phones in agribusiness to obtain information for sound decision-making, particularly in buying, selling and contacting potential customers, is capable of improving agribusiness activities. Mobile phones allow greater access to information and services, including finance and links to the market, as they can increase productivity by ensuring farmers are better informed and can overcome the geographical, social and economic isolation of rural farming communities by connecting them to the value chain (Emeana, Trenchard, and Dehnen-Schmutz, 2020).

In the context of Lesotho, mobile phones have significantly reduced production and communication costs and provide new opportunities for agritourism stakeholders in exchanging relevant information through short messages (Mpiti and De la Harpe, 2015). However, Ahmed

and Laurent (2009) believe mobile phone use, particularly by rural farmers, has some associated challenges, such as illiteracy, since some mobile phone features and services require the ability to read.

Vincent and Cull (2011) found a positive relationship between mobile phones and agribusiness development in Lesotho, reporting ten mobile phones were provided to the women farmers in Thulare Dairy Farmers Cooperative in Lesotho in 2006. Of these, five stayed in the lowlands groups, one went to the foothills groups, and four went to the highlands group. Once the mobiles had been distributed, the women could call ahead to the market and obtain pricing information and then communicate with each other, removing the need for physical travel. The different groups have also been able to make better use of product exchange, building on their geographical advantages, in addition to which external trade (outside the cooperative) has improved through the availability of mobile phones. These authors further mentioned the women farmers in Nyakosoba had a surplus of beans later in 2009 but were able to successfully market their product by using their mobile phones to contact potential markets (Vincent and Cull, 2013).

This corroborates data from India, where Thakur and Chander (2018) found mobile phones play a significant role in farming. Vincent and Cull (2011), therefore, determined mobile phones enabled economic growth within the Thulare Dairy Farmers Cooperative in Lesotho. Further to this, Maleka *et al* (2019) in their study conducted in Roma Valley Lesotho, on the one hand, established farmers are not knowledgeable regarding digital technology use such as smartphones, applications such as video–conferencing, and internet use. On the other hand, the majority farmers are knowledgeable regarding radio, cell phones and television; therefore, Makoala and Marake (2020) suggest farmers have to move from customer contact selling to being digital.

Similar to findings in Nigeria by Falola and Adewumi (2011), the most prominent challenge of agribusiness development in Lesotho is infrastructure. Some main obstacles in digital technology adoption and use are poor infrastructure; the internal road network and other infrastructure, which continue to pose serious challenges to the easy movement of agricultural produce within the country. This creates a situation where it is cheaper to import from SA, thereby depressing the domestic farm sector.

Falola and Adewumi (2011) add network infrastructure has not been installed in many rural areas. As the Alliance for Affordable Internet (2020) points out, the majority rural areas often lack the resources to support network infrastructure. Martinez-Fernandez, Vidal, Simó-Reigadas, Prieto-Egido, Agustin, Paco and Rendón *(*2016) highlight the challenge of connecting rural areas is due to costly infrastructure necessary for connecting. Furthermore, a study by Mandioma (2007) emphasised telecommunication companies invest in areas of high business; as a result, rural areas are left with little or no communication service.

2.25.2 Computers

Twyman (2018) maintains computers and laptops are digital technology devices. They can be used in agriculture and production (Cofas and Chiurciu, 2020). Tembo, Owei and Maumbe (2008) highlight farmers use information technologies such as computers to collect, manipulate and process data automatically, to control and manage agricultural processes. Gyawali, Paudel and Jean (2023) find computers have evolved to the extent where they play a critical role in almost every farmer's daily life. However, Akintunde and Oladele (2019) in their study, determined while there is computer usage in Lesotho, it is very low due to high costs and infrastructure, representing only three per 100 households, mostly people who reside in urban areas. This illustrates the need for farmers and their businesses in Lesotho to have access to broadband connectivity and electricity, in addition to creating awareness regarding the use of various technologies to the farmers and agribusinesses, as well as marketing opportunities to sell their products.

2.26 DIGITAL TECHNOLOGY USE BARRIERS IN LESOTHO AGRIBUSINESS DEVELOPMENT IN THE 1950S AND 1980S

For decades, the Lesotho government has grappled with deteriorating agricultural production, adopting various strategies to increase production commercialisation. As explained by Rantšo (2019), the introduction of new agricultural methods to increase production in agriculture became more common in developing countries during the modernisation era, starting from the 1950s. Abugre (2000) mentions the structural adjustment policies advocated for the reduction of government subsidies benefitting smaller farmers, resulting in reduced subsidies, leading to low productivity, because without subsidies, many small-scale farmers resorted to simple/

primitive technologies. In the absence of technical change, land utilisation had remained low in many countries (Killick and Commander, 1988).

In Lesotho, productivity in agriculture in the past decades declined due to several reasons, with Wellings (1986) highlighting one reason was that farmers in the traditional land tenure systems were not granted loans by commercial banks. However, Mendelsohn, Dinar and Dalfelt (2000) mention, in recent years, the world has witnessed Lesotho's slowest record of agricultural activity, due to climate change. Efforts to improve agricultural production have, nevertheless, been made through projects such as the World's Bank Lesotho Smallholder Agriculture Development Project (SADP), as well as through grants aimed at increasing productivity and post-harvest infrastructure and management (Thompson, 1916).

2.27 CHALLENGES FACED BY AGRIBUSINESS IN DIGITAL TECHNOLOGY USE IN LESOTHO

The cost of adopting agricultural technology is a constraint to its adoption (Mwangi and Kariuki, 2015). Clair (2020) emphasises every farmer wants to benefit from new technologies, but not all can afford an upgrade, due to lack of capital and money to purchase the newest equipment and tools; that being the case, they opt to continue with the traditional way of farming as their only option.

As in most countries, Kamaray (2004) finds Lesotho internet service is not widespread, due to the low income of households and poor computer literacy rates. Modo (2001) emphasises mobile phones and airtime are expensive and beyond the reach of most people in Lesotho, in addition, most communities lack access to electricity, and many send their phones to town for recharging. Kuek, Paradi-Guilford, Favomi, Imaizumi and Ipeirotis *(*2015) also stress lack of cost-effective, available electricity is a major obstacle to digital economy development. Mokotjo and Kalusopa (2010) additionally mention the very high cost of making calls in Lesotho, as well as the high initial costs of purchasing a mobile phone, resulting in the majority people in most rural areas unable to afford ICT services.

The UNCTAD (2019) report, however, states even where there is access to mobile phones or the internet, people may not know how to leverage such tools to advance their business operations. Most of the debate on digitalisation and development has, to date, concentrated on

the extent to which countries have affordable access to various technologies and whether they are being used (UNCTAD, 2021), without addressing the digitalisation implications on agriculture and agribusiness.

2.27.1 Social influence

Saha, Shumway, and Talpaz (1994) highlight the extent of farmers adopting a specific technology is influenced by knowledge of new technology, which affects their adoption decision. This is because farmers often influence each other, since for many farmers; information, skills and knowledge are often passed on through word-of-mouth. Therefore, when a certain group of farmers is against technology used, other farmers may reject it. Nevertheless, Bandura (2001, cited in Straub, 2009) mentions technology adoption is influenced by individuals observing others adopting a particular innovation, thus an individual's experience of using technology may influence others, whether successful or not. As explained by Lwoga, Ngulube and Stilwell (2012), the major sources of information for farmers are predominantly local (neighbours, friends and family). Mokone (1999) found many farmers in Lesotho rely on their indigenous knowledge, in that most families discuss and advise each other on agricultural issues, because of mass media in localities.

2.27.2 Infrastructure

Wilkinson (2022) states infrastructure such as electricity is a prerequisite for the application of technologies. Lesotho's National Digital Transformation Strategy: Agenda 2030 (Government of Lesotho, 2024) describes electricity as a basic digital economy enabler, where access needs to be improved for inclusive digital technology use and the digital economy of the country. As a result, Aruleba and Jere (2022) show infrastructure is a challenge in the digital age, significantly more so in the rural areas. Rijswijk (2022) further determines infrastructure unavailability puts pressure on economic and social development, including struggling agricultural business, while Oboko and Goldman (2016) state infrastructure impacts business effectiveness.

In Lesotho, infrastructure is currently low, with telecommunication services accessible to approximately three percent of the entire population through land telephone lines, and roughly 20 percent for mobile phones (Maphephe, Balkaran and Thakur, 2014). This lack of

infrastructure, such as access to electricity, limits the adoption of technology, as many digital technologies depend on electricity, for instance charging phones, computers and tablets. In this regard, the government needs to initialise options such as private investments to create access, even in the rural areas, or provide other power solutions, such as solar energy, to promote digital technology use (for example, mobile phones) for farmers to access information, as well as markets.

Motseki-Mokhothu (2018) mentions the terrain in rural areas is not easily accessible, subsequently; technology is being introduced slowly, denying cell phone users access to signal and the internet. In addition, a study by Mokotjo and Kalusopa (2010) reveals computers, as the other form of technology, cannot be taken as appropriate for information dissemination to rural areas, due to the lack of ICT infrastructure in most rural areas of Lesotho. The non-availability of digital infrastructure is considered a key constraint inhibiting Lesotho's social development and economic growth, as indicated by the African Development Fund (AfDB, 2019).

Unreliable transport in Lesotho is another major hindrance in delivering produce to market (World Bank, 2009). According to Tunde and Adeniyi (2012), transport is regarded as an important factor, integral to agricultural development all over the world, because it creates a market for agricultural produce, enhances interaction among geographical and economic regions, and opens up new areas to economic focus. However, this requires road and rail infrastructure, with development of these transport networks hampered by the terrain (Motseki-Mokhothu, 2018).

In terms of the internet infrastructure in Lesotho, similar to many small developing African countries, it has not been fully utilised, specifically in the expansion of internet access (Thamae, 2015). The level of access to fixed, wireless, and internet services remains too low, particularly in areas of the country where population density is low (Government of Lesotho, 2008). Sefika *et al.* (2013) add the majority rural communities remain far from having access to computer and internet–related technologies. However, Rantšo (2016b) shows the government had allocated infrastructure to the amount of 20 million Maluti in the 1970s–this money was planned for use to expand transport and communication systems, in order that raw materials from farmers, particularly wool and mohair, would be easily transported to the manufacturing industries. Nevertheless, Van Bocksteal and Vlaasenroot (2011) highlight many rural households struggle

to make ends meet and have, as a result, been moving towards non-agricultural activities to supplement incomes.

2.27.3 Accessibility of digital technologies

Rijswijk, Klerkx, Bacco, Bartolini, Bulten, Debruyne, and Brunori (2021) finds the accessibility of digital technologies by farmers is generally influenced by affordability, whether unable to buy or unwilling to invest in technology. Shaibu, Hudu and Isreal (2018) highlight accessibility to digital technology devices had impacted negatively on peoples' adoption behaviour. Therefore, the digital industry, particularly telecommunication companies, should make their products and services accessible to peasant communities, since difficulties in access to digital technology could also be a factor of exclusion in agriculture, whether at the individual (lack of skills) or territorial (underdeveloped digital infrastructure level (Bellon-Maurel *et al.*, 2022).

The Ministry of Communications, Science and Technology (Government of Lesotho, 2008) indicates the level of access to digital technology in Lesotho is influenced by access to internet services, which remains low. Mokotjo and Kalusopa (2010) further illustrate, despite the growing mobile and internet industries, lack of access to technology is affecting the use by farmers and extension services; that is, the quality of devices that end up in the hands of smallholders is not always of the best. A limitation of the devices that smallholders own is their frequent incompatibility with applications that provide solutions targeting them. In other words, most smallholders can only afford feature phones, yet most digital solutions targeting smallholders are distributed as web and mobile applications (FAO and OECD, 2016)

2.27.4 Lack of appropriate Technology

Technological change is a critical component of agribusiness success Scrimgeour, McDermott, Saunders, Shadbolt and Sheath, 2006). Responding to market conditions requires the introduction of new technologies such as digital, or other technological innovations. In addition, technology can influence either agribusiness in general or merely sectors within it. Although the Lesotho government aims at supporting emerging agricultural business by increasing commercialisation of the agricultural sector (World Bank, 2017), innovative agricultural activity is basically at subsistence level, with limited commercial farming, and a lack of technologies required to enable information creation (FAO, 2013).

2.27.5 Digital Literacy

Digital literacy is the ability to access, manage, understand, and integrate, as well as communicate, evaluate and create information safely and appropriately, through digital devices and networked technologies, for participation in economic and social life. It includes competencies variously referred to as computer literacy, ICT literacy, information literacy, and media literacy (Law, Woo, de la Torree and Wang, 2018). Low-income countries are reported to have fewer skilled people and depend to a large extent on agriculture, which tends to be slower to take advantage of new technologies (UN, 2021).

The current situation in Lesotho provides opposing views. In a study conducted in the Leribe district, Rantšo (2019 mentioned many people participating in block farming have a low education level, as a result, smallholders are unwilling to adopt new agricultural technologies. However, the ITU (2010) and World Bank (2016) reports assert consumers have limited digital skills that restrain the extent of their digital product and service adoption and use, even though they have been rapid new technology adopters in the form of mobile phones and mobile payments. Therefore, as Langyintuo and Mekuria (2005), as well as Tabi, Vabi and Malaa (2010) explain, educated farmers are believed to have a higher ability to perceive, interpret and respond to new information regarding improved technologies, than their counterparts with little or no education.

Due to their low education level, farmers in Lesotho have, furthermore, become passive recipients of technical assistance, beneficiaries of public sector subsidised inputs and price takers in the market, which is particularly volatile due to their small scale and isolation from other markets (Crush, 2016). The FAO and ITU (2022) report pointed out the reason for low digital skills may be attributed to the high costs of mobile phones and computers, and their low penetration in Lesotho as a result.

2.27.6 Rural-Urban Divide

Dörr and Nachtmann (2022) highlight digital technology bears the risks of creating a digital divide between regions and population groups. In this regard, Aruleba and Jere (2022) state the digital divide is centred on two crucial problems, with the first the result of impoverished communities, as this creates more limited digital technology opportunities, while the second is

limited access to technology training, which results in poor digital skills attainment. In addition, resource constraints may result in skewed investment policies favouring urban regions, potentially creating a digital divide within an economy (Taylor, 2023); therefore, to prevent this from occurring, there should be support and expansion of ICT access to rural areas (Shenglin, Simonelli, Ruidong, Bosc and Wenwei, 2017)

According to the FAO (2019), 65 percent of Lesotho's population is rural. Brey, Trauen, Ramsunder and Afrika (2022) highlights the rural areas in Lesotho face several unique development challenges that affect the use of digital technologies. Mohloboli (2025) shows this divide is still a constant challenge in Lesotho, as reliable internet access remains a distant dream, particularly in the rural areas, where farmers do not have access to the tools that would allow them to utilise digital technologies, thus widening the rural–urban divide.

Mothobi and Gillwald (2017) mention the reasons for the continued digital divide in Lesotho, between those able to access the internet and those unable to, can be explained by the unaffordability of services and internet–enabled services. Furthermore, Taele, Mokhutšoane, Hapazari, Tlali, and Senatla (2012) note, similar to many SSA countries, daily life in the remote areas can be very difficult, where among other problems highlighted, is the underdeveloped rural community, while technology use is hindered by infrastructure and resource problems in these areas. This results in uneven distribution of information for agribusinesses and farmers; as a result, the urban farmers may appear to be knowledgeable, with a positive attitude in digital technology use.

Despite serious efforts of the Lesotho Government, the Lesotho Electricity Company (LEC) and other stakeholders, the level of households connected to the grid remains low. In 2015, approximately 72 percent urban region households were connected, while the share of households with access to electricity in rural areas was only 5.5 percent (LEWA, 2017). Most of Lesotho comprises underdeveloped rural areas that lack ICT and other modern facilities, when compared to urban areas (Sefika *et al.*, 2013).

On the one hand, Lesotho has had some notable achievements in a number of its socio-economic sectors, and one is ICT infrastructure, specifically in the urban areas. On the other hand, the country also depends on the manufacturing of farm products such as milling, leather, and canning, to provide the main source of citizen income. Contrary to Lesotho's ICT policy, the

infrastructure for industry and commerce is relatively poor even in urban areas, more so outside the capital city, Maseru, and other urban areas (Government of Lesotho, 2005).

2.28 LESOTHO AGRIBUSINESS OWNER/MANAGER AND FARMER PERCEPTIONS OF DIGITAL TECHNOLOGY USE

Reva (2019) shows digital technologies have not been used to their full potential to provide Basotho farmers with technical assistance and access to market information, due to the lack of internet access in rural areas and low digital literacy, However, despite the difficult environment, there have been several success stories, where small-scale farmers in Lesotho have demonstrated great awareness of digital technology adoption. An example is the wool and mohair grower's association, which has considered adoption of new digital technology-driven methods with Mateka farmers, aimed at increasing earlier revenue sales (Mpaki, 2017).

2.28.1 Technologies that support agribusiness

Sustainability of individual businesses, whether small or large, is stated by Ameen, Hosany and Tarhini (2021) to depend on the adoption of technologies; this includes different domains of agriculture. These domains comprise digital technology for farm management, financial services, market services, and farming knowledge and information services (Mushi, Serugendo, and Burgi, 2022). Technology also plays a role in agricultural sector development and improvement in the income levels and livelihood situation of farmers (Kumar, Singh, Kumar and Mittal, 2011, cited in Thwala, 2017).

According to Pham and Stack (2018), technical changes in agriculture in the 20th century relied on technologies developed in biological, chemical and mechanical fields for application by large companies. Agricultural technology evolved as the third Asian Green Revolution, with a technology package of hybrid seeds, irrigation, modern pest control and fertilisers in the 1960s (Rose and Chilvers, 2018) and more recently, to what is termed "agriculture 4.0", or the fourth agricultural revolution. This is a recent and potentially game-changing transition of high technology (High–Tech) solutions such as the IoT, biotechnology innovations, cloud computing, and precision agriculture, as well as smart farming, drones, sensors, and robotics (Jellason, Robinson, and Ogbaga, 2021).

Digital technology applications are now expected to bring remarkable improvement in agricultural product supply chains in terms of efficiency (Vizza, Tradigo, Veltri, Lambardi, Garofalo, Caligiuri and Guzzi, 2018). Furthermore, Aguera, Berglund, Chinembiri, Comninos, Gillwald and Govan-Vassen (2020) assert technologies such as wireless communication, data management, analytics tools, and remote sensing, along with robotics, drones, satellite systems, and AI, are being integrated to develop services aimed at reducing costs, conserving resources, optimising inputs and maximising outputs.

The food processing industry, as Sikora and Bielski (2017) state, is one of the most important branches of agribusiness, therefore, Ingram and Maye (2020) mention sensing systems and associated analytics can provide producers with better information to make more timely decisions, resulting in more predictable outcomes, while automating tasks using sensing technologies, and machine learning can increase reliability.

Many of these digitalising technologies, particularly the on-site technical infrastructure related to data collection and processing, the IoT and AI, can likely only be adopted in large-scale commercial farming operations, primarily because of the cost involved (Smith, 2018). Nonetheless, mobile phones, electronic billboards, digital television and radio channels are all advertising mediums used as part of the digital marketing strategy of a business (Bojkić, Vrbančić, Žibrin and Čut, 2016). For a small-scale farmer, such services offered by digital tools can mean access to crop price data, weather alerts, or direct buyers, transforming livelihoods at a grassroots level (Mohloboli, 2025).

Farms can, furthermore, reduce labour costs through the use of robotics or semi-autonomous machines, subsequently influencing agrarian labour conditions that might lead to job losses in the sector (Carolan, 2019) and potentially enhance inequalities between farmers (Klerkx and Rose, 2020). Nonetheless, digitalisation can also create difficulties for smallholder farmers as they struggle to compete with new technologies that can even cause price rises by increasing market concentration (FAO, 2020a).

2.29 DIGITAL TECHNOLOGY INNOVATIONS THAT SUPPORT AGRIBUSINESS

Specifically, digital technology innovation refers to the use digital technologies to create a new product, process, marketing method, or organisational method, or to improve existing ones

(Wiesböck and Hess, 2020). Digital innovations to improve agricultural efficiency include software, electrical meters, sensors, and aerial surveying mechanisms, as well as internet-based marketing resources, technological research tools and equipment (Kulik, Androsova, Solovjeva and Zuppelo, 2021).

Digitalisation itself is not new, the food industry was using several digital technologies and data systems a decade ago (Kittipanya-Ngam and Tan, 2020); however, there is no evidence of how Lesotho used digital technologies decades ago. The World Bank Group (2021) reports the state of institutional digital platform readiness is, nevertheless, low, particularly concerning their understanding of the internet or mobile platform readiness and ICT project sustainability.

Mpangile, Ishengoma, and Gillah (2008) add, on the one hand, firms can participate in the agribusiness innovation process, such as through developing new agribusiness products that may reach new evolving markets, developing new products to cater for existing markets, and improving production routines that may lead to price advantage over competitive firms. On the other hand, digitalisation can also intensify the challenges smallholder farmers face, struggling to measure up to new technologies capable of initiating price rises through increased market intensity (FAO, 2020a, p.1). In this regard, Paech (2007) emphasised the innovation orientation of modern market economies leads to pressure for economic growth that can impede sustainable development.

The introduction of digitalisation in the agro-industrial complex, nonetheless, requires the functioning of economic systems, the modernisation and renewal of fixed assets, and the transition to a digital economy, including the degree of agribusiness enterprise readiness and sectoral management mechanism for digital transformation, as well as actively conducting forums, where the start-ups of the latest development of material and technical resources are explained (Kulik *et al.*, 2021). The World Bank Group (2019) highlights the adoption of digital technologies varies significantly across countries, with lower current adoption rates in low-income countries.

2.30 DIGITAL TECHNOLOGY: KEY FEATURES THAT INFLUENCE AGRIBUSINESS DEVELOPMENT

According to Samoggia, Monticone and Bertazzoli (2021), in addition to other features for successful digital technologies that increase customer satisfaction and engagement, are the security of online payments, and the use of videos and photos to promote businesses. Okano (2017) specifies the IoT, as an internet-based technical infrastructure, enables the interchange of items and services, along with the global supply chain network. Furthermore, Banga (2019) states the features of Big Data, cloud computing and AI contribute to the expansion of global value chains by creating efficiencies in production, planning and product development, as well as logistics.

Where agribusiness is concerned, digital apps, websites and other ICT tools allow producers to share content with customers in a fast, low-cost manner (Rahman *et al.*, 2011). Regarding directly applied digital technologies, mobile phones and the internet, these have also increased price transparency in agricultural markets.

While digital technologies are made to work for farmers, consumers and farm workers, GRAIN (2021) argues technology is shaped by money and power and does not develop in a bubble. With specific reference to Big Data, Riahi and Riahi (2018) emphasise the need for specific and increasingly sophisticated computer storage and analysis tools for this kind of technology. Furthermore, Choi *et al.* (2021) add the relatively low levels of education and low-skill of workers across most of the region means businesses may not yet find it cost-efficient to invest in digital technologies.

Ndubuaku and Okereafor (2015) also point out network capacity and poverty rates among the challenges facing SSA countries in the IoT technology use. The authors state for IoT adoption to grow in Africa, the cost of components required to support capabilities, such as sensing, tracking and control mechanisms, needs to be relatively inexpensive in the coming years. López–Vargas *et al.* (2020) suggest one main requirement to achieve IoT dissemination in developing countries, is to use inexpensive technologies. This would assist developing countries that lack resources (Garrity, 2015), unable to adopt modern technologies at the same pace as developed countries.

2.31 CONDITIONS FOR DIGITAL TRANSFORMATION OF AGRICULTURE

Ekekwe (2017) proposes digital technology paves the way and holds hidden potential for farmers, investors, and entrepreneurs, to develop a more efficient means of food production and consumption in Africa, which could bring a considerable amount of economic, social and environmental benefits. However, there are different challenges in the digital transformation of developing economies (Trendov *et al.* 2019). Ally (2020) points out challenges include the country's digital structure, the institutional environment and innovation and development. Hai, Van and Tuyent (2021) state the lack of capital and technology resources are also obstacles that make many countries lag in digital transformation; therefore, certain conditions shape the digital transformation in different contexts.

In Lesotho, factors that limit broader digital adoption include the high cost of communication fixed broadband prices, which are approximately 30 percent higher than the average in SSA, restricting the use of digital tools and services by businesses and consumers (Reva, 2019). The study, therefore, adopts explanations of the conditions that must exist for the use of digital technologies to enable digital transformation, as outlined by Trendov *et al.* (2019).

Figure 2.2 below provides a graphical illustration of both the basic and enabling conditions that must exist when using digital technologies and for the digital transformation of agriculture to occur.

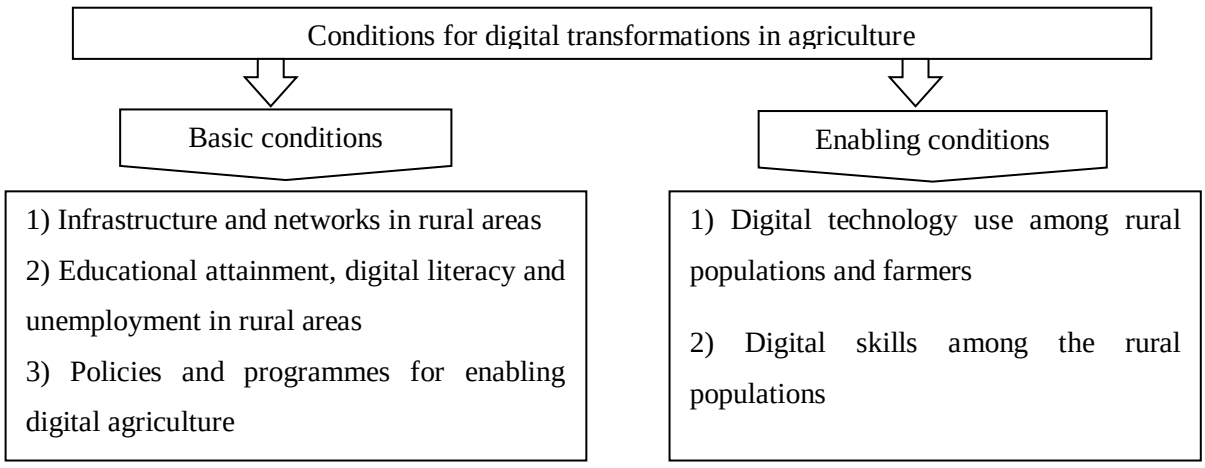


Figure 2.2: Digital transformation conditions

Source: Trendov *et al.* (2019)

Trendov *et al.* (2019) provide a two-part condition for the digital transformation of agriculture to occur, namely basic and enabling conditions, as illustrated in Figure 2.2. Both these conditions are divided into three sub-conditions each. The basic conditions include IT infrastructure and networks in rural areas, educational attainment, digital literacy and employment in rural areas, as well as policies and programmes for enabling digital agriculture. Enabling conditions include the use of digital technologies among rural populations and farmers, along with digital skills among rural populations, and a digital agri-preneurial and innovative culture.

2.31.1 ICT infrastructure and networks in rural areas

Khalil, Abdelli and Mogaji (2022) find the lack of infrastructure and communication networks is exacerbated by the government's lack of interest and support to develop the infrastructure required to expand internet accessibility, particularly in the rural areas. Milovanović (2014) illustrates agribusiness is an economic area that offers great potential for ICT use, with the aim of social and economic development, for particularly the rural area agricultural population.

Notwithstanding the provision of infrastructure and networks in rural areas in various developing countries (Henry, 2019), there has always been a digital divide between the rural and urban areas in developing countries (Abdullah, 2015). This is as a result of insufficient network in rural areas that de-motivates people to purchase and use digital technology, more so in the rural areas, where they feel technology is not made for them.

Mpiti and De la Harpe (2015), nevertheless, mention that farmers in rural communities of Lesotho do not have access to ICT, making it difficult to communicate agri-tourism products and services to the market, resulting in lower sales and productivity. In this regard, the FAO and ITU (2022) further report communication technology use in Lesotho is low due to high costs, with low internet use among businesses and individuals. When sales and production are low, people are less likely to focus on buying technology; they focus on increasing productivity to eradicate poverty.

2.31.2 Educational attainment, digital literacy and employment in rural areas

Digital literacy skills are needed for the development, adoption, use, and scaling up of digital solutions in agriculture (Trendov *et al.*, 2019), however, limited knowledge and skills in using

ICTs by farmers contribute to the challenges in adoption (Abdullah, 2015; Mulauzi and Albright, 2008). According to the World Bank Group (2021), digital skills development in Lesotho is hampered by the low levels of basic literacy and numeracy skills, with a wide gap in basic level digital literacy; consequently, the digital entrepreneurship system is considered nascent, particularly in comparison to its African peers. This is attributed to the majority digital technologies that operate in English; regardless of high literacy rates in Lesotho, many farmers in the rural areas are illiterate, and therefore, digital technology use is not in their favour.

2.31.3 Policies and Programmes for enabling digital agriculture

Digital technology has received political attention globally, with the development and uptake supported through numerous commitments and programmes, such as the Communiqué of Global Forum for Food Agriculture (GFFA) in 2019 (Dörr and Nachtmann, 2022). This type of support is often seen by governments and experts as an opportunity to contribute to the development of agriculture for the benefit of farmers, consumers and society in general (Bellon-Maurel *et al.*, 2022); as a result, Ekekwe (2017) indicates governments in several countries adopt policies and programmes as one of the driving digital transformation forces.

For digital technologies to overcome information scarcity, the digital sector must be accompanied by complementary policy reforms (World Bank, 2016). Hanna (2018) asserts successful digital technology use, therefore, calls for investing in complementary factors such as enabling policies, human resources and new institutions. However, despite the importance of agriculture for the rural economy, the sector suffers from a too limited number of strategies and policies, with policies often outdated or unable to accommodate the emerging trends of new technologies and services offered through the digital economy.

Lesotho's existing policies and strategies are also somewhat outdated and/or not being implemented (IFAD, 2019). In this regard, Bahn, Yehya and Zurayk (2021) emphasise that without appropriate policy support, digitalisation may disrupt the agricultural sector in adverse ways, such as reducing employment, widening inequalities, and further exploiting already scarce resources. Stanley, Harrigan, Serrano and Kraak (2022) maintain the most advanced countries in digital technologies have significant support for digitalisation by the government. Lesotho needs to have significant government support for digitalisation, which will include

training and financial support for agribusinesses; because the majority farmers are highly dependent on government support for their commercial and subsistence farming.

UNCTAD (2003) states the essence of technology policy is to promote skill development and improve information supply. Chang (2011), however, argues all these policies need greater resources, better organisation or even political and administrative reforms to succeed, along with changes in the international rules of the game. The author further mentions none of these difficulties are insurmountable, with a wealth of experience from countries in Europe, North America and East Asia that African countries can draw from, to devise an effective technology policy, adequately calibrated to meet their material, technological and political conditions (Chang, 2011).

In the context of Lesotho, the World Bank Report (2020) reveals digital skills have a high priority in national and sectoral development strategies and plans, yet, their implementation remains insufficient, constituting a clear bottleneck for Lesotho in an area where policy and institutional reforms are needed. In agricultural sector development, Makoa (2014) mentions the statement of the Lesotho government's policy and strategy includes the Agriculture Sector Strategy 2003, National Action Plan for food security 2007-2017, Comprehensive African Agricultural Development Programme (CAADP), and National Agricultural Investment Programme (NAIP). In addition, these strategy policies are formulated with goals, objectives, and outputs, while also emphasising the development of productive capacities of households or farmers to tap into agribusiness. However, Makoa (2014) highlights the implementation has fallen short, as Lesotho's agricultural productivity remains low, despite huge government subsidies, because subsidies are less likely to be beneficial without proper strategies and policies.

According to Rantšo (2019), the colonial government in developing countries, specifically in African states, introduced several policies to improve the productivity of farmers. This was done by introducing: conservation measures intended to reduce soil erosion, such as compulsory tie-ridging and terracing; destocking; and other measures aimed at improving methods of cultivation and animal husbandry, including the introduction of compulsory dipping fees; and the forced growing of cash crops (Cliffe and Saul, 1972). Some policies were meant to reduce poverty in the rural sector and increase the productivity of African agriculture. However, they

often worked negatively, and the policies aggravated, instead of curbing, the high poverty rate; these regulations were to ensure an adequate raw materials supply to the colonies and colonising countries.

2.32 TECHNOLOGICAL INNOVATION

2.32.1 Innovation definition

Rogers (2003) states innovation is defined as an idea, practice, or project, which an individual or other adoption unit perceives as new. In addition, the World Trade Report (2020) explains innovation means new practices society is provided with and disseminated to. This involves culture changes with regard to a specific practice for enhanced outcomes and processes (Kilelu, Klerkx, and Leeuwis, 2013); while it also offers the opportunity to appraise new or better ways to conduct business, thereby improving organisational processes (Sun and Henderson, 2017). Improvements in management of the practice should arise, as explained by Haggblade (2011), with proper adoption of specific innovations, which will also produce market share among those places where innovation is found.

Feder, Just and Zilberman (1985) determined the adoption of technological innovations in agriculture has attracted considerable attention among development economists, because the majority population of less developed countries derive their livelihood from agricultural production and new technology offers the opportunity to increase that production substantially. Digital technologies escalate the range of opportunities to increase innovation, specifically through the collection of huge and diverse data volumes (Dana *et al.*, 2022).

Jackson and Shafron (2016) mention the agriculture sector, nonetheless, still lacks the use of digital technologies, which concurs with Spielman (2005), who shows weak innovation systems in developing countries. Where innovation is concerned, it is held by Egbetokun, Oluwadare, Ajao and Jegede (2017) that the costly nature of innovation is among the main differences between firms in developed and developing countries.

2.32.2 Innovations in business development

According to Ngibe (2020), one of the keys to any successful business is being able to come up with new ideas to keep operations, products and services fresh. This echoes Al-Ansari (2014),

who stated innovation is crucial for business and market environments to survive. The process of bringing those ideas to reality is called “innovation” (Brooks, 2013; Schmieder, 2014). Nevertheless, innovation is not purely concerned with technological integration. The Global Entrepreneurship Monitor (GEM) (2011) emphasises innovation is perceived differently. It can take various forms, including new business models, business organisational forms, and innovative marketing and project solutions (Kronig, 2014), while rent markets and economies, as well as products and services that might seem new to firms and customers in one market and economy, yet may already be familiar in another (GEM, 2011). Furthermore, Paunov and Planes-Satorra (2019) mention there are differences between industries regarding their products and their engagement in innovation.

Innovation is highlighted by Crossan and Apaydin (2010) as a value-added novelty either being created, or accepted, adapted and utilised in trade and industry spheres. This involves the regenerating of products and expanding services and markets, as well as developing new product development ways and establishing new demands. Therefore, innovation effectiveness determines business success.

Lesotho is not an exception to the reality of countries unable to support businesses using innovations such as digital technologies, due to lack of access to the internet, consequently, the country cannot innovate around a whole range of agricultural areas. For example, Lesotho lacks precision farming capacity, which helps farmers to utilise technology to mitigate climate change, increase yields and also mitigate the effects of natural disasters (Lesotho Times, 2021).

Conversely, several barriers delay some businesses in achieving innovations, which include unwillingness to change culture, inability to exploit new products and services, insufficient systematic innovation processes, and difficulty in accessing new markets (Scozzi, Garavelli and Crowston, 2005; Loewe and Dominiquini, 2006; Williams and Cowling, 2009; Zhu, Wittmann and Peng, 2012). Despite these barriers in using innovations, Mohutsiwa (2012) notes businesses are required to recognise opportunities to establish potential and competencies enabling their innovativeness, proactiveness and willingness to take risks in developing their performance or retaining competitive advantage. Moreover, as the world evolves, businesses need to remain relevant and ensure a profit, which requires meeting these new realities by

adapting to technologies (Purcell, 2019). In other words, for agribusinesses to develop; they need to adjust to new technologies and more relevant ways to ensure increased profits.

Very little is known on the status of agricultural innovation in Lesotho (FAO and ITU, 2022), however, as the Lesotho Times (2021) reports, an innovation policy was launched to offer guidance and a framework for the acceleration of innovation activities in the country. In an attempt to help Lesotho and other countries improve technology and innovation use in addressing challenges such as food security, inclusive economic growth and climate change, the United Nations Technology Bank (UNTB) was established specifically to support the least developing countries.

In Lesotho, the Department of Science and Technology and ministry of communications, science and technology, in collaboration with the Organisation of African, Caribbean and pacific states and the European Union (EU), introduced an innovation policy, providing guidance and a framework to fast-track innovation activities in the country (Government of Lesotho, 2021). However, these initiatives have had little to no success in achieving their aims, specifically in the agricultural sector, as farmers in Lesotho still struggle to access markets (Phakoana, 2023) easily accessible through digital technology. Senoko (2022) also shows Lesotho remains excluded from large and dynamic exports due to lack of technology use, therefore, this explains why the study is relevant.

2.33 FACTORS THAT AFFECT INNOVATION IN BUSINESS

2.33.1 Social factors affecting innovation

Social factors are defined as the facts and experiences that influence an individual's personality, attitudes and lifestyle (Chernyshenko, Kankaraš, and Drasgow, 2018). Henry (2010) sees social factors as those that affect not only individuals, but business thought and behaviour within social settings. As argued by Genis-Gruber and Öğüt (2014), being mindful of social factors allows entrepreneurs to be innovative in ways sensitive to current social needs and preferences (Shalley and Gilson, 2004). The business environment is, nonetheless, changing and requires innovative, strategic and entrepreneurial minds to help bridge the business gap through innovativeness and creative thinking ability, to meet market preferences (Juliana, Hui, Clement, Solomon and Elvis,

2021). In many communities, social factors may limit digital technology use for agribusiness development.

2.33.2 Economic factors that influence business innovation

The economic situation is an important factor that often influences a decision whether an innovative activity should be undertaken by a company, both in developing and developed countries (Tomaszewski and Swiadek, 2017). According to Nichter and Goldmark (2009), economic factors influence changes in costs of production, product prices, wage and interest rates, as well as inflation. These factors influence how a business generates profits, losses or growth (Gachuhi, 2016). Archibugi and Filippetti, and Frenz (2013) find companies are characterised by high-intensity development and accumulation of technologies involved in above-average innovative activity during times of prosperity.

2.33.3 Disadvantages of innovations

According to Womack, Jones, and Roos (1990), there are cases in which innovation does not lead to positive effects on business performance. However, an examination of the positive side of innovation shows, when people use appropriate innovations, it leads to positive effects on the business and more profits. Therefore, farmers and agribusiness need to be trained regarding the appropriate technologies, based on the characteristics of their businesses.

Siguaw, Simpson and Enz (2006) argue innovation-oriented firms become too enamoured with the idea of innovations, creating more innovations for the sake of innovations and failing to adequately consider consumer needs in the innovation process. Furthermore, Pombriant (2006) mentions the development, adoption, and implementation of innovations involve considerable market risk. Nevertheless, business opportunities have arisen as a result of increased globalisation and technological effects; therefore, with innovations as a foundation, it allows entrepreneurs to act on these opportunities in ways that result in competitive advantage (Jain, 2019; Edralin, Tibon, Poblador and Yu, 2019).

2.34 TECHNOLOGICAL INNOVATION IN AGRIBUSINESS

In the agricultural sector, technical change in the form of production technologies has been reported to have positive impacts on productivity growth in the developing world (Nin, Arndt,

and Precktel, 2003). Additionally, the ability to innovate in agriculture is often related to strengthening capacity in research and development, collective action, coordination, and the exchange of knowledge among diverse actors, as well as the incentives and resources available to form partnerships and develop businesses, in addition to conditions that enable farmers or entrepreneurs to use the innovations (World Bank, 2012).

Filser and Eggers (2014) showed a strong correlation exists between innovativeness and business performance. Nevertheless, Qamar (2014) mentions the Department of Agricultural Research (DAR) in Lesotho, responsible for adapting and generating improved agricultural technologies, has been rendered largely dysfunctional by incessant financial constraints and other factors. However, were agribusinesses to gain access to innovations, they can improve the efficiency of their work and businesses.

2.35 LIMITATIONS IN TECHNOLOGICAL APPLICATIONS

Rogers (1962) asserts diffusion is not a simple process; it takes time for technology to be diffused and adopted by farmers. Talwar, Talwar, Kaur and Dhir (2020) indicate adoption resistance is a major cause of failure of any innovation. Nonetheless, as Moula (2023) points out, there is often a communication gap between scientists and producers regarding the benefits and potential of their innovations, in return leading to a lack of adoption. Furthermore, Bontsa, Mushunje and Ngarava (2023)) emphasise the mismatch between farmers' literacy levels and the level of technology selected to address the gaps in the value chain. Moreover, Mohanty (2014) mentions when farmers are developed with skills, technology transfer is sustainable.

2.36 FACTORS AFFECTING EFFECTIVENESS OF INNOVATION PLATFORMS IN AGRIBUSINESS DEVELOPMENT

Innovation does not occur in a vacuum (Essegbey, Sakyi-Dawson, Kossou, Ouologuem, Dembele, Adu-Acheampong and Jiggins, 2017), as there is always a context and a multitude of actors in any innovation process, beyond those directly engaged (Falleti and Lynch, 2009; Faure, Gasselin, Triomphe, Temple and Hocdé, 2010).According to Hanyani-Mlambo (2017), resistance to change and adherence to established structures can often stifle innovation and the effectiveness of innovative platforms, because innovations are not only concerned with technology but also include social and institutional change, and have a systemic and co-

evolutionary nature (Biggs,1990; Leeuwis and Van den Ban, 2004). Conversely, farmers who are well informed regarding technologies are less likely to critique technology in a manner that will lead them to refusing to adopt technology completely. This means the government must implement training in technology use to assure farmers and agribusiness owners/managers how its use contributes to development of their agribusinesses.

Innovation systems in developing countries have been noted to be rather weak (Spielman, 2005), with the necessary linkages often absent or dysfunctional, resulting in what has been referred to as system and market failure (Szogs, 2008; World Bank, 2006). In Lesotho, Phoofolo (2018) identified the challenge of rate of change in new products, as well as new technology changes in customer preferences, which have increased dramatically. This is an impediment, because as Letuka (2017) mentions, most farmers cannot afford equipment, therefore, manual conservation practices are predominantly preferred by resource-poor farmers when weighed against the use of farming technologies.

Doss (2005) remarks on some reasons farmers do not adopt improved technologies, which include their misconceptions concerning costs and benefits of technologies and that they are not profitable, considering the complex sets of decisions farmers make regarding land and labour allocation for agriculture and non–agricultural activities. Nonetheless, Kim, Shah, Gaskell and Prasann (2020) indicate many digital technologies, such as disruptive agricultural technologies (DATs) that can be applied to the agriculture sector, can be deployed even in low connectivity rural environments.

2.37 RELEVANT THEORIES ADOPTED FOR THIS STUDY

The following section expands on the different theories identified as relevant to the study.

2.37.1 Technology diffusion and adoption

Technology is defined in many ways, with Rogers (2003) using the words ‘technology' and 'innovation' synonymously, on the one hand, defining technology as the design for action that reduces the uncertainty in the cause-and-effect relationship involved in achieving the desired goal. On the other hand, Sjoberg and Jorde (1995) argued technology is not always aimed at human welfare, while Nyamnjoh (1996) asserted modern technologies are characterised not to meet needs, but to create new needs in the market. Nevertheless, Azumah (2019) states the

contribution of new technology to economic growth can only be realised, when and if new technology is widely disseminated and used. Therefore, the study adopts Rogers' DoI theory to discuss technology adoption by agribusiness.

2.37.2 Diffusion of innovation (DoI) theory

The first theory of consideration in this research is Rogers' DoI theory, developed in 1962 and considered one of the critical older theories that remain relevant in social science and innovation in IT today. The DoI theory has been widely applied in various fields and industries (Gao, Li, and Tan, 2013, p.262). This theory is closely linked to the objectives of the current study. It is focused on the conditions in which a new idea, product, practice, philosophy, or process is likely to be adopted by members of a given culture (Rogers, 1995; Kaminski, 2011).

The DoI theory was propounded by Simin and Jancovic (2014) to attempt predicting the behaviour of individuals and social groups, considering their characteristics and social relations. Among other advantages of the DoI theory, as Ituma-Aleke and Egwu (2014) assert, is the provision of a contextual set driving technological innovation acceptance, such as the use of ICT-based information sources. According to Rogers (2003), the key dimensions of this theory include five innovation characteristics—relative advantages, compatibility, complexity, and trialability, as well as observability.

Relative Advantage - The degree to which an innovation is seen as better than the idea, programme, or product it replaces;

Compatibility - How consistent the innovation is with the values, experiences, and needs of potential adopters;

Complexity - How difficult the innovation is to understand and/or use;

Trialability - The extent to which the innovation can be tested or experimented with before a commitment to adopt is made;

Observability – The extent to which the results of an innovation are visible to others, enough to motivate them to adopt technology.

This theory seeks to explain how ideas and technologies such as social media spread through social systems, from adoption to actual use. Accordingly, this theory can be of great support to

agribusiness when diffusing technology, because as Petrović, Samardžija and Jankovic (2004) highlight, the rural community is part of a global society and shares their destiny; in many ways, they are very specific social organisms, particularly with regard to changes in agriculture. Furthermore, this theory is relevant to this study, since ICT use in small-scale agribusinesses may, in certain circumstances, be regarded as innovative. This serves as reason that agribusinesses in Lesotho should significantly improve their innovation adoption approaches and strategies for their development. However, this theory does not take an individual's resources or social support to adopt innovations into account, where the study seeks to investigate the mechanisms set in place to enable the diffusion of digital technologies among agribusinesses in Lesotho.

Criticism nonetheless exists regarding the diffusion of innovations, not considering the changing characteristics and behaviours of the market segments over time; the primary theory focus does not deal with people changing, but the innovations themselves (Robinson, 2009). Faure, Chiffoleau, Goulet, Temple, and Touzard. (2018) mention innovation can lead to social exclusion, destroy jobs and businesses, result in monopolies and misappropriations, and generate new technical and societal risks that need to be understood and addressed.

Leeuwis and Van Den Ban (2004) further emphasise innovation is a complex, constantly changing and unpredictable process; hence, developed countries have led much of the digital technology innovation and adoption, while in developing countries, the impact of these technologies on agriculture is not extensive, in view of the economic, social and environmental roles played by agricultural sectors (World Bank, 2019b). Wanjala (2013) adds, when technology is constantly changing and introduction of new hardware and software components is ongoing, the theory provides an understanding of how to introduce new ideas into the social system and sustain them. The theory in this study seeks to explore how digital technologies can be accessed in Lesotho.

The study sought to demonstrate the extent to which innovations are adopted by the agriculture industry, with a focus on agribusiness development in Lesotho, using DoI theory. Furthermore, diffusion theory was also applied in this study to investigate whether agribusiness owners have knowledge of digital technology and their willingness to actively use this knowledge, based on the contexts within which innovation is applied. In addition, the element of this theory provides

a framework that helps in understanding why some farmers choose to use digital technology for the business, yet others do not.

2.37.3 Production theory

Production theory explains the relationship between factors of agricultural production and output. It emphasises that when factors of production are combined and put in some transformation process, the result will be output (Endurance and Nathan, 2021). In this study, production theory is used to evaluate the effectiveness of technology in agricultural production for agribusiness. From an economic perspective, the business activity has to fulfil the requirement of the economy, or the effectiveness. It would be irrational to spend production factors (inputs) to gain a lower output amount than possible in the specified time (Kotulic and Pavelková, 2014).

Lesotho is home to two million people with low-input, low–output rain fed agriculture for production of cereals and extensive animal grazing that faces many challenges (World Bank, 2024b), with the agricultural sector as the main source of livelihood for 70 percent of the population in rural areas. The low adoption of technology for the development of agribusinesses hinders the development of technology in use. The literature reveals the adoption of improved technologies is the key to increasing agricultural production and farmers' income (Duflo, Kremer and Robinson, 2011). Therefore, without inputs such as technology, Lesotho will not be able to sustain itself with production, because production processes are required to facilitate output production.

Among the input factors that influence agribusiness production is technology, with countries without inflow of technology to expand on production depending excessively on the inflow from industrialised countries (Endurance and Nathan, 2021). The inflow hinders agribusiness development in Lesotho, therefore, the theory highlights the importance of digital technology use for agribusiness development, as Rantšo (2019) revealed the agricultural production in Lesotho is low.

Nishimizu and Page (1982), furthermore, argue output growth is not only determined by technological innovations but also by the efficiency with which available technologies are used. Additionally, Feder *et al.* (1985) and Varshney, Joshi and Devesh (2019) also maintain both

demand and supply side factors play a crucial role in the adoption and diffusion of improved agricultural technologies.

Demand side factors include technology awareness and knowledge, along with relevant inputs such as access to credit and supply, while the supply side includes policy support, investment in agricultural research and extension system, availability of infrastructure, as well as institutional arrangements for the delivery and benefit sharing of technologies (Barrett, Caster and Timmer, 2010; Besley and Case, 1993). This implies although agricultural production is influenced by technology, it does not happen in a vacuum, with several factors influencing technology use. This means countries without productive capacity such as Lesotho, will usually depend excessively on the inflow from industrialised countries, which hinders their agribusinesses development.

2.37.4 Modernisation theory

Welzel and Inglehart (2006) explain modernisation theory as a theory of social change that emerged in the enlightenment era, with the belief that technological progress would provide humanity increasing control over nature. Rostow (1960) emphasised the importance of transferring technologies from the industrialised to the developing world, in order to support this progress. Smelser and Haferkamp (1992) add the theory is an umbrella term, referring to the complex processes of transformation in technology, economy, society and culture that eventually resulted in replacing traditional or rural societies with modern or industrial ones.

Modernisation theory links technological innovation with development, where Enuka (2018) and Ates, Es and Bayraktar (2005) explain the theory assumes when poor countries follow the footsteps that saw the west to economic and socio-political development, they will experience the same level of development. Nonetheless, technological innovation has been traditionally concentrated in a few developed countries, considering the costs and risks involved in fomenting technological advances (Zanella, Bui, Castellani, Vangelista and Zorzi, 2014).

2.37.5 Modernisation theory stage model

The study adopts Rostow's five stages of economic growth (Rostow, 1965). In his theory on stages of economic growth, Rostow argues developing countries need to experience these stages

of economic growth to reach the age of high mass consumption regarding agricultural growth (Rostow, 1960). The stages of economic growth are described below:

2.37.5.1 Traditional society

A traditional society is one whose structure is developed within limited productions, although agriculture is the most important, technology is limited, and resource allocation determined by traditional production methods (Rostow, 1960). As a result, these societies have limited access to modern technology, because of limitations on productivity, which is a barrier to development (Rostow, 1990).

2.37.5.2 Transitional Stage (Preconditions for Take-off)

In this stage, there is an emergence of a transport infrastructure to support trade, as entrepreneurs emerge and incomes, savings and investment grow. External trade also occurs, concentrating on primary products (Rostow, 1956).

2.37.5.3 Take-Off

At this stage, industrialisation increases, with workers switching from the agricultural sector to the manufacturing sector; therefore, Rostow (1956) emphasises technological take-off preconditions generally combine institutional change, economic performance, political regimes, and social norms, as well as attitudes and state of development of backbone infrastructure.

In a broad sense, the 'technological take-off' requires society and an economy to be prepared to actively respond to newly emerging possibilities (Rostow, 1956). When these requirements are not sufficiently fulfilled, the technological take-off will not occur (Baumol, 1986). Furthermore, Rostow (1956) highlights development is determined by entrepreneurial actors willing and able to respond to open possibilities and consistent to changes in techniques modern technology can provide. However, Faux (2005) argues Africa does not need to go through the industrial stages Europe experienced to be economically self-sufficient; it can leap the superhighway technology and gain fast economic growth.

2.37.5.4 Drive to Maturity

After the take-off, regularly growing the economy includes drives to extend modern technology over the entire front of its economic activity (Rostow, 1990). Technology is used widely as a

result, with the economy producing a wide range of goods and services, while there is less reliance on imports (Rostow, 1960).

2.37.5.5 High Mass Consumption

The economy is geared toward mass consumption, and the level of economic activity is very high. Rostow (1956) adds mass production feeds consumer needs at this stage.

The stage model of modernisation has, nevertheless, been criticised on the basis that development does not strictly follow a particular motion (Uchejeso and Udenze, 2020). Furthermore, Rostow suggests a minimum specific proportion of national income has to be directed to investment, which would make graduation possible into the take-off stage in development (Ates *et al.*, 2005). In this regard, Mizero (2018) asserts upper-middle-income countries are aligned with the take-off stage, unlike lower-middle-income countries. Lesotho is categorised by the World Bank (2021) as a lower-middle-income country, therefore; it may not align with the stage model.

In terms of agriculture, the modernisation theory process encourages farmers to try new crops, new production methods and new marketing skills (Ellis and Biggs, 2001), however, according to the theory, modernisation involves adhering to new processes to follow in the footsteps that saw the West to greatness in economic and social-political development (Enuka, 2018; Ates *et al.*, 2005). Nevertheless, to be able to use western technologies, the theory focuses on what people have in terms of skills and resources. In the context of Lesotho, Rantšo (2017) argues the majority people living in rural areas are poor and illiterate; therefore, this approach would not be successful.

Mhlanga (2004) mentions Lesotho has adopted many foreign cultural values and traditions that have led to severe erosion of indigenous traditional knowledge systems in the country, which has resulted in the country being compelled to depend heavily on imported technologies, with many not well adapted to local conditions. Zanello, Fu, Mohnen and Ventresca (2016) point out the adoption of many innovations fail, since they comprise risky and lengthy process that requires intense knowledge and capital investments, with most ground-breaking innovations concentrated in rich countries, linked with specific forms of university science and research capacity.

Frank (1967) also criticised the theory for misleading, as it does not articulate the true relationship between the developed and poor regions of the world, also distorting the truth regarding the motive of developed countries. For instance, Daño (2007) shows, although the Green Revolution was introduced in Africa to emancipate Africans from the clutches of hunger and poverty, it followed the same formula used in Asia. This was a technology package for agriculture involving external inputs and massive agricultural infrastructure, because the technology alone did not provide answers, suggesting the idea of modernisation of an impoverished Africa (Matunhu, 2011).

Modernisation theory has also been criticised for considering development as simply a matter of knowledge and technology transfer that is unproblematic, straightforward, context-free and not disruptive of existing social and cultural arrangements in developing countries (Herkenrath and Bornschier, 2003). Weber (1930) notes some cultures achieve more than others, because of their values for people, while Mofuoa (2015) points out Lesotho achieved more in the 19th century, based on the socio-ethical values that shaped their worldview and behaviour towards socio-economic development and human progress.

While criticising the theory in the context of colonialism and imperialism, Matunhu (2011), on the one hand, shows modernisation contributed to the under-development of Africa through colonialism and imperialism by the West, which depleted the continent's resources such as oil and minerals. On the other hand, the author asserts European colonialism deems everything African as irrelevant, despite still sourcing natural resources from the continent (Matunhu, 2011). Furthermore, many African countries have experienced the negative consequences of colonialism.

Ocheni and Nwankwo (2012) state colonialism began as a result of changes in the mode of production to machinery in Europe, referred to as the Industrial Revolution. The modernisation concept was introduced in Africa in the colonial era, and many countries experienced negative impacts. For instance, Rantšo (2015b) shows farmers had to sell their livestock to pay taxes and adopt new methods of agriculture, leaving them in a cycle of poverty. Based on modernisation theory, countries such as Lesotho that were colonised, are thus led into poverty by technology adoption; however, technology is adopted in Lesotho for agriculture and agribusinesses, and therefore, the study investigated technology use for agribusiness development.

This theory, moreover, implies the adaptation of new digital technologies is pivotal in agribusiness, since agricultural development is currently linked with the underprivileged, and an advanced level of technology in developing countries. There are also challenges faced by agribusinesses in developing countries that include establishment of marketing channels and technical assistance (Stanton, 2000). In addition, the adoption of modernisation theory can help agribusinesses to assess how modernising agriculture with digital technologies can be beneficial and whether the technologies will enforce or hinder business development. The study thus sought to understand how agribusiness modernisation through technology use influences their development.

For developing countries, the use of digital technologies can result in the loss of many jobs, because technology influences companies in high-income countries to bring production sites back into their own countries (Petersen, 2019). Malkawi (2019) highlights this is due to technological innovations that originate in developed countries and the proponents of the modernisation paradigm for development should obtain the characteristics of western societies (Monaheng, 1995). Additionally, several authors show these innovations reflect the wants, needs, desires, and norms, as well as the values of its designers (Van den Hoven, Lokhorst and Van de Poel, 2012; von Schomberg, 2011, cited in McCampbell, Schumann and Klerkx, 2022).

2.38 DEPENDENCY THEORY

Dependency theory is a school of thought that emerged in the mid-20th century, it posits that the global economic system is structured to benefit a core of wealthy nations at the expense of a periphery of developing countries (Almakaty, 2025). It is a powerful critique of modernization theories (Frank- André, 1966) while emphasizing the benefits of digital technology Kabonga (2016) highlights that digital technology increases productivity in the agricultural production process, has more accurate analytical data, a more effective risk management system, reduced waste, improved quality of products, increased yield, reduced harm to the environment and reduced risks. The theory argues that digital technology use in agribusiness benefits multinational agribusinesses rather than the poor local farmers, owing to this, existing studies present contrasting viewpoints, Klerkx, Bacco, Bartolini, Bulten, Debruyne and Brunori (2021) argue, that this digital transformation process is not inherently good as it impacts many aspects such economic, environmental, social, technological, institutional and their relations. Ekekwe

(2017) further makes an example that traditional organic farmers are resisting the use chemical fertilizer as they fear it will have a long-term negative impact on their farmlands, on the other hand, Schnebelin, Labarthe and Touzard 2021 argues that the tendency to adopt innovations varies across different actors, as users do not perceive the same benefits and risks of the digitalisation process,

When dependency theory is applied to digital technology in Lesotho's agribusiness, Mpiti and Harpe (2015) show that Lesotho is already unhealthily dependent on South-Africa due to its poor physical infrastructure, limited industrial skills and poor agricultural productivity, low wages, limited industrial skills for development, highlighting the struggles in the agribusiness sector. The majority of the population in Lesotho still lacks basic services such as electricity and faces high data costs (Nkabane 2024), while it depends on the support of donor agencies for technology support and training (UNDP 2026). Therefore, Nwobi (2007) opines development of the moral, social, political and economic potentialities of rural communities to enhance their self-reliance through the provision of appropriate infrastructures such as pipe-borne water, electricity, good roads for the development of their agribusinesses.

2.38 ROLE OF TECHNOLOGY IN THE MODERNISATION PROCESS

According to Mokgobu (2006), technology is often depicted as the engine processes of modernisation and as one of the principal icons of modernity. Shapiro (1999) suggested technology has been used to modernise societies, either from the traditional or authoritarian, to modern democratic societies. However, Sharma and Mungarwal (2019) opine modern agriculture is driven by continuous improvements in digital tools and data, as well as collaborations among farmers and researchers across the public and private sectors. In particular, digital transformation is considered the solution to challenges agriculture faces (Trendov *et al.,* 2019; World Bank, 2019a). Nevertheless, Eastwood, Klerkx, Ayre, and Dela Rue (2019) point out lessons from the past technological revolution suggest caution, as agricultural innovation is not an inherently good and value-free process.

2.39 THE MODERNISATION CONCEPT IN LESOTHO

According to Ellis and Biggs (2001), the modernisation period started in the 1950s, with Moody (1974) who stated the modernisation process in Lesotho is related to its diffusion, including the

spread of political, social, economic and institutional change that transpired down the urban hierarchy and from towns to villages; yet, Lesotho has experienced little of the change implied by the term modernisation. Concerning agriculture, modernisation of technologies was introduced in Lesotho in the late 1950s and 1970s in the form of the Green Revolution, to increase agricultural inputs (Rantšo, 2015a) and, as time passed, more technological advances appeared in agriculture (Sharma and Mungarwai, 2019).

In more economically developed countries, the early digital era spanned from the mid-1990s to the mid-2000s, with the internet and other forms of digital replication and distribution, such as DVD burners (Rayna and Striukova, 2021). Although developing countries struggle to comprehend digital technologies, the internet's far-reaching impact on societies and economies has entered a very significant phase (Singh, S., 2018). However, as a consequence of relatively low adoption of modern practices, one challenge facing agriculture in Lesotho is the use of traditional agronomic practices (Climate-Smart Agriculture Profile, 2020).

2.40 TECHNOLOGICAL INNOVATION

2.40.1 Innovation definition

Innovation is defined as an idea, practice, or project that an individual or other unit of adoption perceives as new (Rogers, 2003). The World Trade Report (2020) states innovation means new practices provided to and circulated by society. It entails the change of cultures relating to a particular practice to achieve improvements in outcomes and processes (Kilelu *et al.*, 2013) moreover, it endeavours to evaluate new or improved ways of conducting business, which aids in improving organisational processes (Fagerberg, Srholec and Verspagen, 2010). When adequately adopted, the specific innovations should lead to improvements in managing the practice and generating market share among places with innovation (Haggblade, 2011).

In examining old literature, Feder *et al.*, (1985) are found to mention the adoption of technological innovations in agriculture has attracted considerable attention among development economists. With the majority population in less developed countries deriving their livelihood from agricultural production, new technology offers the opportunity to increase that production substantially. The agricultural sector, nevertheless, still lacks the use of digital

technologies (Jackson and Shafron, 2016), which confirms findings by Spielman (2005) that innovation systems in developing countries have been specifically noted as weak.

According to Egbetokun *et al.* (2017) where innovation is concerned, the lack of technologies and resulting weak innovation systems, due to the costly nature of innovation, are one of the main differences between firms in developed and developing countries. Nonetheless, the vast majority farmers in Lesotho are smallholder farmers, whose primary concern is feeding their families, thus, adherence to traditional methods in agriculture may overshadow interest in adopting new technologies (Umar, Aune, Johnsen and Lungu, 2011).

2.40.2 Innovations in business development

Ngibe (2020) asserts the ability to generate new ideas that keep operations, products and services fresh, is one of the keys to any successful business. The process of bringing those ideas to reality is called "innovation" (Brooks, 2013; Schmieder, 2014). Al-Ansari (2014) adds innovation is crucial to the survival of business and the market environment. However, innovation is not purely concerned with technological integration. It can take various forms, including new business models, business organisational forms, and innovative marketing, as well as project solutions (Director-General for Enterprise, 2004). GEM (2011) emphasises innovation is perceived differently in different markets and economies, where seemingly new products and services in one market and economy, could already be common in another. Further to this, Paunov and Planes-Satorra (2019) state industries vary in not only their products, but also how they engage in innovation.

Crossan and Apaydin (2010, pp. 1154-1191) point our innovation is the creation of a value-added novelty or its acceptance, adaptation and utilisation in trade and industry spheres. Product regeneration, improved services, expanded markets, and new product development ways are required, as well as establishing new demands; as a result, it is the effectiveness of the innovation that determines the success of the business. Lesotho is no exception to the reality of countries unable to support businesses using innovations such as digital technologies, due to the lack of access to the internet. This means it cannot innovate around an entire range of agricultural areas, such as precision farming capacity, which assists farmers to use technology

to lessen the climate change impact and increase yields, while also diminishing the effects of natural disasters (Lesotho Times, 2021).

It was established some businesses, however, delay achieving innovations, due to challenges such as not being willing to change culture, restricted capacity and competence to take advantage of new products and services, insufficient systematic innovation processes, and inability to access new markets (Scozzi *et al.*, 2005; Loewe and Dominiquini, 2006; Williams and Cowling, 2009; Zhu *et al.*, 2012). Notwithstanding the barriers in innovation use, Mohutsiwa (2012) notes it is necessary for businesses to recognise occasions to establish potential and competencies could be established, thereby enabling them to be inventive and pioneering, take the initiative in risk-taking for enhanced performance or in retaining competitive advantage. Furthermore, as the world evolves, businesses need to adapt to technologies to stay relevant and turn a profit in meeting these new realities (Purcell, 2019).

The UNTB was established specifically to support least developing countries, such as Lesotho, to improve technology use and innovation, in order to deal with challenges, including food security, all-encompassing economic growth and climate change (Lesotho Times, 2021). In addition, an innovative policy was introduced to provide guidance and a framework to fast-track innovation activities in the country, by the Department of Science and technology in the ministry of communications, science and technology, in collaboration with the Organisation of African, Caribbean and pacific states and the EU (Government of Lesotho, 2021).

2.40.3 Technological innovation in Agribusiness

In the agricultural sector, technical change in the form of production technologies has been reported to positively impact productivity growth in the developing world (Nin *et al.*, 2003). The success of an agribusiness is highly dependent on new innovations focused on sustainability and competitiveness in a sector (Garcez and Dias, 2023). Moreover, innovation in technology and management does not only contribute to improved international competitiveness, international trade and economic growth, but also allows farmers to produce more with less (Akkoyunlu, 2015).

In agriculture, the ability to innovate is often related to strengthening capacity in research and development, collective action, coordination, and knowledge exchange among diverse actors,

as well as the incentives and resources available to form partnerships and develop businesses, along with conditions that make it possible for farmers or entrepreneurs to use the innovations (World Bank, 2012). Innovativeness and business performance were further shown by Filser and Eggers (2014) to strongly correlate. However, Qamar (2014) mentions incessant financial constraints and other factors have rendered the DAR in Lesotho largely dysfunctional.

2.41 TECHNOLOGICAL CHANGE BENEFITS

As explained by Nguthi (2008), it is proposed technological change, which leads to increases in food production and reduction in production costs, can reduce poverty by raising the incomes of farmers who adopt the technology, changing the demand for agricultural labour, reducing food prices (or dampening food price increases), thus creating more incomes and purchase. Tilahun and Bedemo (2014) emphasise agricultural technologies include all kinds of improved techniques and practices that affect agricultural output growth, where adopters of improved technologies increase their production, leading to productivity increase (Jain, Arora and Raju, 2009). A study by Mulugeta (2011) reveals low productivity and production are mainly associated with poor adoption of improved technologies.

2.42 BARRIERS TO TECHNOLOGY ADOPTION

Ndah, Schuler, Uthes, Zander, Traore, Gama, and Corbeels (2014) find there has-been technological awareness over the years, however, most innovations in the field of agriculture have fallen short of wide-scale adoption and diffusion, particularly in Africa. Ramilo (2014) agrees, adding that this happens even where technologies are available in abundance, because whether technological, social, or another, it is a process shaped by key supporting factors and barriers that contribute to innovation adoption and diffusion (Knierim, Borges, Kernecker, Kraus and Wurbs, 2018).

2.42.1 Failure of previous technologies

Wodajo (2016) asserts farmers are highly suspicious of the sustainability of new technology, as they observe the failure of some technologies. Shiva (1991) additionally highlights the Green Revolution is one of the technologies that shares the pros and cons of many technological advances that have built and changed modern global societies. According to Atanga (2020),

new technology needs to be investigated, considering the performance of past technologies such as the Green Revolution, which adversely impacted agriculture, specifically in SSA.

Kassie, Shiferaw and Muricho (2011) maintain the success stories that emanated from the Green Revolution in Asia, as well as efforts to increase agricultural productivity in Africa, have been directed towards the adoption of improved agricultural innovations. Therefore, Atanga (2020) further predicts digital technology may risk following a similar trend and could threaten small-scale farming, which many people in Ghana rely on. It could gradually lead to dependency, loss of indigenous knowledge, dispossession, and threaten livelihoods, hence, the need to investigate new technology. Nonetheless, Katengeza, Okello and Jambo (2011) reveal the decision by farmers to adopt a new technology is a choice between traditional and new, when the new technology offers greater benefits than the old technology.

2.42.2 Economic barriers

The important determinant of new technology adoption, as per Foster and Rosenzweig (2010), is the net gain to the agent from adoption, inclusive of all costs of using technology. Further to this, Kinyangi (2014) asserts the high agricultural technology cost has been reported as a hindrance to agricultural technology adoption. Schmitz (1982) shows it is much more difficult to find sufficient financial knowledge and institutional support for innovation in backward economies.

Reddy (2007), on the one hand, mentions large farms in developing countries use their political and economic influence to obtain the best technologies to grow cash crops, negotiate agreements and move their products; therefore, reaping the benefits of agricultural markets of developed countries. On the other hand, Bisangwa (2013) found another challenge of moving from traditional agriculture to a technology-based way of farming, is a result of insufficient economic opportunities for farmers. Consequently, farmers' financial problems limit the potential gains and opportunities in line with the commercialisation of agricultural products (Rafoneke, Mshenga, Owuor, and Rantlo, 2020).

According to FAO (2023), Lesotho is among countries with high food insecurity levels, due to high food prices and slow economic recovery impinging on households' economic capacity to access food. Garcez and Dias (2023) and Taya (2012) explain, first, a price spike affects all

supply chain stages; second, unexpected price volatility decreases farmers' productivity and innovation.

2.42.3 Access to Credit

Agricultural credit is the backbone for any agribusiness and an integral part of the modernisation of agriculture and commercialisation of the rural economy (Manta, 2019). Meijerink and Roza (2007) additionally state agricultural credit is one of the most important policies that have facilitated agricultural development in many developed and developing countries.

Countries such as Namibia have established agricultural banks to promote agricultural activities. As explained by Amadhila (2016), the agricultural bank of Namibia aims to expand the scope of agricultural activities and capitalise on market opportunities of agricultural products, by lending money to farmers. Furthermore, Akkoyunlu (2015) shows a large credit market for agriculture in the private banking sector in Turkey, associated with the increase in investments in agricultural innovations and technologies.

Conversely, Motsoari (2012) finds agricultural credit in Lesotho used to be provided mainly by the Lesotho Agricultural Development Bank (LADB), which was closed in 1998 due to problems of heavy losses, illiquidity and severe capital deficiencies (Bisangwa, 2013). Since the closure of the bank, institutional framework is essential to address financial service provision for farmers in Lesotho.

2.42.4 Institutional Barriers

Institutional barriers can refer to a lack of formal support from the government extension services and NGOs or informal institutions, which act as shared social governance (Biesbroek, Klostermann, Termeer and Kabat, 2013). In Lesotho, much innovation takes place as a result of non-international organisations and donor programmes, rather than through government systems (World Bank, 2011). However, governments in the developing world are increasingly acknowledging the role ICT plays in enhancing agricultural productivity and reducing poverty (Subramanian, 2021).

The FAO conducted an appraisal of the organisational arrangements used to support inclusive agribusiness and agro-industry development (FAO, 2014). In addition, the FAO has been

instrumental in supporting vulnerable farming households in Lesotho by providing essential agricultural inputs, technical support and improved technologies (FAO, 2018b).

2.42.5 Transaction costs

Transactional cost contains infrastructure and coordination cost (Cordella and Simon, 1997), as well as information (Coase, 1937). High transaction costs deter the entry of small farmers into the market (Okoye, Abass, Bachwenkizi, Asumugha, Alenkhe, Ranaivoson, and Ralimanana, 2016). Additionally, Holloway, Nicholson, Delgado, Staal, and Ehui (2000) and Makhura, Kristen and Delgado (2001) mention transactional costs act as key barriers to market participation for resource-poor smallholders. Jesen (2007) notes obtaining information was so costly before the availability of mobile phones, agents could not engage in optimal arbitrage, whereas De Silva and Ratnandiwakara (2008) identify mobile phone usage can reduce information search costs, thereby dramatically lowering transactional costs and enabling greater farmer participation in commercial agriculture.

Reasons identified by Doss (2003) for farmers' non-adoption of improved technologies comprise their erroneous beliefs with regard to the costs and benefits technology adoption offers, including not being profitable, in view of decisions farmers make regarding land and labour allocations to activities, both agricultural and non–agricultural. However, Kim *et al.* (2020) show many digital technologies, such as DATs, can apply to the agricultural sector and be deployed, even in low connectivity rural environments, where the authors point out digital accessibility is much lower and varies greatly according to age, gender, and income. In Lesotho, Letuka (2017) asserts access to mechanised farming is challenged by most farmers' inability to afford equipment; subsequently, manual practices are predominantly preferred by resource-poor farmers, compared to farming technologies.

2.42.6 Access to finance

The more involved farmers are in commercial farming and value chains, the greater the need for an array of financial services specifically tailored to agricultural production (Christen and Anderson, 2013). Furthermore, Bisangwa (2013) states when farmers have different income sources, they are in a better position to make decisions regarding technology adoption. Hamp, Agwe and Rispoli (2016) further mentioned smallholders are largely unable to access financial

products, because of a dearth of financial services in agricultural production. Through the use of digital financial solutions, smallholder farmers benefit significantly from agricultural commercialisation and household income (Kirui, Okello, Nyikal and Nijiraini, 2013; Jack and Suri, 2011).

2.42.7 Input Efficiency

The cost of inputs such as fertilisers and fuel have increased, while product processes have remained fairly constant or even dropped, as a result, farmers are currently faced with narrowing profit margins (Milovanović, 2014). The potential contribution of digital technologies is already improving smallholders' access to inputs (Trendov *et al*., 2019), furthermore, according to the World Bank (2019a), digital technologies improve the quality and quantity of agricultural inputs. Thus, the introduction of precision agricultural technologies crop yields rise significantly (Revich, Koort, Archambault, Samuelson, Nannizzi, Moawalla and Bonin, 2016).

2.43 CHAPTER CONCLUSION

The literature review provided a review of published works on agribusiness development through digital technology use, with detailed definitions of agribusiness and digital technology, and how technology use has impacted agribusinesses and the necessary conditions for digital technology use. This chapter also provided insights on the state of agribusiness development in Lesotho and the challenges faced by agribusinesses, a historical overview of agribusiness, literature on digital technology at the global, regional and domestic levels, and digital technology adoption in developing and developed regions. Furthermore, literature showed the link between digital technology and agribusiness, the state of agribusiness in Lesotho and globally, was pursued.

In summary, the literature review revealed how digital technologies fit perfectly in the modernisation trajectory using modernisation theory, which is critique by dependency theory, explaining the complexity and plethora of digital technologies in agribusiness in contemporary development, how technologies are diffused within technologies using DoI theory, and how agribusiness could increase production relating to producing theory. The diffusion and adoption of digital technologies remain a challenge in developing countries such as Lesotho, because of barriers such as the costs of these technologies, farmers unable to access credit to purchase these

technologies, the unavailability of the internet in many rural areas, and literacy levels. Moreover, digital technologies have been a breakthrough for agribusiness, where digital applications have been used for marketing and information, while there has also been criticism of technology use. The success of these technologies has mainly been due to government contribution, through policies and strategies that enable the use of digital technologies, as well as the investment in digital infrastructure.

The literature further revealed digital technology use in Lesotho is generally low, due to the lack of proper digital infrastructure; therefore, there is no evidence how digital technologies have been utilised in the past for agribusiness development. In addition, most studies have focused more on agribusiness development but none on digital technologies and their impact along their value chains, while the literature available on the use of digital technologies in Lesotho is mainly on ICTs and not on the other types of digital technologies now used. These include the IoT, robotics, sensors, and AI, which are commonly used for agribusiness development. Furthermore, Lesotho faces a challenge of limited research on effective agribusiness policies and the structured implementation of policies for agribusiness development. Additionally, there is little literature on the relationship between agribusiness and infrastructure for digital technology use; therefore, the study aims to fill the gap in existing knowledge regarding the prospects and challenges in digital technology adoption in Lesotho. The next chapter provides the research philosophy, paradigm, the methodology adopted for the study, as well as the justification for the selected approaches.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 INTRODUCTION

While the previous chapter focused on analysing and discussing the literature review, this chapter provides the research philosophy, followed by a justification of the selected paradigm and last, an outline of the methodology applied in this study. It discusses how data were collected through focus groups, key informant interviews and questionnaires, and analysed, as well as the data validity and reliability for the methods chosen. According to Kabir (2016), research is a scientific approach to answering a research question, solving a problem, or generating new knowledge through a systematic and orderly collection, organisation and analysis of information, with the ultimate goal to generate research useful in decision-making.

The procedures, by which researchers go about their work of describing, explaining and predicting phenomena, are known as the research methodology (Goundar, 2012). The purpose of research methodology is to find answers to research questions (Kumar, 2023). In addition, Kothari (2011) further shows the research methodology presents the various steps adopted by a research team to study a specific research problem, as well as the logic behind these steps. The chapter aims to explicate and discuss the research design, methods, population, and data collection instruments, along with validity, reliability, and ethical considerations pertaining to this study.

3.2 RESEARCH PHILOSOHY

According to Saunders, Lewis and Thornhill (2009), research philosophy is a system of beliefs and assumptions regarding the development of knowledge. Research philosophy is relevant in a research methodology, because as Akhtar and Eniodunmo (2021) show, it describes the researcher ‘s view concerning the world and drives the research strategy. For this study, the research philosophy serves as motive for creating unique knowledge, which Taylor and Medina (2011) have expressed as its importance.

For mixed-methods design, Akhtar and Eniodunmo (2021) show the appropriate philosophical assumptions. The study adopted pragmatic philosophy; its characteristics align with the nature of the study, which comprised a mixed-methods approach, with the main study objective to investigate digital technology use for agribusiness development. The different perspectives in pragmatic philosophy provided the researcher with a more comprehensive and holistic understanding of digital technology use for agribusiness.

Focus groups and key informant interviews were used for an in-depth investigation to gather data on the perception of digital technology use. The key to pragmatic philosophy is further based on the understanding of real-world issues, therefore, inferential statistics were used to test variables identified from the questionnaires. This measurement instrument was designed in the form of a 5-point Likert scale, with questions derived from the literature review and the problem statement. The tests and models employed were:

- Cronbach's Alpha
- KMO and Bartlett's Test
- Factor analysis
- Chi-square test
- Covariance–based (SEM) CB-SEM test
- Structural Equation Modelling (SEM)

3.3 RESEARCH PARADIGM

Kivunja and Kuyini (2017) define a research paradigm as a researcher's philosophical orientation, with significant implication for every decision made in the research process, including the choice of methodology and methods. The study adopted both inductive and deductive approaches to investigate different views, with reference to the literature review on research methodology and in accordance with pragmatic philosophy.

3.4 RESEARCH APPROACH AND DESIGN

According to Creswell (2003) and Creswell and Plano-Clark (2007), as cited in Dawadi, Shrestha, and Giri (2021), there are three research approaches, namely: qualitative, quantitative

and mixed-methods. This study involves collecting and analysing both quantitative and qualitative data, thus a mixed-methods approach.

3.4.1 Quantitative research

Salim and Mushood (2022) describe a quantitative research approach as a research method that uses numerical data to understand a phenomenon. Mathematical approaches, particularly statistics, are used to examine data. Abuhamda, Ismail and Bsharat (2021) add quantitative research is used to measure the issue by producing numerical data or data that can be translated into usable statistics. The main aim of quantitative research design is to control the connotation between an independent variable and a population dependent or outcome variable.

A quantitative research design was chosen as part of this study to provide a detailed numerical presentation of the research findings. In this study phase, the data collection method adopted was a 5-point Likert scale questionnaire, developed with only closed-ended questions, for the basis of ascertaining respondents' experience and knowledge in digital technology use for promoting agribusiness development in Leribe and Thaba-Tseka districts.

3.4.2 Qualitative research

Isik (2025) describes qualitative research as a method that aims to explore and understand how individuals make sense of their experiences and the social world around them it values depth, context and human meaning (Creswell and Poth, 2018). A qualitative research was chosen as part of this study for focus group interviews and key informants interviews to examine, interpret and explain the data**.**

3.5 RESEARCH DESIGN

According to Khanday and Khanam (2019), a research design is a procedural plan a researcher adopts to validly answer questions. The research design was meant to provide a suitable framework for this study; therefore, a mixed-methods approach was used, combining both quantitative and qualitative methods.

The purpose of this form of research is, in combination, both qualitative and quantitative research methods provide a better understanding of a research problem or issue, than either research approach alone (Creswell, 2003). Qualitative research usually has a smaller sample

size and is thus not generalisable, therefore, for a detailed conclusion; quantitative samples can be larger, because the researcher is not in direct contact with the participants but through questionnaire distribution.

The qualitative approach alone would not be adequate to respond to all the study questions; consequently, a quantitative approach was used in a concurrent phase, to answer the unanswered questions in the qualitative study phase (focus group and key informant interviews) phase of the study.

The population consisted of agribusiness managers and farmers, all within the Leribe and Thaba-Tseka districts in Lesotho. The participants in the study were from all farming categories, which included: wool and mohair, poultry, livestock, and dairy, as well as cereal (maize and wheat), and horticulture (fruits and vegetables).

The first study phase used a quantitative approach and consisted of a well-structured questionnaire distributed to respondents. The participants completed a 5-point Likert-scale questionnaire with the assistance of the researcher and four research assistants (two in Thaba-Tseka district and two in Leribe district), who personally delivered the questionnaire to the agribusiness owners/managers and allowed 14 days for questionnaire completion. Tanujaya, Prahmana and Mumu (2022) showed it is easier to use a 5-point Likert scale, because it can map respondent choices into five clear options, ranging from strongly disagree to strongly agree. However, for this study, the presence of the researcher or assistant was required in aiding, explaining and addressing respondent concerns that could arise at the place of data collection.

3.5.1 Focus Group interviews

A focus group is an in-depth group interview with discussion (Gundumogula and Gundumogula, 2020). It consists of a researcher leading a collective conversation with a group of usually four to eight people, guided by questions for their comment (Mnazano, 2023). A group answers questions to relate their perceptions, attitudes, beliefs, and opinions concerning a concept, product, advertisement, service, or idea. Sedlock (2020) shows focus group questions can allow participants to expand on interview question responses. Participants for the focus groups were made up of eight participants in Leribe and eight in Thaba-Tseka districts.

The study aim was to establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts, in addition to assessing how agribusiness characteristics impact digital technology use in the Leribe and Thaba-Tseka districts.

Focus groups were appropriate, because farmers from selected sectors of agribusiness participated in a group discussion on the challenges, characteristics, as well as strategies and efforts in digital technology use for agribusiness development. This method was appropriate, with all types of agribusinesses accommodated, while farmers were easily accessed during their monthly farmer's meetings, due to the geographical settings. Had the researcher not chosen focus groups, it would have been very difficult to reach the agribusiness owners separately for timely interviews. Questions were posed in an interactive group setting, where those participating were free to converse on the topic with other group members.

For the focus group in Thaba-Tseka, the researcher recorded the discussions, while in Leribe, the discussions were noted, because participants did not agree to recording. The purpose of this was to establish an in-depth understanding of the problem and to find facts that may have been left out in answering the quantitative 5-point Likert-scale questionnaire, which could provide the researcher with added information for better study outcomes. These interviews with business owners/managers and representatives from the Department of Small Business and Agriculture were done simultaneously with the questionnaire distribution, to ensure consistent findings.

3.5.2 Key Informant Interviews

Pahwa, Cavanagh and Vanstone (2023) show key informants provide high-level perspectives and comparative insights on issues or questions under study. Therefore, the study conducted 12 key informant interviews, in order to gather information not obtained in the focus groups, owing to the depth of information needed by the researcher and the inability of key informants to participate in the focus groups, because of their location and schedule.

Targeted key informants were identified as key policy makers in the agricultural sector. This included different officers in the Ministry of agriculture, professionals and experts, such as extension officers (crop, irrigation and livestock) and agricultural assistants, as well as officials from the Ministry of Agriculture Department of Marketing, and Communications and extension

workers. The extension officers and agricultural assistants are placed in districts to work closely with farmers in the rural and urban areas of Lesotho and have a clear understanding regarding the use of technologies by agribusinesses in Leribe and Thaba-Tseka districts, Key informant interviews were used to obtain information from knowledgeable individuals, who contributed rich and diverse perspectives on the research phenomenon (Cossham and Johanson, 2019).

To investigate past and present efforts and strategies in digital technology use for agribusiness development in Lesotho and their impacts on agribusiness development. In addition, the study aims to examine the status and extent of existing policies concerning agribusiness development promotion in Lesotho, with specific reference to the districts of Leribe and Thaba-Tseka, therefore, key informant interviews was the appropriate method to achieve the objective. This is because they are the officials from the ministries responsible for formulating policies and their implementation, furthermore, the extension officials are the main agricultural service providers all over the country, including the rural area where agribusiness and farmers depend on them for new information.

Key informants were thus meant to provide intensive details and substantiate findings on the status and extent of existing, past and present efforts and strategies in digital technology use, which the extension officers provided. Since farmers are not well-informed regarding the policy, the extent of existing policies concerning agribusiness development promotion was examined by interviewing officials from the Ministry of Agriculture Department of Marketing and Communications.

3.6 POPULATION AND SAMPLE

3.6.1 Population

The population is a set of all the units that possess the variable characteristics under study and for which findings of the research can be generalised (Shukla, 2020). The target population is the entire aggregation of respondents that meets the designated set of criteria (Burns and Grove, 1997). Asiamah, Mensah and Oteng-Abayie (2017) emphasise population specification is a requirement in the documentation of both qualitative and quantitative studies, therefore, for this study; the target population is 5 506 participants (3 678 Leribe participants and 1 828 from Thaba-Tseka).

3.6.2 Sampling and Sample size

The sample for the method in the qualitative phase of the study consisted of eight participants per focus group in two districts, while the sample for the quantitative method comprised 551 participants - Leribe (368) and Thaba-Tseka (183).

Bhardwaj (2019) defines sampling as a procedure to select a sample from an individual or a large group population for a certain kind of research purpose. Mujere (2016) adds sampling is a technique of selecting a suitable sample or a representative part of a population, in order to determine the parameters or characteristics of the entire population. A sample is needed as it may not be practical and rarely economical to conduct a census of the entire population (Lohr, 1999), because as Sarantakos (2000) shows, the population under investigation will, in most cases, be too large to collect data from each member. Although Nkholise (2020) emphasised 80 percent of the rural population lives in rural areas, the sample was influenced by factors such as the geographic location of the farmers and the type of their agribusiness.

Sekaran and Bougie (2010) show effective research requires a clearly defined study population to ensure a representative sample size, which may then produce easy to generalise results. However, Struwig and Stead (2001, cited in Lekhanya 2016) argue it is not possible to identify whether an ideal sample size is good or bad and suggest the researcher should rather consider the study purpose and goal.

3.6.3 Sample size

The sampling number was determined by the BOS (2018), which shows Leribe district has 3 678 farmers operating, while Thaba-Tseka is reported to have 1 828 farmers operating in the district. Furthermore, Sekaran and Bougie (2016) state when the population is 5 506; it may be represented by a sample size of 608. Therefore, the 608 sample for this study was selected using the table of random numbers. However, only 16 participants (eight in Leribe and eight in Thaba-Tseka) of this sample participated in the focus group for the qualitative interviews and 12 participants for key informant interviews.

Participants were from all categories of farming, as indicated below:

- Wool and Mohair;

- Poultry;
- Livestock and Dairy;
- Cereal (maize and wheat); and
- Horticulture (fruit and vegetables).

Marlow (2005) finds simple random sampling the easiest sampling method, where each individual in the population, theoretically, has an equal chance of being selected for the sample. Furthermore, the researcher drew a sample from the agribusiness owners/managers and farmers conveniently available for the focus group discussions and key informant interviews, while the questionnaire was randomly distributed within the businesses, as well as to policy makers, marketing officers and agricultural officers.

3.7 DATA COLLECTION

Primary data were collected using focus groups, and key informant interviews, with a questionnaire also distributed among agribusinesses and farms in Leribe and Thaba-Tseka districts. Due to travel costs, the research assistant distributed the questionnaire in Leribe district, while the researcher distributed the questionnaire in the Thaba-Tseka district. The questionnaires were completed with the help of the research assistants and the researcher. The researcher collected data with two research assistants per district (two in Thaba-tseka, two in Leribe) over a period of one month. The reason for two assistants per district was to avoid a delay in data collection, particularly in the remote areas of the two districts, where travelling is difficult. Prior to the questionnaire administration to farmers, the researcher equipped the research assistants with skills in questionnaire use for data collection.

3.7.1 Data Collection Instruments

3.7.1.1 Questionnaire

For empirical data collection, a questionnaire provided easy and timely access to information from the respondents, as it was an easily administered instrument. Bulmer (2004) describes a questionnaire as a well-established tool within social science research for acquiring information from participants concerning a topic under investigation. Welman, Kruger and Mitchell (2009) assert one advantage of a questionnaire is the researcher can explain questions the respondents do not understand.

The questionnaire adopted a 5-point Likert Scale format, comprising only closed-ended questions, in ascertaining respondent experiences and knowledge on the use of digital technologies in promoting agribusiness development in the Leribe and Thaba-Tseka districts.

3.7.1.2 Questionnaire development

The questionnaire development process is one of the most important steps of the study. Before developing the questionnaire, literature from local and international academic and professional sources were reviewed. While Gratton and Jones (2010) show questionnaires are ideal to collect a large volume of simple data, Moloko (1996, cited in Moeketsi, 2004) finds a badly designed questionnaire is a waste of time and effort for both the researcher and the respondents. Therefore, the researcher highlighted some guidelines regarding the process of answering the questionnaire items, providing participants the necessary procedure to complete the questionnaire.

This sections were created in line with the aims, objectives, research questions and reviewed literature underpinning the study. Leedy and Ormrod (2010) show, in quantitative research, a researcher identifies variables they intend to study and then collects data specifically related to those variables. The research instrument consisted of 13 items, with a level of measurement at an ordinal level. The questionnaire was divided into five sections that measured various themes, as illustrated below, identified using factor analysis:

A Location and Financial Constraints

B Government and Financial Support Deficiency

C Farmer Experience and Technical Skills

D Market and Political/Infrastructure Challenges

E Connectivity and Social Influence

Agribusiness owners/managers were interviewed to gain data on the following variables:

- Challenges to digital technology use by agribusiness managers /owners;
- Technical skills of agribusiness managers/owners;

- Characteristics profile of agribusinesses;
- Technological viability of agribusinesses;
- How access to digital technology affects agribusiness; Social and political factors that affect agribusinesses.

3.7.1.3 Pilot testing the questionnaire

A pilot study is delineated by Leedy and Ormrod (2010) as a small, preliminary investigation designed to acquaint the researcher with the feasibility of the study. Therefore, a pilot study was carried out by the researcher involving 20 research participants in the Thaba-Tseka district, prior to data collection for the main study, to verify the quality and effectiveness of the questionnaire, after completion of a pilot study.

Feedback suggested that the questionnaire is too long and had complex statements, which were difficult for the agribusiness owners to understand, even though translated from English to Sesotho, therefore, the questions and statements were revised, consultation with research expects was made and two items were eliminated from the questionnaire; this was the basis of the final questionnaire formation officially used for the study to achieve the set objectives.

Gudmundsdottir and Brock-Utne (2010) highlight a feasibility/pilot study is used to assess the practicalities of the main study in respect of its implementation and utility. This often includes an assessment of resources, such as time and costs, for the main study. The time set for the pilot study was two weeks, however, the questionnaire collection took longer, due to the different schedules of the owners and farmers and their locations. The pilot study research participants were not involved in the main study; nevertheless, their responses were included in the revision of the final questionnaires, allowing changes to the questionnaires to enable a better understanding of questions and the basis for the amount of time to be spent on each interview, as well as the questionnaire costs.

3.7.1.4 Questionnaire dissemination

The 5-point Likert scale questionnaire was delivered to respondents by the researcher and a research assistant, with the same instructions to respond, based on the statements, for consistency. In the case where respondents needed clarity on the questionnaire, the researcher and research assistant helped with explanations. Likert scales are generally used to assess

attitudes. A Likert scale allows the respondent to indicate the extent of their agreement with a certain statement (Gratton and Jones, 2010). The Likert scale used for the study provided a statement, with a response selection ranging from agree, disagree, and neutral, to disagree, or strongly disagree. The questionnaire was designed to establish the characteristics of agribusinesses, as well as challenges and barriers in digital technology use for the promotion of agribusinesses in the Leribe and Thaba-Tseka districts. Although the respondents were provided the same length of time to finish completing the questionnaire, in order to enable the researcher to consistently collect the completed questionnaires, participants differed in the time used for completing the questionnaire; some spent a day, while other respondents required more than a day to complete, as a result of factors such as their schedules and misunderstanding some questions.

Respondents were informed regarding the research topic: Investigation of digital technology use for agribusiness development, with 400 questionnaires distributed to respondents by the researcher and research assistants in both districts. The number of questionnaires distributed was influenced by the characteristics of agribusinesses, and their location. However, the willingness of agribusiness owners to participate influenced the outcome of the responses obtained. As a result, the number of responses obtained was 389, with a 97.25 percent return rate. According to Sekaran and Bougie (2016), 400 participants can deliver an acceptable scientific conclusion on the findings of the study conducted. Therefore, the number of 389 respondents for this study was acceptable, as some participants were unwilling to answer questions, because of the absence of incentives/rewards for their participation.

3.8 INTERVIEW GUIDE

Key informants were selected based on the roles of the ministry in agribusiness development, specifically, extension and communication officers play an essential role in agribusiness development in the rural and urban areas of Lesotho, second, the department of marketing focuses on marketing of agricultural products.

For key informant interviews, the interview guide was divided into two parts. As advised by Dörnyei (2007), the first part of the interviews is important to set the tone of the interviews. General questions in the first part of the interviews were, therefore, concerned with the type of

technologies used by the ministries for agribusinesses development in Leribe and Thaba-Tseka districts. The interview guides for all the key informants were similar. The following questions were asked:

- Are you aware of digital technology used for agricultural practices?
- What type of digital technology is used for the development of agribusiness in the ministry?
- How long have you been using digital technology in your operations?
- In your opinion, can digital technology promote agribusiness development?

The second part of the questions included the challenges in the use of digital technologies, policies and strategies used in agribusiness development, as well as information with regard to past and present technologies used in agribusinesses development, resulting in the following questions:

- Do you know of policies to promote agribusiness development in Lesotho? (If yes, state which)
- Do these policies create challenges in promoting agribusiness development in Lesotho? (If yes, state the challenges)
- What are the challenges in digital technology use by the ministry?
- What digital technology strategies are used to promote agribusiness development?

3.9 DATA ANALYSIS

Data analysis commences after data collection has been completed (Jacelon and O'Dell, 2005). The process of data analysis is outlined by Reio and Werner (2017) as sorting, collating and coding, as well as collected data tabulation or organisation, in order to derive meaning from it.

3.9.1 Qualitative data analysis

TA was used to analyse the data, which were grouped and organised according to themes, based on the research objectives and participant responses. According to Wæraas (2022), a flexible

and systematic way to make sense of qualitative data is achieved through TA, therefore, data were transcribed and themes generated for analysis.

The second step was to name the generated themes. In the third and last step, the themes were analysed as significant to make sense of the data. The steps followed are as advised by Braun and Clarke (2006). The following themes were generated: infrastructure, poor network connection, digital skills and literacy, radio, access to information, internet, NGOS, efficiency digital magazines, resources, data, training, climate change, small spaces /small agribusinesses, and agribusinesses located in rural areas, in addition to mobile phones, costs, outdated policies, and marketing, along with language barriers.

3.9.2 Quantitative data analysis

Quantitative data were obtained from primary and secondary data. It was analysed using, Word format, SPSS version 29.0 and Microsoft Excel. SPSS Version 29.0 was utilised for two reasons, to analyse the collected data and test the research questions and expectations, and to analyse and compare the results of different variables used in the research questionnaire. Many researchers have suggested statistical techniques are a major tool for data analysis, specifically in social science research (Nachmias and Nachmias, 2008; Saunders, Lewis and Thornhill, 2012). With the research involving mixed research methods and different objectives, several statistical tools were used in the analysis. An initial step in the quantitative data analysis was for the researcher to transfer the answers to excel sheets, following which a professional statistician was provided the data, for extraction of statistics using SPSS version 29.0, as well as interpretation of data collected from the questionnaires. SPSS version 29.0 was used to generate graphs and cross-tabulations for inferential statistics and presented to show frequencies and percentages as a summary for scoring patterns, while graphs are used to display summarised numerical study data.

In this research, each respondent was requested to reply to an identical list of questions based on a 5-point Likert scale, with responses required to each question ranging from 1=strongly disagree, to 5=strongly agree. Responses were summarised to produce a score to reflect measurements (Saunders *et al.*, 2012) in order to prevent bias. Initially, the questionnaire design was coded from the specific topic, based on uniform structures, to allow the questionnaire to

produce valuable data necessary to achieve the research objectives. Data exploration was done using descriptive statistics and graphical analysis. The analysis included discovering whether relationships exist between variables and how they affect each other.

3.9.3 Importance of Frequencies

Frequencies were used for two reasons in this study: To determine how often a respondent made a certain response to a particular question and to cross-check the data coding (Tables 5.4-5.11). Babbie, Mouton, Boshoff and Vorster (2002) state when the responses are not equal to the sample total, the data were not correctly captured. Therefore, the frequencies confirm the data were correctly captured for this study.

3.9.4 Importance of Chi-square test

Moore and McCabe (2003, cited in Col Debella, 2004) describe the Chi-square statistic as a measure of how much the observed cell counts in a two-way table diverge from the expected cell counts. Connor-Linton (2010) and Clark and Foster (2014) explain a Chi-Square test (X^2) is conducted to determine whether there is a significant association between two variables in one or more categories. Therefore, the Chi-square test was used to test the objectives/ research questions as hypotheses for the study. The researcher used a Chi-Square test for goodness of fit and also to test relationships between the study variables (Gravetter and Wallnau, 2013). All variables were tested, guided by the study objectives.

Reasons for selecting Chi-square test for this study

The chi-square test is used to determine whether there is a significant association between two categorical variables.

- **Context of Study:** This test can be applied to understand the relationships between different categories of responses, such as the association between barriers to digital technology and demographic variables.
- **Example Analysis:** Chi-square test to determine whether there is a significant difference in the perception of barriers between different age groups of agribusiness owners.

3.9.5 Importance of Cronbach's Alpha

Cronbach's Alpha was used in this study to test questionnaire reliability. Vaske, Beaman and Sponarski (2017) found it a popular method to access the internal consistency of the questionnaire. In addition, Cronbach's Alpha was also used to measure questionnaire reliability, by taking several measurements on the same subjects (Table 4.5).

Reasons for selecting Cronbach's Alpha test for this study

Cronbach's alpha was used to assess the reliability or internal consistency of the questionnaire. A high reliability coefficient indicates the items consistently measure the same underlying construct.

3.9.6 Reliability Analysis (Cronbach's Alpha)

Contribution: This test ensures the scales used in the questionnaire are reliable and consistently measure the intended constructs. Reliable scales are essential for the validity of the subsequent analyses and findings.

Example Analysis

- Cronbach's alpha value of 0.705 indicates acceptable reliability.
- Each section of the questionnaire (such as barriers, technical skills) has items that consistently measure the same construct, ensuring data robustness.

3.9.7 Importance of Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

The KMO Measure of Sampling Adequacy and Bartlett's Test were used to support the validity of the identified variables. The KMO is a statistic that indicates the variance proportion in the variables, potentially caused by underlying factors (Li, Huang and Feng 2020).

Reason for Selecting KMO and Bartlett Test for this study

To evaluate data suitability for these techniques, the KMO and Bartlett's Test of sphericity are used in factor analysis and principal component analysis (PCA).

The KMO was used to assess how suited the data were for factor analysis and to measure the variance proportion among variables that might be common variance. To assess data suitability, a high KMO value (generally above 0.6) indicates the sample size is adequate, and the patterns

of correlations are relatively compact, making it appropriate to proceed with factor analysis. Furthermore, the identification of Multicollinearity with the KMO helps identify whether the variables have too much common variance or Multicollinearity, which is a prerequisite for conducting a reliable factor analysis (Li *et al.*, 2020).

3.10 FACTOR ANALYSIS

3.10.1 Importance of using Factor Analysis

Factor analysis, according to Reilly and Jones (2017), has data reduction and summarisation as its aim. For this study, factor analysis was part of accessing validity and reliability, based on statistics to measure the relationship between variables.

3.10.2 Reasons for selecting Factor analysis

Contribution: Factor analysis identifies which items group together under common factors, validating the questionnaire structure. By reducing the data into key factors, it directly contributes to answering questions regarding the main barriers and facilitators of digital technology use in agribusinesses. This helps in understanding the dimensions (such as barriers, technical skills, and so on) and their relative importance.

3.10.3 Examples of how these tests will be done to analyse data

Factor Analysis

Steps:

1. **Conduct the KMO Test:** Assess the sampling adequacy.
2. **Perform Bartlett's Test of Sphericity:** Ensure data are suitable for factor analysis.
3. **Extract Factors:** Use PCA to identify the number of factors.
4. **Rotate Factors:** Apply Varimax rotation to simplify the factor structure.

Example:

- Conduct KMO and Bartlett's test, obtain a KMO value of 0.750 and a significant Bartlett's test ($p < 0.001$), indicating suitability for factor analysis.
- Extract factors and interpret the rotated component matrix to see how items load onto different factors.

3.10.4 Importance of using a Covariance–based structural equation modelling (CB-SEM) test

CB-SEM enables researchers to estimate models with hypothesised cause-effect relationships between latent variables such as constructs, where each is operationalised by several items such as indicators (Hair, Babin, Ringle, Sarstedt, and Becker, 2025)

Reasons for using CB-SEM

Its purpose in this study is to evaluate model fit and confirm whether the data align with an established theoretical framework.

3.10.5 Importance of using Structural Equation Modelling (SEM)

SEM offers a robust approach to examining complex relationships among observed and latent variables also enabling researchers to simultaneously analyse multiple dependent and independent variables, account for measurement errors, and evaluate theoretical models comprehensively (De Carvalho and Chima, 2014**).**

3.10.6 Validity and Reliability

Dependability (Reliability): According to Nkholise (2020), in qualitative studies, researchers mostly make use of dependability rather than reliability, however, for the focus groups; the reliability of the questionnaire was confirmed by carrying out a pilot study, while dependability was confirmed by ensuring transcripts were free from errors, as reported by the participants. Similarly, Baten and Amadi (2020) emphasise reliability ascertains the credibility of the study.

Cronbach's alpha was used in this study to confirm quantitative data reliability. The overall alpha for all 12 items was 0.697. Although these values are below the conventional threshold of 0.70 recommended for high reliability, they are considered acceptable in exploratory research (Hair, Sarstedt and Ringle, 2019), particularly in view of the small number of items per factor (two to three items each), which typically lowers alpha values. Furthermore, Reio and Werner (2017) indicate research instruments are regarded as reliable when they provide similar and accurate responses, while being tested several times.

Validity: This concept was formulated by Kelly (1927, cited in McLeod, 2013), who stated a test is valid when it measures what it claims to measure; it refers to the overall study quality and

accuracy. Researchers can, for instance, ask the appropriate questions but then misinterpret the results. Similarly, they can interpret the results appropriately but still produce inaccurate findings. One element most discussed in ensuring validity, is reliability. The validity of this study was tested using a pilot study, with questionnaires administered to selected participants, who piloted questionnaire completion to ensure the questions were simple to understand and unambiguous, thus, the validity of this phase of the study was tested.

Questionnaire validity: Lekhanya (2016) shows the pilot test enables the researcher to obtain some assessment of the question's validity and the likely reliability of the data that would be collected. The questionnaire was, therefore, validated using face validity prior to conducting a pilot study. Face validity is explained by Aithal and Aithal (2020) as a test conducted with selected respondents, to determine how easily they understand questions in the questionnaire, including its feasibility, style, formatting, and readability, as well as language clarity. Furthermore, Reio and Werner (2017) state face validity is used to ensure the right items are included in research instruments. Subsequently, the questionnaire was given to an expert and supervisor for opinion. Research assistants were also provided the questionnaire for opinions to ensure clarity before distribution.

3.11 ETHICS

According to Sekaran and Bougie (2010), ethics are norms and standards of behaviour that guide moral choices regarding our behaviour and relationship with others. Bryman and Bell (2007) state research should include ethical issues, both for those performing the research and those participating/responding; these ethical concerns include participant injury, a lack of knowledge, a risk to privacy, or any type of fraud. The reason for this, is due to respondents frequently being the ones impacted, depending on how the researchers performed the research (Saunders *et al.*, 2009).

Adhering to ethical standards is key to ensuring research is more generally of a high standard, furthermore, Aberg (2022) shows ethics are applied to ensure the integrity of both the researcher, the research in itself, and those participating and possibly impacted by it. Therefore, the researcher must inform the respondents with regard to the research objectives, in order to

make their own decision to participate in the study. The ethical considerations were deemed crucial to the study.

3.11.1 Ethical Considerations

The goal of ethics in research is to ensure no one is harmed or suffers adverse consequences from the research activities (Rodrigues, Kaiseler, Aguiar, Cunha and Barros, 2015). Ethical clearance was obtained from the University Ethics Committee prior to conducting the study. The researcher assured respondents the information provided would only be used for this study and they could withdraw from the research process at any time, without providing reasons. In addition, the researcher complied with the COVID-19 rules and guidelines of Lesotho and the University, as advised by the World Health Organisation (WHO), to ensure the safety of research participants, as well as the researcher and assistants.

The following is a summary of some ethical principles upheld when conducting this study:

3.11.2 Honesty

The researcher needed to strive for honesty in all scientific communications and honestly report data, results, methods and procedures, as well as publication status. Hence, there is no fabricating, falsifying, or misrepresenting data. It was also stated responses would be processed anonymously and no questions would be asked to potentially identify or damage the respondents in any manner. Plagiarism and fabrication were also closely observed, and a methodical approach employed to obtain data without interfering with or damaging respondent rights.

3.11.3 Confidentiality

In research, confidentiality is regarded as concealment, as well as secrets, according to Dube, Mhlongo and Ngulube (2014). As advised by Pillay (2014), the confidentiality of the study was maintained**,** and names of participants not mentioned. Furthermore, the right of research participants to not disclose the information and retain control over their privacy was acknowledged in this study, no data are shared with unrelated parties. Confidentiality enables participants to provide truthful information concerning digital technology use in developing their agribusinesses, without fear and doubts.

3.11.4 Anonymity

Vainio (2012) asserts anonymity is one way to apply confidentiality; it means information regarding the identity of research participants should be removed from the researcher's reports. Coffelt (2017) highlights anonymity is the procedure followed in quantitative studies. The participants in this study remained anonymous, while confidentiality was followed in the qualitative methods. In this study, the personal identities of respondents who participated are not revealed, thus, there is no concern with regard to participant privacy**.**

3.11.5 Objectivity

Nahrin (2015) explains objectivity as the willingness and ability to examine evidence dispassionately. For this study, the researcher strived to avoid bias in the empirical design, data analysis, data interpretation, and personal decisions, in addition to other aspects of research where objectivity is expected or required, accordingly, an authentic knowledge of this study was created.

3.11.6 Integrity

Research integrity is, at its essence, any and all ethical concerns of the research cycle, from design to publishing (Zandstra, 2022). The researcher kept to promises and agreements; acted with sincerity; strived for consistency of thought and action, as well as tools, and resources, and was open to criticism and new ideas.

3.12 DELIMITATION AND SCOPE

The study covered the years from 1990-2023 and focused on agribusiness owners and farmers in the Leribe and Thaba-Tseka districts, as representative of Lesotho as a whole. Care was, however, taken not to include people outside this category; hence, the study concentrated on farmers recognised by the district administrators in each district.

- **Voluntary nature of participation and non-coercion**

Zegwaard and Hoskyn (2015, cited in Fleming and Zegwaard, 2018) opine participants must be fully informed of what will be asked of them, how the data will be used, and what consequences there could be. The respondents in this study were notified of their right to refuse to participate or provide answers to the interview questions when uncomfortable with the interview process.

For this study, no participant was forced or threatened to participate. Marshall, Adebamowo, Adeyemo, Ogundiran, Vekich, Strenski, and Rotimi (2006) indicated individuals and communities may be vulnerable to coercion, due to factors such as poverty and social status. Participants were informed the researcher would not offer incentives for them to provide information related to the study; as a result, some participants refused to participate without incentives; this did not affect the study outcome, and these participants were excluded.

- **Responsibility for data analysis and reporting of research findings**

The findings of this study were reported with honesty and careful consideration, regardless of researcher expectations of the outcomes.

Timeframe: The study covers the years from 1990 to 2023, as this was the period of rapid technological changes in agricultural development in many countries, including Lesotho. Furthermore, this study covers a time when the COVID-19 pandemic threatened the survival of agribusinesses, with major disruptions in the sector worldwide, due to lockdown and restriction of people's movements, thus influencing the adoption and integration of several digital technologies.

3.13 CHAPTER CONCLUSION

This chapter provided an overview of the research philosophy, research paradigm and methodology used in the study, presented the research design, data collection tools, ethical considerations, and research methodology limitations, as well as the justification for adopting mixed research methods. Both qualitative and quantitative analysis approaches were explained, with statistical tests for quantitative data analysis also clarified concerning the study. Furthermore, this chapter discussed the validity and reliability of the research instruments used, and why and how they were tested. In addition, a clear description of how data were collected was provided, as well as the responses obtained, and how they were analysed, for both qualitative and quantitative study phases.

The next chapter will provide a detailed analysis of the quantitative and qualitative data, presenting the results obtained from questionnaires in tables and graphs, along with results from Inferential tests that include the use of Reliability analyses, Factor analysis and Chi-square test

values; interpreted using the *p*-values. Chapter 4 will discuss these results, with qualitative data presented and analysed in the form of themes.

CHAPTER 4

PRESENTATION OF QUANTITATIVE AND QUALITATIVE RESULTS

4.1 INTRODUCTION

This chapter outlines a complete analysis of the findings and interpretation of the quantitative and qualitative research. As outlined in the methodology chapter, qualitative primary data were collected through focus groups and key informant interviews. The themes that emerged from the study were: infrastructure, poor network connection, communication, and the language barrier, as well as government initiatives, digital skills and literacy. In addition, mobile phones, computers, global positioning systems, and training, as well as climate change, along with resources, technology availability, and marketing are further themes identified. Other themes that arose include digital magazines, small agribusinesses, agribusinesses located in rural areas, and costs, as well as old policies, lack of access to digital technology that affects or does not affect agribusiness, and data.

For quantitative research, the findings are based on a questionnaire conducted in relation to the research questions and objectives, discussed in chapter one, and themes that emerged from qualitative data. The findings are linked to the research objectives and research questions. Although the results of both qualitative and qualitative study were obtained differently, the findings with the same themes are presented simultaneously to complement the data. The qualitative themes and quantitative results that do not complement each other will be presented separately, allowing the researcher to put forward all the themes generated from the study. The first section presents the findings, interpretation and quantitative data discussion, with the following sections describing the themes that emerged from the qualitative data findings that complement each other, as follows:

4.1.1 Quantitative data (figures): Qualitative data (themes)

1. Lack of infrastructure and electricity supply affects the use of digital technology: Theme one: Infrastructure.

2. Agribusiness owners/Farmers lack experience in using digital technology:

Theme two: technology availability

3. The lack of agribusiness owner's technical skills affects the use of digital:

Theme four: Digital skills and literacy.

4. Costs of digital technology affect its use by agribusiness owners/farmers

Theme three: Costs.

5. Agribusinesses operate in small spaces

Theme five: Small Spaces /small agribusinesses.

6. Agribusinesses are located in rural areas:

Theme six: Agribusinesses are located in rural areas.

7. Lack of broadband connectivity affects the use of digital technologies by agribusiness owners

Theme seven: Poor network connection.

8. Lack of access to digital technology affects access to market products:

Theme eight: Marketing.

9. Lack of professionalism in political offices affects digital technology use by agribusiness owners

Theme nine: Government initiatives.

10. Lack of technical skills or workshop training by the government affects digital technology use: Training

11. Lack of government financial support for agribusiness affects digital technology use: Resources

4.1.2 Findings, Interpretation and Discussion of the data

This section presents the results and discusses the findings obtained from the questionnaire, analysed with SPSS 2.90. Complementary outputs were generated through SEM, including both CB-SEM and partial least squares (PLS-SEM) approaches. The descriptive statistic results were presented in the form of tables, graphs and cross-tabulations. Inferential techniques include the use of correlations and chi-square test values, interpreted using p-values. The traditional approach to reporting a result requires a statement of statistical significance, with a p-value generated from a test statistic, where a significant result is indicated with $p < 0.05$.

The results are organised into descriptive and inferential components. Descriptive statistics include frequency distributions, percentages, and graphical summaries for each item and section of the questionnaire. Where relevant, cross-tabulations are presented to illustrate patterns across key demographic and biographical variables.

Inferential statistical analyses include:

- Chi-square tests of independence to examine associations between categorical variables, with significance determined at $p < 0.05$.
- Reliability analyses - Cronbach's alpha and composite reliability (CR) - to assess the internal consistency of the constructs.
- To determine the underlying structure of the questionnaire items and confirm the dimensionality of the constructs.
- SEM results, including model fit indices for CB-SEM and path coefficients with R^2 values for PLS-SEM, to evaluate the hypothesised relationships between latent constructs.

All inferential tests are interpreted using their corresponding p-values and, where applicable, confidence intervals. A statistically significant result is indicated where $p < 0.05$, in line with conventional reporting standards.

4.1.3 The Sample

According to Sekaran and Bougie (2010), sampling begins with precisely defining the target population in terms of elements, geographical boundaries and time. Creswell and Creswell (2017) further describe a sample size as the total number of individuals or items selected from

the bigger population to be part of the research. In total, 400 questionnaires were despatched and 389 completed responses achieved, with a 97.25 percent return rate.

4.2 FACTOR ANALYSIS

Factor analysis was done only for the Likert-scale items. Certain components were divided into finer components; explained in the rotated component matrix, as illustrated by the summarised result (Table 4.1) of this analysis.

Table 4.1: Summarised result-rotated component matrix

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.744
Bartlett's Test of Sphericity	Approx. Chi-Square	552.532
	df	78
	Sig.	< 0.001

All conditions were satisfied for factor analysis. That is, the KMO Measure of Sampling Adequacy value should be greater than 0.500 and for Bartlett's Test of Sphericity sig. the value should be less than 0.05.

Table 4.2: Rotated Component Matrix (factor analysis)

	Component					
	1	2	3	4	5	
Agribusinesses are located in rural areas	0.750	0.053	-0.019	0.045	0.249	A1
Agribusinesses operate in small spaces	0.724	0.061	0.226	0.092	-0.105	A2
Costs of digital technology affects the use by agribusiness owners/farmers	0.633	0.173	0.058	-0.005	0.019	A3
Lack of technical skills or workshop training by the government affects the use of digital technology	0.128	0.746	0.170	0.004	-0.068	B1
Lack of government financial support for agribusiness affect the use of digital technology	0.004	0.732	-0.054	0.075	0.132	B2
Lack of access to credit affects the use of digital technology for agribusiness	0.244	0.495	0.183	0.163	0.049	B3
Agribusiness owners /farmers lack experience in using digital technology	0.157	0.042	0.757	0.002	0.129	C1
Lack of agribusiness owner's technical skills affect the use of digital technology	0.051	0.164	0.741	0.079	-0.031	C2
Lack of access to markets to market their products affect the use of digital technology by agribusiness owners	0.119	0.298	-0.002	0.629	0.209	D1
Lack of professionalism in political offices affects the use of digital technology by agribusiness owners	0.134	0.138	0.230	0.617	0.031	D2

Lack of infrastructure and electricity supply affects the use of digital technology	-0.227	-0.356	-0.240	0.598	-0.171	D3
Lack of broadband connectivity affects the use of digital technologies by agribusiness owners	0.093	0.124	-0.047	-0.051	0.859	E1
Social influence affects the use of digital technologies by agribusiness owners	0.021	-0.044	0.340	0.334	0.591	E2

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

The Rotated Component Matrix (Table 4.2) revealed clear factor loadings, with each item loading strongly on a single component (≥ 0.40). The components were interpreted as follows:

Component 1: Location and Financial Constraints

Represents agribusinesses being in rural/small spaces and facing cost constraints in adopting digital technology.

Component 2: Government and Financial Support Deficiency

Indicates the lack of government training, financial support, and access to credit affecting digital technology usage.

Component 3: Farmer Experience and Technical Skills

Captures agribusiness owners' lack of experience and technical skills in using digital technology.

Component 4: Market and Political/Infrastructure Challenges

Reflects issues of market access, political professionalism, and infrastructure/electricity availability.

Component 5: Connectivity and Social Influence

Represents the impact of broadband connectivity and social influence on digital technology adoption.

The five-component solution aligns with the study's conceptual framework, demonstrating that digital technology adoption among agribusiness owners is shaped by location and cost constraints, government and financial support gaps, farmers' technical capacities, market and infrastructure conditions, and connectivity/social influence factors. These components were subsequently used in the Confirmatory Factor Analysis (CFA) and SEM to validate the measurement model and test the hypothesised relationships.

The component matrix is an additional statistical analysis of the above figures. A component test was conducted on the statements. The respondents indicated five categories of components, and a strong to moderate significance was identified. A component test was conducted on digital technology use for agribusiness development in the Leribe and Thaba-Tseka districts.

Respondents indicated five categories of components (Table 4.2) where a strong positive significance of 0.732 is shown for the statement whether "lack of government financial support for agribusiness affects digital technology use". This is supported by Akmarov, Gorbyshina and Kniazeva (2019) who show the development of digital agriculture is strongly supported by the mechanism of government support. The respondents indicated the lack of government financial support is a concern for digital technology use by agribusinesses. This shows farmers cannot afford technology without government support and lack access to credit from banks and other financial institutions.

These findings concur with Daemane and Muroyiwa (2022), who revealed farmers do not have access to credit due to several factors, which influence access to credit. These factors include farmers' level of education, farm size, employment status, and household savings, as well as collateral, and interest rates. Motsoari *et al.* (2015) further show this inhibits the transition of agriculture from traditional methods to technology adoption. Kolane (2023) also finds farmers are still using outdated technologies, due to lack of access to credit. However, the Isle of Man: Final project report (2018) asserts farmers have been trained by Action Aid, without government support, acquiring skills to set up and run a savings and credit cooperative, where members are able to manage their projects and agribusinesses on their own. Notwithstanding these efforts, farmers remain unable to afford technology; therefore, they recommend government financial support.

On the variable "digital technology costs affect technology use by agribusiness owners/farmers", the score of 0.633 demonstrates a positive significance. A score of 0.746 was also recorded for "lack of technical skills or workshop training by the government affect digital technology use", proving significant (Table 4.2). The finding concurs with the Digital Agriculture Country study annex for Lesotho (World Bank Group, 2021/2022), which highlights the lack of skills as one barrier to implementing and adopting modern technologies and innovations. However, several reports in Lesotho have shown farmers and agribusinesses

are trained on several agribusiness issues, such as climate change, finances and seedlings (Isle of Man: Final project report, 2018; CCARDESA, 2023).

The other variable, regarding whether "lack of infrastructure and electricity supply affects digital technology use", has a positive significance of 0.598 (Table 4.2), indicating the lack of infrastructure and electricity supply is a challenge and will affect digital technology use by agribusinesses. These findings are in line with Akintunde and Oladele (2019), who confirmed lack of access to electricity constrains ICT use by extension workers and farmers.

The score of 0.629 on "lack of market access to market their products" demonstrated a strong positive significance (Table 4.2); this means lack of access to markets to market their products affects digital technology use by agribusiness, which shows respondents are concerned by the lack of markets to market their products to that would enable them to purchase technology. The findings concur with Johane *et al.* (2021), who show farmers in Lesotho sell their products to street vendors and informal community markets, because they do not have access to formal markets and buyers who offer better prices. Furthermore, wool and mohair farmers in Lesotho choose one of three options available to them as market for their products, namely, to sell through informal traders, government sponsored markets or private traders.

Latela (2022) indicates farmers are to begin selling their products directly to China, therefore, ICT would offer Lesotho farmers more options. For instance, marketing and improving production to remain competitive in global markets such as China, as opposed to relying on SA as their main market because, as Nkamisa (2020) shows, SA exports wool and mohair to China, as China is the biggest wool importer (Research and Markets, 2023).

The score of 0.859 on the statement "lack of broadband connectivity affects digital technology use by agribusiness owners" demonstrates a strong positive significance (Table 4.2), which shows respondents are concerned regarding the lack of broadband connectivity in their areas that affects their technology use. This concurs with Olesky (2023), who shows many people remain unable to access the internet, particularly in the rural areas. Therefore, without access to broadband, farmers and agribusiness are unable to pursue opportunities such as market access and information offered by digital technology. This corroborates Mohloboli (2025), who shows broadband connectivity in Lesotho limits farmers, specifically in the rural areas, to access markets and necessary information, such as crop prices and weather updates.

On the statement "social influence affects the use of digital technologies by agribusiness owners", the score was 0,591, whereas the variable "costs of digital technology affects technology use by agribusiness owners /farmers", produced a score of 0.633 (Table 4.2), which demonstrates a positive significance, indicating that digital technologies affect farmers' lives. According to Bontsa *et al.* (2023) one factor affecting digital technology use by farmers, is social influence. Dissanayake, Jayathilake, Wickramasuriya, Dissanayake, Kopiyawattage, and Wasala (2022) determined subjective norms affect the perceptions of farmers regarding technologies; farmers thus perceive the relevance of technology according to how other farmers or neighbours feel regarding the technology. Consequently, their attitude influences their decision to adopt technology.

The statement "Lack of professionalism in political offices affects digital technology use by agribusiness owners" generated a score of 0.617 (Table 4.2), which demonstrates at a significant level that is not strong. It shows a lack of professionalism is not highly significant in digital technology use. This aligns with David, Yigitcanlar, Li, Corchado, Cheong, Mossberger, and Mehmood (2023) who find political officials need more experience with adopting different, appropriate, digital technologies to meet citizen demands. Where they do not have the technology experience and understanding, they have the challenge of introducing and advocating technology use for citizen issues and development.

On the statement of "agribusinesses in small spaces", the score of 0.724 (Table 4.2) reflects a high significance, which justifies that agribusinesses operate in small spaces; this means the small sizes of agribusinesses have a strong impact on digital technology use by farmers. This corresponds with Dhillon and Moncur (2023), who show small scale farmers face challenges such as lack of resources and technology, mainly because of challenges such as marketing, infrastructure and lack of awareness and education. It is suggested digital technology implementation in small farms requires actions aimed at increasing farmer knowledge (Kramarz and Runowski, 2025); this is consistent with the study objectives.

The statement "Agribusinesses are located in rural areas" generated a score of 0.750 (Table 4.2), which demonstrates a significance level that is strong, and a justification that agribusinesses are located in rural areas. According to Sihlobo (2025), one characteristic of rural areas is their economic dependence on agriculture. Matopote, Joshi, and Manatsha (2025) add that agriculture

is the main livelihood source in the rural areas. The statement “lack of access to credit affects digital technology use for agribusiness” generated a 0.495 score (Table 4.2), which demonstrates a significance level that is very weak.

4.2.1 Reliability statistics

Reliability refers to the consistency of research measures and validity to the accuracy of such measures (Shannonhouse, Barden and McDonald, 2017). The reliability statistics for the five themes identified (Table 4.3) are illustrated below.

Table 4.3: Reliability Statistics

		N of Items	Cronbach's Alpha
A	Location and Financial Constraints	3	0.557
B	Government and Financial Support Deficiency	3	0.506
C	Farmer Experience and Technical Skills	2	0.460
D	Market and Political/Infrastructure Challenges	2	0.377
E	Connectivity and Social Influence	2	0.395
All items included		12	0.697

Measuring reliability is achieved by repeating measurements several times on the same subjects (Kumar and Gosh, 2019). A reliability coefficient (Cronbach’s alpha score) of 0.70 or higher is considered acceptable.

Table 4.4 shows the Cronbach's alpha score for all items that made up the questionnaire. Cronbach’s alpha tests in this study resulted in overall reliability values of 0.705, therefore, the Cronbach's alpha score reflects the overall reliability of the questionnaire.

4.2.2 Construct reliability and validity

Table 4.4: Construct reliability and validity

Cronbach's alpha (standardised)	Cronbach's alpha (unstandardised)	Composite reliability (rho_c)	Average variance extracted (AVE)

A	0.5243	0.5243	0.5183	0.3524
B	0.4765	0.4760	0.5435	0.3574
C	0.4615	0.4596	0.4844	0.3145
D	0.3799	0.3773	0.5200	0.3256
E	0.3950	0.3949	0.5465	0.3626

The internal consistency reliability of each factor was assessed using Cronbach's alpha, and the results summarised in Table 4.4. Cronbach's alpha values ranged from 0.377 (Component D) to 0.557 (Component A), while the overall alpha for all 12 items was 0.697. Although these values are below the conventional threshold of 0.70 recommended for high reliability, they are considered acceptable in exploratory research (Hair *et al.*, 2019), particularly considering the small number of items per factor (two to three items each), which typically lowers alpha values.

Construct reliability and validity were, in addition, evaluated using CR and Average Variance Extracted (AVE) (Table 4.4):

- CR ranged from 0.484 (C) to 0.547 (E). These results are slightly below the recommended cut-off of 0.70, indicating moderate internal consistency and suggesting further scale refinement may be needed.
- AVE values ranged from 0.315 (C) to 0.363 (E), which are below the recommended 0.50. This indicates the latent constructs explain less than 50 percent variance in their items, pointing to limited convergent validity.

Overall, while the constructs demonstrate moderate reliability and exploratory validity, the relatively low alpha and AVE values suggest the measurement model could be strengthened by adding more items per factor or refining item wording to capture the constructs more comprehensively. Despite these limitations, the results provide a meaningful basis for interpreting the five underlying dimensions influencing digital technology adoption in agribusinesses.

Although some Cronbach's alpha values fall below the conventional 0.60 threshold (for a new construct), this is expected in exploratory research with two- to three-item factors (Hair *et al.* 2019). The factor analysis yielded a clear and interpretable five-factor solution with strong

loadings, supporting construct validity. The moderate reliabilities are, therefore, acceptable for the study's exploratory purpose and provide a foundation for future scale refinement.

The section that follows analyses the scoring patterns of the respondents per variable per section, with results first presented using summarised percentages for the variables that constitute each section. Results are then further analysed according to the importance of the statements. The statements relate to finance, skills and infrastructure, which are critical digital technology components. There is a summary at the end of each section.

4.2.3 Section Analysis

This section presents an analysis of respondent scoring patterns for each variable within the respective questionnaire sections. The results are initially summarised using descriptive statistics, including frequencies and percentages, to illustrate the overall distribution of responses for the variables in each section. These summaries provide an overview how respondents evaluated the different digital technology adoption aspects in agribusiness.

Chi-square goodness-of-fit tests were used to determine whether the observed response distributions differ significantly from what would be expected under a uniform or null distribution. This approach supports the data interpretation by identifying patterns not due to random variation.

Together, these analyses provide both a descriptive and inferential perspective, highlighting the key areas of concern and the statistical significance of differences in response patterns across the questionnaire sections.

4.2.4 Section A: Location and Financial Constraints

Table 4.5 below presents respondent perceptions of location and financial constraints affecting agribusiness digital technology adoption. The statements focus on rural/small space operations and the financial burden of adopting digital solutions. It is very important to investigate the interplay between agribusiness characteristics and financial constraints, particularly how they influence the use of digital technologies; therefore, the primary aim of this section is to dissect and understand the characteristics of agribusinesses in Leribe and Thaba-Tseka districts, their

financial constraints, and how digital technology use affects agribusiness development in these districts.

The scoring patterns are summarised in the table below:

Table 4.5: Agribusinesses are located in rural areas

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Agribusinesses are located in rural areas	A1	26	6.7%	78	20.1%	33	8.5 %	119	30. 6%	133	34.2 %	< 0.001

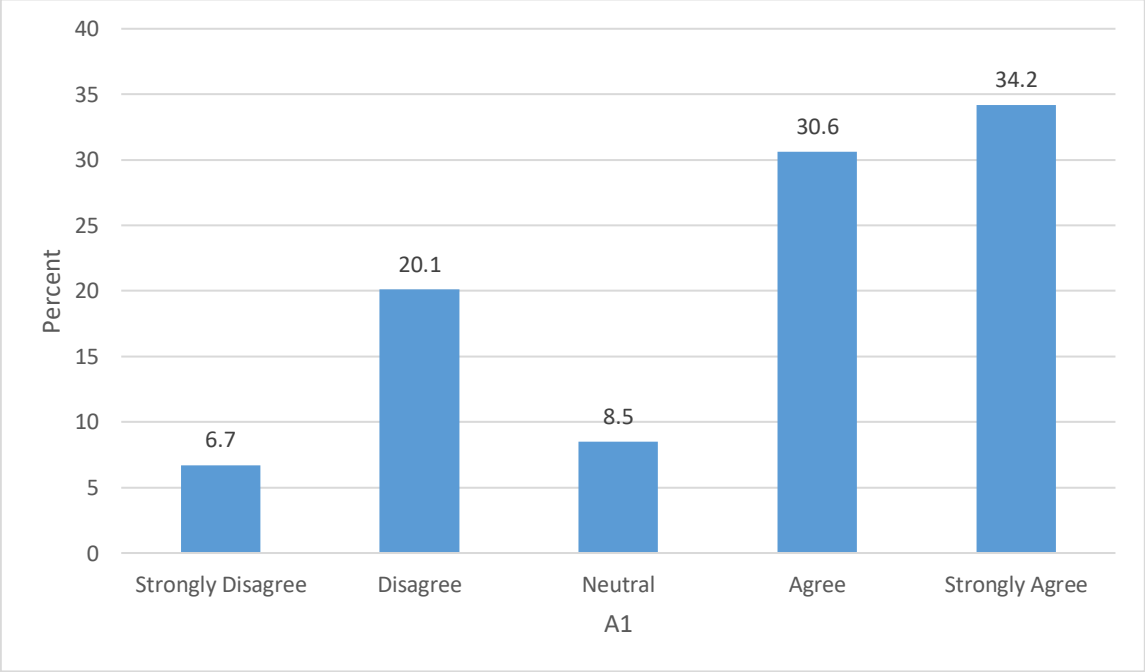


Figure 4.1: (A1) Agribusinesses are located in rural areas

In general, Table 4.5 and figure 4.1 show the vast majority (34.2 percent) respondents strongly agreed, and 30.6 percent agreed agribusinesses are located in rural areas. The literature endorsed this finding, as Wegren (2018) reveals most agribusinesses are located in rural areas, where they are marginalised in digital technology use.

These findings are supported by a Chi-square test, conducted to determine whether many agribusinesses are located in rural areas. The results indicated ($x^{2=}552.523$ df=78 p=0.001)) for this variable, confirming these enterprises are mainly located in rural areas. It can, therefore, be argued digital technologies can be used as tools to transform agriculture in rural areas (Bamigboye and Ademola, 2018). Moreover, Boateng (2012) suggested governments must invest in rural infrastructure to enable the use of digital technologies.

Complementary qualitative theme: Agribusinesses are located in rural areas

Research question: How do the characteristics of agribusiness in Leribe and Thaba-tseka districts impact digital technology use?

Research objective: To assess how the characteristics of agribusinesses impact digital technology use in the Leribe and Thaba-tseka districts.

Participants in the focus group were asked following question:

- How does the location of your business affect your digital technology use?

To assess the impact of agribusiness characteristics on digital technology use in the Leribe and Thaba-Tseka districts, respondents were asked how the location of their agribusiness has affected digital technology use in their area. The majority respondents indicated they are located in rural areas. This echoes Ayer (2015), who found agribusiness is dominated by smallholder farmers working in rural areas. Mpho, Lerato and Neo explained that the location of agribusiness inhibits digital technology use by farmers, as a result of factors such as infrastructure and network. *"We don't have a network tower that is why I don't use technology…" "…I can't use a phone the whole day…" "…My project is based in the highlands of Lesotho, we still experience poor network coverage, which leads to poor network coverage…", "…Where I'm located there is no electricity, electricity solves a lot of problems. People do not have proper electricity and network."*

Greyson (2018) points out small-scale enterprises in the rural areas of developing countries are in the agribusiness category. However, Gazetdinov, Gazetdinov, Semicheva and Badamshin (2021) argued agribusiness in rural areas currently cover only the production of raw materials for the processing industry. Denis (2018) established the reason for stagnant production in rural

areas is the failure of most rural area farmers to benefit from new and improved farming methods, particularly those without access to information.

It is, therefore, evident from this theme that agribusiness development in rural areas could be influenced by digital technology use. Digital technologies such as mobile phones promote local and global connectivity to people in rural areas, who are difficult to reach due to the geographic terrain. Farmers require timely and accurate information regarding modern technologies, including digital technologies with the potential to improve the quality of life in rural areas (Kremer and Houngbo, 2020).

Table 4.6: Costs of digital technology affect its use

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Agribusinesses operate in small places	A2	22	5.7%	70	18.0%	38	9.8%	110	28.36%	149	38.3%	< 0.001

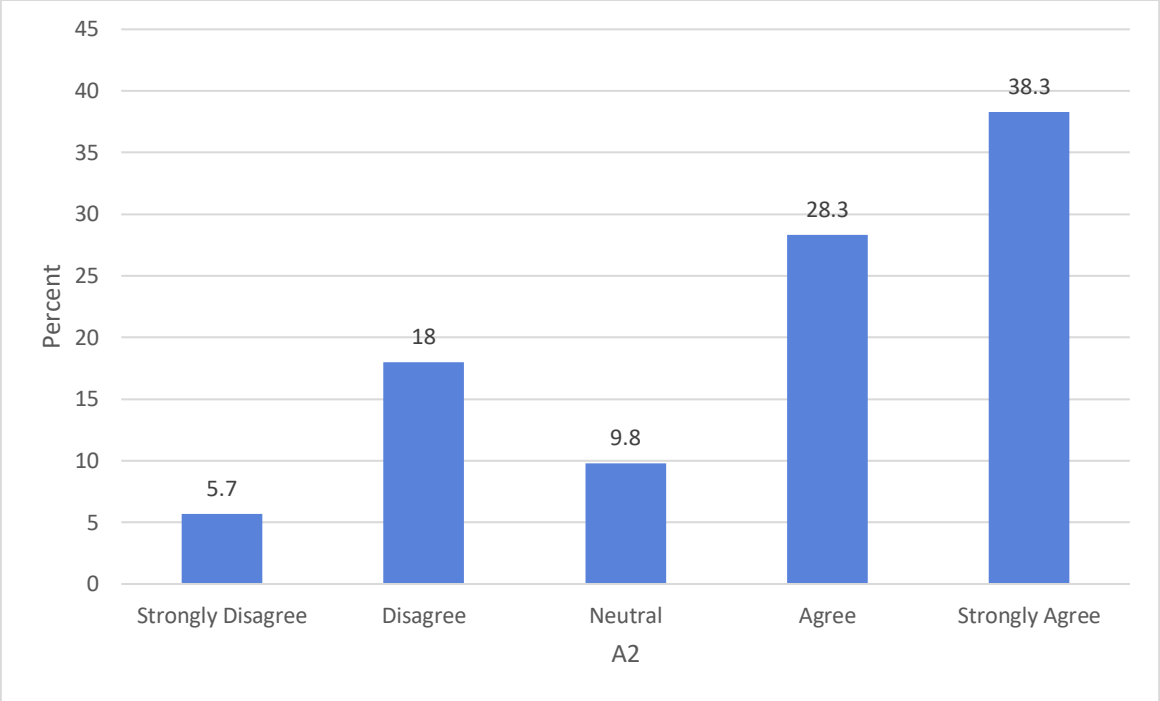


Figure 4.2: (A2) Costs of digital technology affect its use

As depicted (Table 4.6 and Figure 4.2), the majority 38.3 percent respondents strongly agreed, and 28.3 percent agreed the costs of digital technology affect its use by agribusiness owners/farmers. These findings are supported by a Chi-square test, with the results indicating (= $X^{2=}$552.532 df78 p=0.001) for this variable, showing access to credit affects the use of digital technology for agribusiness development.

The findings are also in line with Mushi, Serugendo, and Burgi (2023), who determined many farmers cannot afford modern technologies, particularly small and medium-sized farmers, because they depend on farming and grants for income. However, 5.7 percent respondents strongly disagreed, with 18 percent that disagreed and 9.8 percent indicating neutral, with regard to "the costs of technology affect the use of technology by agribusinesses". Mottaleb (2018) confirms the reduction of technology costs can significantly benefit the farmers, due to the extreme poverty, which is widespread among farm-holds in rural areas of developing countries.

Complementary qualitative theme: Small Spaces /small agribusinesses

Research question: How do the characteristics of agribusiness in Leribe and Thaba-tseka districts impact digital technology use?

Research objective: To assess how the characteristics of agribusinesses impact digital technology use in the Leribe and Thaba-tseka districts.

Participants in the focus group were asked following question:

- What is the size of your agribusiness, and how does the size affect the use of digital technology?

When responding to the question on their business size and how it impacts the use of digital technology, the majority agribusinesses showed they operate in small spaces. This was attributed mainly to some agribusiness owners in the focus group being comprised of youths, who do not have large pieces of land or land of their own; however, the size of their agribusiness does not affect their use of digital technologies. For example, Thabang said "*I operate on a small piece of land, but it does not affect it."*

Kramarz and Runowski (2025) posited many commercial precision agriculture technologies are not profitable for small farms; there are, nevertheless, several solutions worth trying to implement. Adding to Thabang's response, Leboko also said, "*small but I still manage to buy data, just the network is poor,"* while Lefu had a similar opinion *"Small but I afford to buy airtime."* Sello articulated he also has a small business, thus *"the use of digital technology is affected because it is small."*

Rantšo and Seboka (2019) emphasised agriculture is particularly practiced by peasants or small-scale subsistence farmers in many rural areas of developing countries. Abban (2020) adds agribusinesses in Africa are characterised by businesses that operate on a small scale, which is in line with the findings of the literature review. Denis (2018) found, because of their size, smallholders face additional barriers to modernisation, with the literature revealing small-scale farmers face several obstacles that inhibit agribusiness development, where the main obstacle among them includes technology use. This is confirmed by Mpho, who declared; "…*my land is small; therefore, I cannot afford to buy technology."*

Brooks (2013) shows it is, furthermore, mostly unprofitable to farm on small pieces of land, specifically for the youth, while Dörr and Nachtmann (2022) argue digital technologies can support all kinds of farming, including on a small-scale. Nevertheless, Sharma, Bambawale, Gopali, Bhagat, Yelshetty, Singh, Anand and Singh (2011) determined agriculture on large

farms is economically lucrative, allowing farmers to secure effective expertise and technology use, while small-scale subsistence farmers use basic and traditional production techniques. It also emerged from one focus group respondent in the Thaba-Tseka district, who owns a large agribusiness that this, consequently, meant they hired a professional computer scientist to assist with technology in their business, where services such as information systems and information security are concerned.

Monnier and Mige (2022), however, argued small and dynamic agribusinesses are now tapping modern technology to succeed or expand into process marketing and retailing, even though they lack human resources. This is a barrier to adopting digital technologies, because it is effortless for large firms to attract technology-skilled talent, as they have sufficient resources to employ skilled labour (Chen, Lin, Chen, Chao, and Pandia, 2021). It is, thus, evident from this theme that agribusinesses, despite their sizes, have recognised the importance of digital technologies; nonetheless, the sizes of their business are a barrier to technology adoption. Digital technology can, nonetheless, help small businesses by providing information and access to markets.

Table 4.7: Costs of digital technology affect its use by agribusiness owners/farmers

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Costs of digital technology affects the use of digital technology by farmers	A3	15	3.9 %	54	13.9 %	48	12.3 %	121	31.1 %	151	38.8 %	< 0.001

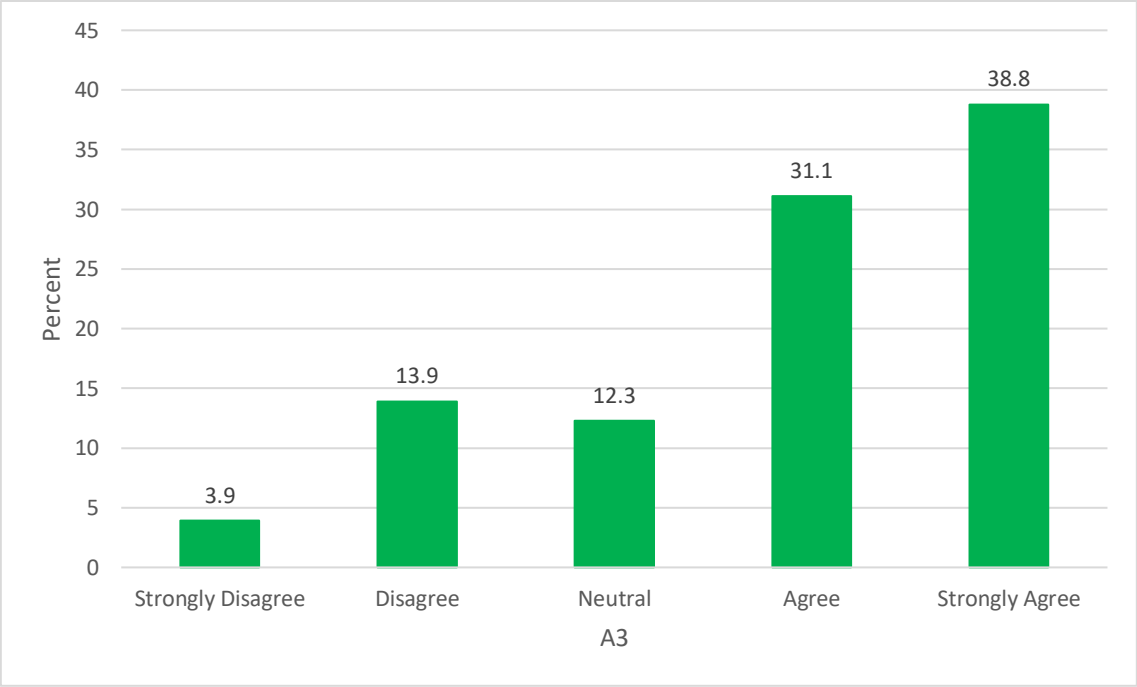


Figure 4.3: (A3) Costs of digital technology affect its use by agribusiness owners/farmers

As depicted (Table 4.7 and Figure 4.3), the majority (38.8 percent) respondents strongly agreed, and 31.1 percent agreed digital technology costs affect its use by agribusiness owners/farmers. These findings are supported by a Chi-square test, where results indicate (= $X^{2=}$552.532 df78 p=0.001) for this variable, showing access to credit affects digital technology use for agribusiness development.

The findings are aligned with Mushi *et al.* (2023), who determined many farmers cannot afford modern technologies, particularly small and medium-sized farmers, because they depend on farming and grants for income. However, the least number (3.9 percent) respondents strongly disagreed, with 13.9 percent that disagreed and 8.8 percent indicating neutral, with regard to "the costs of technology affect the use of technology by agribusinesses". Mottaleb (2018) confirms that, due to the extreme and widespread poverty of farmers and farm-holds in rural areas of developing countries, technology costs reduction can be of significant benefit.

Complementary qualitative theme: Costs

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

The respondents in the focus group were asked the following question:

- What limits your access to digital technology and how does that affect your business?

Three business owners showed their awareness of digital technologies and their importance in agribusiness and indicated their willingness to adopt these technologies for their businesses and production. However, costs of promising digital technologies are, nonetheless, a hindrance in their adoption by agribusiness owners in both districts. Specifically, Teboho highlighted *"the cost of data for internet, if you are also dependent on your agribusiness for survival*."

The responses confirm the statement of Shaibu *et al.* (2018) that digital technology cost affects the decision to adopt the technology. Furthermore, when responding to the question, Line expressed: "*My business does not make enough money, the costs of technology are heavy.*" This corresponds with Yoon, Lim and Park (2020), who assert emerging technology adoption is relatively costly, particularly cyber secure technology such as block chain (Tomashuk, Koliadenko, and Burdiak, 2025), yet its advantages in innovation and growth are essential. However, while some focus group members showed obstacles related to cost affecting their businesses, other members indicated their businesses are not affected.

Ralebese (2011) pointed out the first modern farming techniques were also very expensive and inaccessible for the poorest farmers; as a result, the adoption rate was relatively low among poor farmers. Additionally, Soto, Barnes, Balafoutis, Beck, Sánchez, Vangeyte, and Gómez-Barbero, (2019) determined, compared to small farms, large farms are more likely to adopt technologies, since the adoption is coupled with income measure. Looking back into old literature, mobile phones are found to be very expensive in different developing countries, where poor farmers/entrepreneurs cannot afford to purchase this technology (Frempong, Essegbey and Tetteh, 2007).

In confirmation, Mosa stated*: "The price of technology, I want to buy a modern phone which costs thousands."* These findings concur with Mtombeni, Bove, Thabane and Makgabo (2019), who established the primary barrier to stimulating agribusiness development, for emerging farmers in particular, is the high business operating cost. Sen (*et al* 2025) add the cost of ICT equipment, as well as the cost to use and maintain the service, is unaffordable for farmers in low-earning areas. Therefore, Mishrif and Khan (2023) confirm, other than businesses depending on their income to continue operating, they need to also invest in developing resources for technology adoption and management. This theme shows agribusinesses in Lesotho cannot afford digital technology; however, technology needs to be accessible to agribusinesses that can afford to invest in it, as well as those who cannot, therefore, farmers need financial support.

Section A Summary

The results indicate a strong leaning towards agreement across all three items. For the statement "Agribusinesses are located in rural areas" (A1), 64.8 percent respondents agreed or strongly agreed, while only 26.8 percent expressed disagreement. Similarly, "Agribusinesses operate in small spaces" (A2) showed 66.6 percent agreement, with minimal strong disagreement (5.7 percent). The cost of digital technology (A3) had the highest agreement levels, with 69.9percent respondents agreeing or strongly agreeing that costs hinder adoption. Neutral responses were relatively low (8.5 percent–12.3 percent), indicating most respondents held clear opinions, all p-values being significant. The consistently high agreement for cost-related barriers highlights that affordability remains the most pressing challenge, overshadowing locational limitations.

4.2.5 Section B: Government and Financial Support Deficiency

This part (section B) of the analysis examines the roles government and financial support play in influencing digital technology adoption by agribusinesses. The items capture perceptions of training, funding, and access to credit as potential barriers, since the study also wanted to identify different challenges in their digital technology use, along with any barriers that inhibit digital technology use by agribusiness owners and farmers.

Table 4.8: Lack of technical skills or workshop training by the government affects digital technology use

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Lack of technical skills or workshop training by the government affects the use of digital technology	B1	6	1.5%	47	12.1 %	20	5.1 %	135	34.7 %	181	46.5%	< 0.001

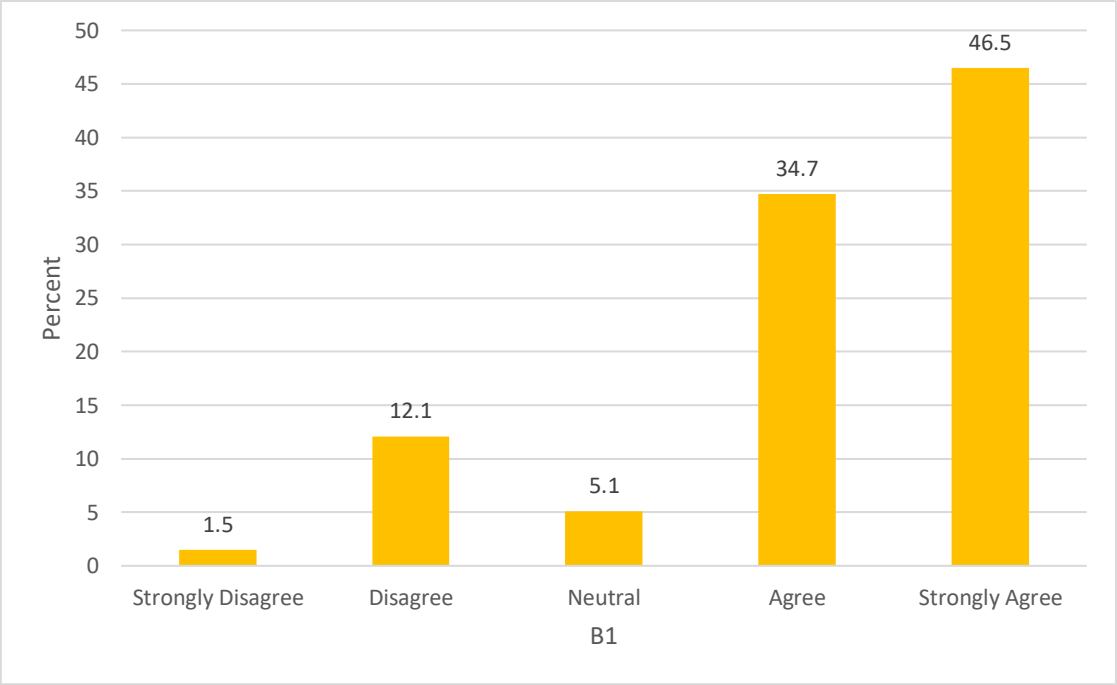


Figure 4.4: (B1) Lack of technical skills or workshop training by the government affects digital technology use

As depicted (Table 4.8 and Figure 4.4), a vast majority (46.5 percent) respondents strongly agreed, and 34.7 percent agreed the lack of technical skills or workshop training by the government affects the use of digital technology. These findings are supported by a Chi-square test, with the results indicating ($x^{2=}552.523$ df=78 p=0.001) for this variable, which shows lack of technical skills or workshop training by the government affects digital technology use for agribusiness development. As reflected (Figure 4.4), 12.1 percent disagreed, 5.1 percent indicated neutrality and the least number (1.5 percent) strongly disagreed.

According to Qureshi (2020), education and training are losing the race with technology, therefore, Katz (2009, cited in Ngibe, 2020) states specialised knowledge is required in acquiring technical skills, incorporating the ability to be analytical, and knowledge regarding how to use that discipline's tools and methods or systems. This means digital technology use necessitates possession of technical skills by agribusiness owners and managers, with Trendov *et al.* (2019) showing people without technical skills are generally disregarded in increasingly digitally-driven societies.

Complementary theme: Training

Objective; To investigate the past and present efforts and strategies in digital technology use for agribusiness development in Lesotho.

Research question: 2. What are the past and present efforts and strategies in digital technology use for agribusiness development in Lesotho?

Participants in the focus group were asked the following questions:

- What can be done to improve the use of digital technologies for your business?
- How does your level of education affect your ability to use digital technology?
- Are there any government development partners that assist you in ensuring digital technology use?

Key informants were asked the following question:

- What can be done to improve the use of digital technologies for your business?

Agricultural extension services consist of systems and initiatives that convey knowledge and expertise and technical tools to farmers and rural communities for better production enhancement and sustainable livelihoods (Rahman *et al.*, 2025). This adds to findings that the adoption of digital technologies in agriculture by smallholder farmers is greatly aided by agricultural extension agents (Ocran, Asante and Ametepey, 2024). Therefore, agricultural extension workers require a diverse set of skills and competencies to effectively fulfil their roles in supporting farmers and facilitating technology adoption (Arowosegbe, Alomaja, and Tiamiyu, 2024).

Farmers can master the essential operations of digital technology through training and instructions (Gong, Ma and Zang, 2024), which is corroborated by respondent Thabang, who shows he was able to use technology at his old age, because he was provided instructions. He narrated *"...my level of education does not affect my ability to use technology, I once used artificial insemination, and I was able to use it more than the educated youth because I was trained*." This is in contrast with Aphunu and Atoma (2010), who observed farmers with a good education level are eager to learn and receptive to new ideas. However, Shoaib (2024) suggests training labour to operate complex machinery and manage digital platforms was a considerable challenge, particularly for regions where traditional farming skills predominate.

In contradiction, Mojabeng stated farmers must be assisted to use their primitive ways of agriculture, because they struggle with the use of technology. She narrated, *"People who produce a lot agriculturally do not rely on technology, they should just be assisted with primitive [and] easy, because they struggle due to lack of access to technology due to network and lack of skills."* Innovative training programmes complement extension services by offering practical, hands-on education, tailored to the specific needs of farmers. These programmes can take various forms, including in-field training sessions, workshops, and digital learning platforms (Raji, Ijomah and Eyieyien, 2024).

The government, therefore, needs to invest in education and training to fully harness the potential of modern agriculture tools. Three extension workers suggest the ministry of agriculture needs to provide training for them to be able to use digital technology, while Makara mentioned he has not used a tablet provided by the ministry, because he has not been trained to use digital technology. "*Last year we were given phones and laptops, but it did not reach the intended purpose, because there was a mismatch between skills, technology and the system."* Ongoing training for both farmers and extension agents is essential to keep pace with evolving digital tools and technologies (Kapoor, Sinha, Desa, Baldaniya, 2024; Asante, 2024*)*. Additionally, Li and Li (2023) show a certain number of farmers remain that cannot make full and effective use of the technology to improve the overall agricultural production efficiency.

Training is thus necessary for agribusiness development for both farmers and extension services, with training tailored for farmers ensuring technology is not just present but useful (Mohloboli, 2025). This theme indicates that farmers, extension workers and officials are

familiar with digital technologies, such as mobile phones and computers; however, they require training to equip them with the necessary skills to adopt these digital tools and to upgrade their existing skills to remain relevant in their roles.

Table 4.9: Lack of government financial support for agribusiness affects the use of digital technology

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Lack of government financial support for agribusiness affect the use of digital technology	B2	18	4.6%	41	10.5 %	27	6.9 %	104	26.7 %	199	51.2%	< 0.001

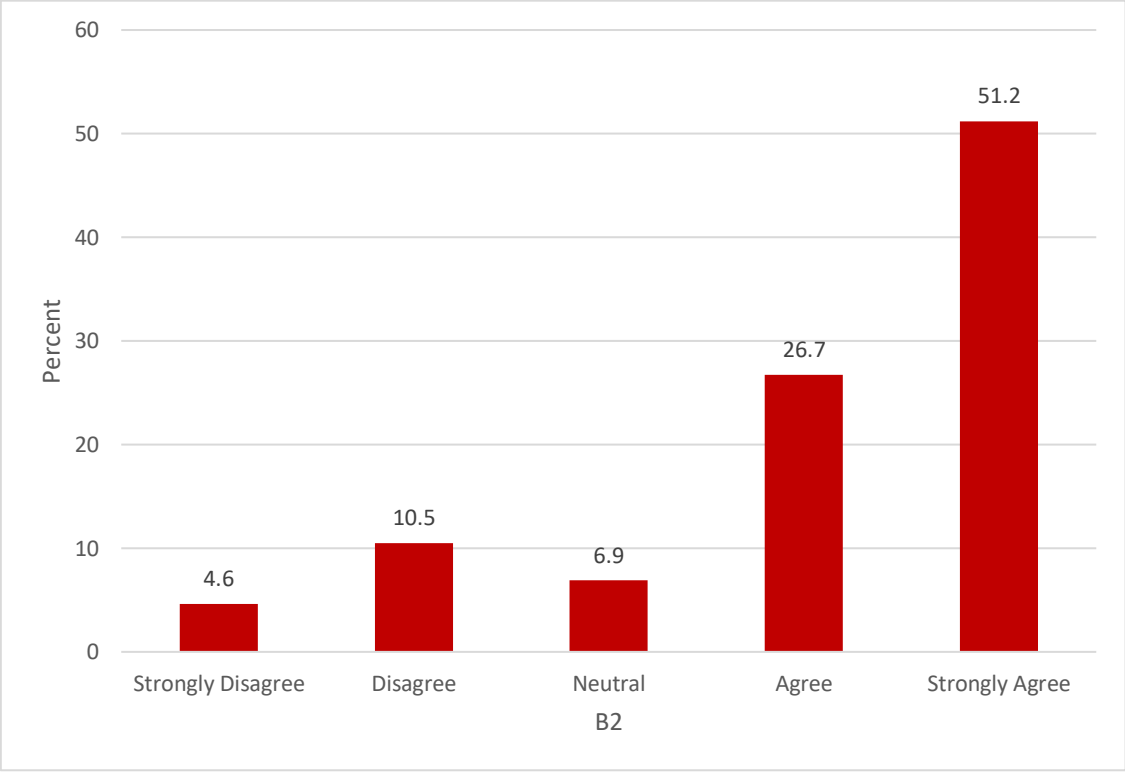


Figure 4.5: (B2) Lack of government financial support for agribusiness affects digital technology use

As depicted (Table 4.9 and Figure 4.5), the vast majority (51.2 percent) respondents strongly agreed, and 26.7 percent agreed the lack of government financial support for agribusiness affects digital technology use. These findings are supported by a Chi-square test, where the results indicate ($X^{2=}$552.532; df=78 p=0.001) for this variable, showing lack of government financial support affects digital technology use for agribusiness development. Very few respondents strongly disagreed (4.6 percent), with a limited number that indicated neutral (6.9 percent) and 10.5 percent that disagreed with the statement.

Literature indicates smallholders often rely on their limited savings to invest in their farms (Martin, Harihareswara, Diebold, Kodali and Averch, 2018), due to lack of financial support and lack of credit availability, which is a result of low incomes and insufficient knowledge regarding financial assistance. Therefore, notwithstanding the lack of financial assistance, agribusinesses remain capital and resource intensive businesses, which rely heavily on technology.

On the one hand, Atanga (2020) argues the reliance of farmers on support to finance digital technology provided by external bodies is, likely to threaten their autonomy, since it can create a system of dependency, where farmers will continuously rely on platforms for new skills and other means of production. On the other hand, the FAO (2018, cited in Smidt and Jokonya, 2022) advocates for direct support of small-scale farmers in digital technology use. Joiner and Okeleke (2019) assert the role of governments is to support farmers' operational functions by creating an enabling regulatory environment to motivate donors and investors to invest in viable services that recognise local market conditions.

Complementary theme: Resources

Question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-Tseka districts?

Objectives: To identify the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked the following questions:

- What are the major challenges with the use of digital technology for your business?
- Do these challenges negatively impact the development of your business?

Key informants were asked the following questions:

- In your opinion, can digital technology promote agribusiness development?
- What can be done to improve the use of digital technologies for your business?

To successfully use digital technology, farmers need a range of resources to effectively use technology in agriculture, without resources farmers are limited to access technology resulting in low agricultural productivity (Vurchio, Isitan, Zelenic, Ionescu, Sevillano, Cem, Gok, Kutlubay, Alessandroni, Sulak and Hedzet, 2024). In developing countries, the government is dedicated to enhancing the livelihoods of farmers by providing resources to agricultural extension services, however, it was observed the results are consistent with the findings of Thamaga-Chitja and Morojele (2014), who studied the context of smallholder farming in SA. Their findings indicate inequality in resource allocation and support from stakeholders and government has excluded smallholder farmers from accessing advanced technology, resulting in reliance on traditional farming methods and limiting their contribution to national food security. Furthermore, Poulton (2014) shows farmers lack financial resources to access smart devices (Sen *et al* 2025).

This is line with the respondents, who showed the lack of resources limits their access to digital technology. When asked regarding the major challenges with digital technology use for their business, Leruo explained: *"We lack resources such as data, sometimes I can't afford to buy it because we submit timesheet things midmonth without financial support",* while Mahase expressed the need for resources to fully utilise digital technology. He stated, *"we need resources to improve technology use…."*

When asked whether digital technology promotes agribusiness development, Moleleki stated, *"yes, when there are enough and appropriate resources".* This response confirms Arowosegbe *et al.* (2024) who made a similar assertion from previous research. The responses from this theme collectively show a need for resource allocation for digital technology use to enhance their effectiveness in agricultural extension services.

Table 4.10: Lack of access to credit affects digital technology use for agribusiness

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Lack of access to credit affects the use of digital technology for agribusiness	B3	11	2.8%	44	11.3 %	29	7.5 %	118	30.3 %	187	48.1%	< 0.001

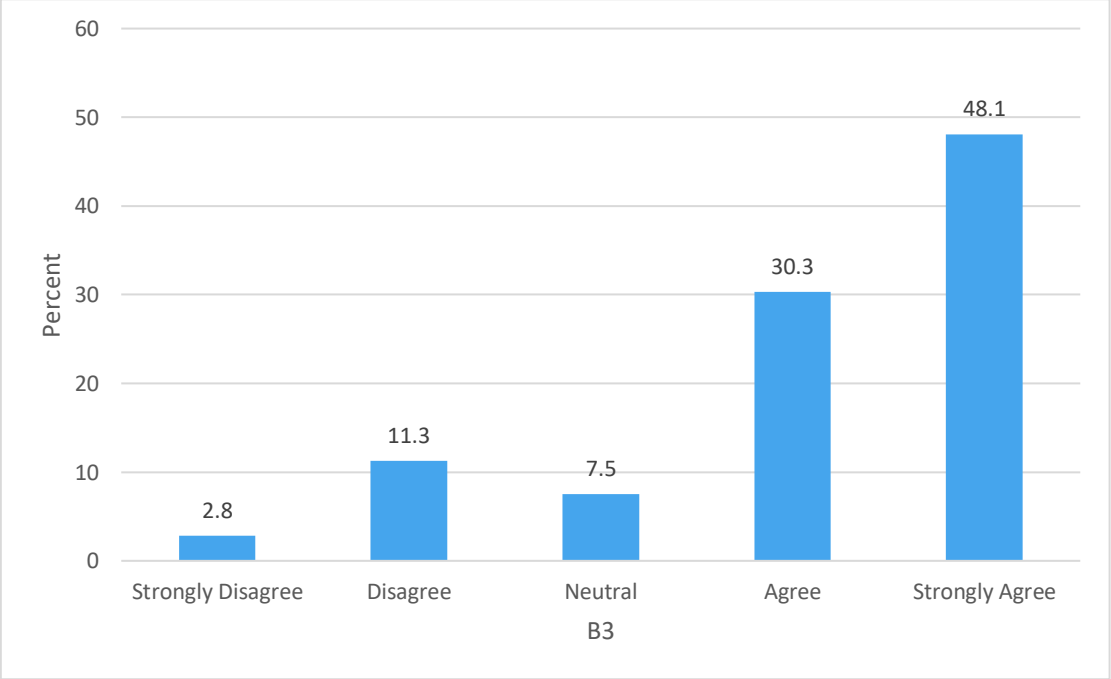


Figure 4.6: (B3) Lack of access to credit affects digital technology use for agribusiness

As depicted (Table 4.10 and Figure 4.6), the vast majority (48.1 percent) respondents strongly agreed, and 30.3 percent agreed lack of access to credit affects digital technology use for agribusiness. These findings are supported by a Chi-square test, where the results indicate ($X^{2=}$552.532; df= 78 p=0.001) for this variable, which shows access to credit affects digital technology use for agribusiness development. There were very few respondents (11.3 percent) that disagreed, and 2.8 percent strongly disagreed with the statement.

The literature endorsed this finding, as Balana and Oyeyemi (2022) were able to show conclusively that poor access to credit is seen as a key barrier to the adoption of these

technologies. This concurs with Abdallah (2016), who found credit availability and access enable farmers to invest in new technology, adding to Martin *et al.* (2016), who determined smallholders frequently have to use their limited savings to invest in their farms. Should this not be an option, Qaim, Subramanian, Naik and Ziberman (2006) explain either formal credit institutions or informal lenders are then approached to finance technology, subsequently resulting in devastating results for farmers. Notwithstanding the observable gains from digital technology adoption, Mdoda and Mdiya (2022) show the costs of technology are, furthermore, often associated with constraints in digital technology use, in general. This agrees with the findings of this study.

- **Section B Summary**

The results show a clear pattern of strong agreement across all three items, indicating that respondents consistently perceive insufficient government support as a significant barrier to digital technology adoption.

For the statement "Lack of technical skills or workshop training by the government affects the use of digital technology" (B1), 81.2 percent respondents agreed or strongly agreed, while only 13.6 percent disagreed, and 5.1 percent were neutral. Similarly, "Lack of government financial support for agribusiness affects the use of digital technology" (B2) recorded the highest agreement, with 77.9 percent respondents agreeing or strongly agreeing and only 15.1 percent expressing disagreement. Finally, "Lack of access to credit affects the use of digital technology for agribusiness" (B3) saw 78.4 percent agreement, with 14.1 percent disagreement and 7.5 percent neutrality.

These results highlight that government-related deficiencies—particularly in providing financial support and facilitating training—are viewed as critical obstacles to the adoption of digital technologies. The consistently low neutral responses (5.1 percent–7.5 percent) reflect that respondents hold firm opinions on the importance of government intervention in enabling agribusiness digital transformation.

4.3.6 Section C: Farmer Experience and Technical Skills

This section discusses and presents an analysis of data gathered from respondents concerning barriers that affect the use of digital technologies in agribusiness in the Leribe and Thaba-Tseka

districts of Lesotho. Farmer experiences and technical skills are evaluated as barriers to digital technology adoption in agribusinesses. This section captures the extent to which limited expertise and skills constrain the effective utilisation of digital tools.

Table 4.11: Agribusiness owners/Farmers lack experience in using digital technology

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Agribusiness owners /farmers lack experience in using digital technology	C1	19	4.9%	70	18.0%	51	13.1%	115	29.6%	134	34.4 %	< 0.001

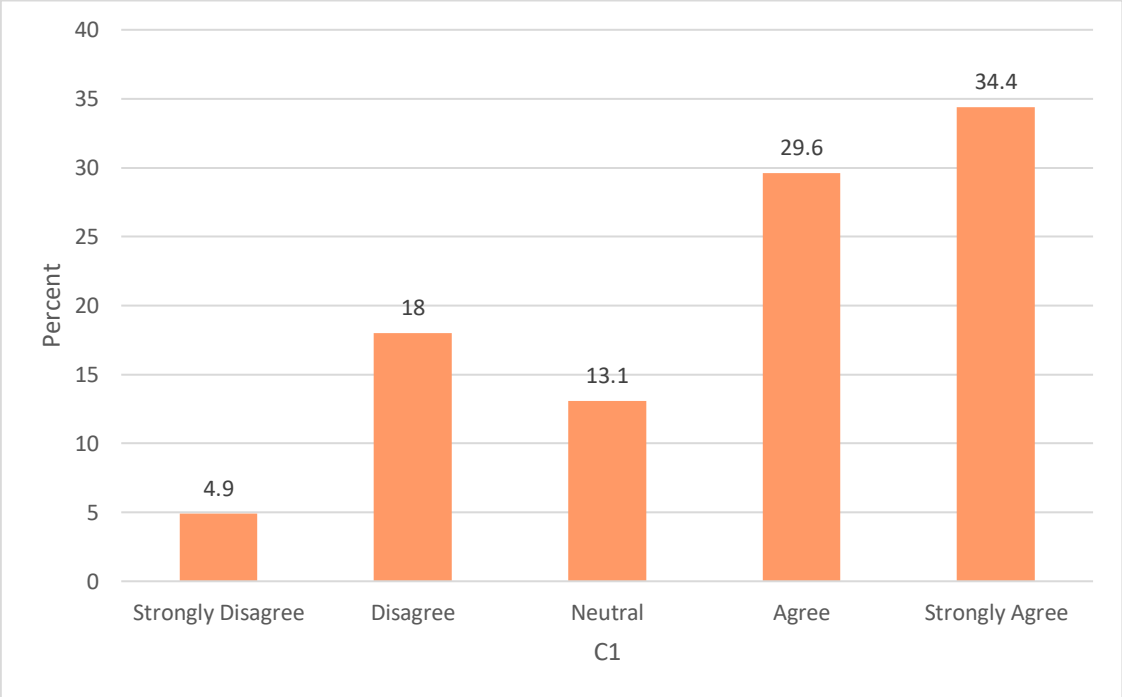


Figure 4.7: (C1) Agribusiness owners/Farmers lack experience in digital technology use

As depicted (Table 4.11 and Figure 4.7), the vast majority (34.4 percent) respondents strongly agreed or agreed (29.6 percent) agribusiness owners/farmers lack experience in using digital technology. These findings are supported by a Chi-square test, with the results indicating

(X^(2=) 552.532; df=78 p=0.001) for this variable, which confirms a lack of lack experience in digital technology use. While 11.1 percent respondents indicated neutral to the statement, very few respondents disagreed (13.1 percent) and strongly disagreed (4.9 percent), respectively.

Dias, Franco and Pereira (2012) and the OECD (2018, cited in Ngibe, 2020 highlighted the lack of experience required in its use as one primary barrier to adopting technological advances. The lack of experience in digital technology use by many farmers is confirmed in a study by Schulz, Prior, Kahn and Hinch (2022); as a result, they are uncertain regarding technology use in their business. Suyanti, Ira, Vaudhan and Naya (2021) further add the experience to use technology is influenced by government initiatives to narrow the digital divide.

Complementary theme: Technology availability

Research question: What are the major challenges with digital technology use for your business? Do these challenges negatively impact the development of your business?

Objective: To identify the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked the following questions:

- What limits your access to digital technology and how does that affect your business?
- What can be done to improve the use of digital technologies for your business?

Key informants were asked the following question:

- What can be done to improve the use of digital technologies for your business?

Despite the shift from traditional agriculture to modern technology, such as precision agriculture, farmers remain reluctant to adopt new technologies due to unavailability of technology. Ratha, Yoeu, Ty and Vong (2025) show the lack of technology availability can be a result of technology non-availability in the markets and lack of technology service charge. Respondents in the focus group acknowledged the challenges they face when adopting new technologies, including availability and affordability.

For farmers who can afford data, the problem is poor internet connection due to poor network. Matlotlo expressed: *"Sometimes I buy data for my business and not use it all."* The respondents further highlighted the availability of technology enlightened them regarding weather and other hazards in preparation for planting. Leluma pointed out: *"Digital technology can also detect growth of plants and weather forecast so that people know which crops to plant and when and the general risks and timely preparation,"*

This aligns with Etwire, Buah, Ouédraogo, Zougmoré, Partey, Martey and Bayala (2017), who show the lack of interaction of weather forecasting services through text messages affected farmers' decision-making process in agricultural production. In many rural areas, farmers have limited access to digital devices, which makes it difficult for them to benefit from the tools and information available online (Kumar, Singh, Kumar, and Mittal, 2022). This is in line with Mpepuoa, who showed the ministry needs to "*avail technology*" for extension workers, where Mafa, furthermore, expressed, "*accessibility and outsourcing suitable relevant technology."* This theme shows technology availability will enable farmers to fully utilise digital technology.

Table 4.12: Lack of agribusiness technical skills affects digital technology use

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Lack of agribusiness owner's technical skills affect the use of digital technology	C2	20	5.1%	34	8.7%	30	7.7%	161	41.4%	144	37.0 %	< 0.001

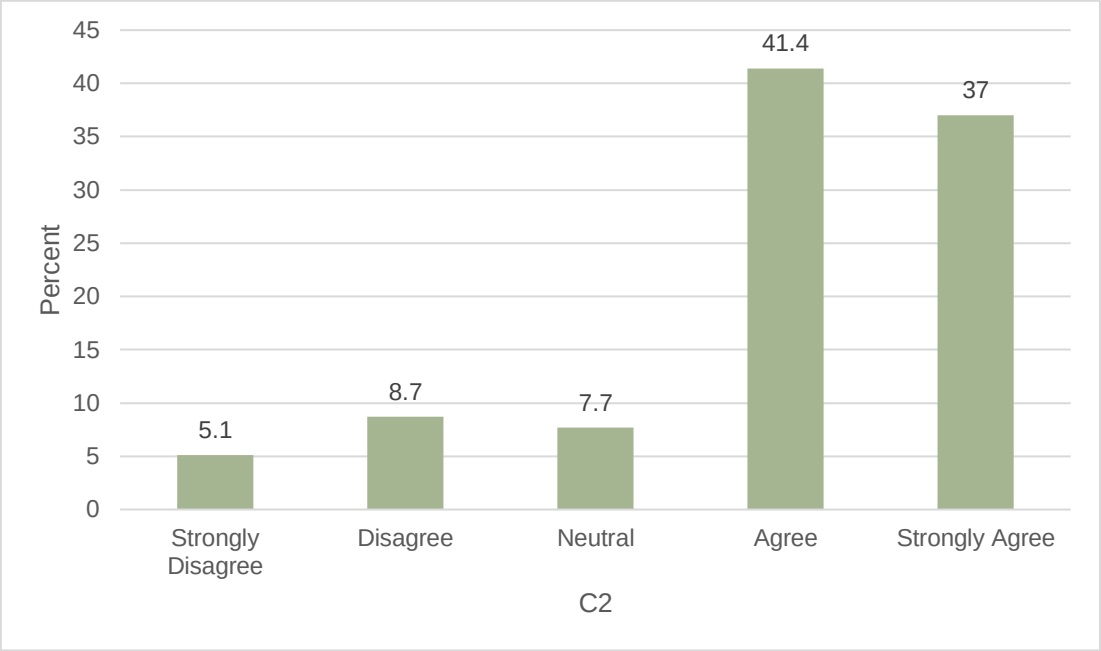


Figure 4.8: (C2) Lack of agribusiness technical skills affects digital technology use

As depicted (Table 4.12 and Figure 4.8), the vast majority (37 percent) respondents strongly agreed (37 percent) or agreed (41.4 percent) the lack of agribusiness owner's technical skills affects digital technology use in Leribe and Thaba-Tseka districts. These findings are supported by a Chi-square test, where the results indicate ($X^2 = 552.532$; df=78 p=0.001) for this variable, which suggests the lack of agribusiness owners' technical skills affects digital technology use. There were very few respondents (8.7 percent and 5.1 percent) who disagreed with the statement.

This concurs with Musakwa (2009), who illustrates business owners lack technical skills; therefore, training in technical skills is important for agribusiness owners to develop their business. Ayim, Kassahun, Addison and Tekinerdogan (2022) further indicated farmers do not adopt technologies deemed too complicated to use, due to their lack of skills and knowledge.

Complementary theme: Digital skills and literacy

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-Tseka districts?

What are the important lessons you learned regarding the challenges in digital technology use?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba-Tseka districts of Lesotho.

Participants in the focus group were asked the following questions:

- What are the major challenges with digital technology use for your business? Do these challenges negatively impact the development of your business?
- What kind of skills do you have to use digital technology?
- How does your level of education affect your ability to use digital technology?
- What are the important lessons you learned regarding the challenges in digital technology use?

Key informants were asked the following question:

- What can be done to improve digital technology use?

Kumar *et al*. (2022) identified two digital literacy types among farmers. Information literacy: the ability to search, locate, assess and critically evaluate information found on the web and; on-shelf in library and branching literacy, which is the ability to successfully navigate in non-linear medium of digital space. According to the respondents, farmers and extension workers lack both information and branching literacy; in many instances they are unable to figure out how to use digital technology. As example, Ramaili stated, "*Last year we were given phones and laptops, but it did not reach the intended purpose because there was a mismatch between skills, technology and the system*."

Although younger agribusiness owners have shown diversification and different digital technology equipment adoption, participants in the focus groups comprised literate agribusiness owners with an academic background, in addition to respondents without an educational background, where at least a basic educational level is required for digital technology such as mobile phones. On the one hand, Thabo said they are unable to use mobile phones, because of their unfamiliarity with technology, "*My challenge is lack of skills as I was born before technology*", while Keketso, on the other hand, showed he has no skills that would enable him

to use digital technology, stating *"I do not have a skill."* Nevertheless, Tumelo, expressed: *"I am able to use digital technology, because I have basic technological skills from school"*.

The above is in keeping with results from a study by Asenso-Okyere and Mekonnen (2012), who determined literacy is one of the constraints to digital technology. This supports findings by Ahmed and Laurent (2009) that illiteracy can prevent many rural people from taking advantage of digital technologies, such as mobile phones, due to features and services that require a considerable amount of literacy. Moreover, Paudel, Mishra, Pandit, Larkin, Rejesus, and Velandia (2020) specified the educated and most experienced farmers are most likely to adopt technologies for profit reasons, because of literacy levels. Furthermore, Feder *et al.*(1985, cited in Shaibu *et al.*, 2018) noted education not only improves the decision-making process, but it also influences the understanding and application of technology.

Hem, Ty, Yoeu, Vong, Carpio, and Hoem (2025) argue, while low education levels among farmers can create obstacles towards digital technology adoption in agriculture, the relationship between education and literacy levels is intricate, as some studies indicate lower education levels correlate with increased perceived economic barriers to adopting smart farming technologies (Caffaro and Cavallo, 2019). However, research conducted by Uematsu and Mishra (2010) reveals higher education may impede adoption, particularly among small scale farmers.

Lefa and Thabo from both focus groups stated, in their experience with digital technology, the ability to read and write is a prerequisite. Worku (2010) affirms a low literacy rate hinders digital technology adoption, with Ajani (2014) additionally finding illiteracy cited as a major barrier to the use of digital technologies among small-scale farmers. Further to this, Mohlehli and Rantlo (2016) confirm most agribusiness managers have no tertiary education, implying they have little information concerning agribusiness, hence, leading to poor agribusiness growth.

Similarly, when asked regarding the important lessons in the challenges to digital technology use, and how their level of education aspects the use of digital technology, Thabo indicated "*Money and resources, because even if we have money we can't be able to use technology because of the skills,"* which shows digital skills are prerequisites for the application of technologies. Sello expressed "…*I learned how to use technology in school."* However, Kolobe

(2019) showed Basotho lack digital skills, because of their negative attitudes towards digital technologies such as mobile phones. It will, therefore, be near-impossible for some farmers and agribusiness owners to acquire the required skills to use technology.

Focus group participants, Teboho and Neo, declared their awareness of mobile phones; while Tebello declared knowledge of a sheep-shearing digital technology machine; however, because of their mobile illiteracy and lack of skills, they are unable to use these technology tools. Mobile literacy is defined by Dudeney, Hockly and Pegrum (2014) as the ability to navigate on the mobile internet−access, interpret and contribute information on a mobile device, as well as communicate on the internet. The findings of this study resemble those of Wyche and Steinfield (2016) and Nxumalo and Chauke (2025), who discovered mobile phones are complicated for farmers to use, because of the design, language and multiple sub-skills required in their use.

Thabo and Neo, furthermore, posited farmers must be digitally literate to transition from the traditional methods they use in agriculture. These respondents stated *"…People who produce a lot agriculturally do not rely on technology, they should just be assisted with primitive [and] easy, because they struggle due to lack of access to technology due to network and lack of skills…*" Lefa elaborated: "*It is affected because my desire is to be able to [work with] complicated technology such as drones, therefore, I'm unable to use them without school skills*." When asked regarding the skills they have to use digital technology, the majority respondents in the focus group showed they do not have digital technology skills. Teboho explained*: "I do not have enough skills and knowledge; therefore, I have to pay people who have skills to have work done like software and advertising*."

Chandra and Collins (2022) highlight many farmers in low-middle-income countries may not be illiterate; however, they have poor technical skills. Bauer, Brooks and Hampton (2020 explained digital skills as skills related to proficiency in a range of domains beyond simple technology and higher digital skills. This shows the demand for digital skills is increasing among farmers; identifying digital skills that can help farmers better understand the use of digital technologies should be a priority in Lesotho.

- **Section C Summary**

For the statement "Agribusiness owners/farmers lack experience in using digital technology" (C1), 64.0 percent respondents agreed or strongly agreed, while 22.9 percent disagreed and 13.1

percent were neutral. Similarly, “Lack of agribusiness owners’ technical skills affects the use of digital technology” (C2) showed even stronger agreement at 78.4 percent, with only 13.8 percent disagreement and 7.7 percent neutrality.

These findings indicate technical competency and hands-on experience are significant barriers, with technical skill deficits perceived as a slightly greater challenge than general experience. The low proportion of neutral responses suggests respondents hold clear views, emphasising the importance of capacity building and skills development to enhance digital adoption.

4.3.7 Section D: Market and Political/Infrastructure Challenges

Section D examines market, political, and infrastructure challenges that limit digital technology adoption in agribusinesses. It focuses on how restricted market access, political inefficiencies, and inadequate infrastructure contribute to these constraints.

Table 4.13: Restricted market access

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Lack of access to markets to market their products affect the use of digital technology by agribusiness owners	D1	6	1.5%	26	6.7%	22	5.7%	118	30.3%	217	55.8%	< 0.001

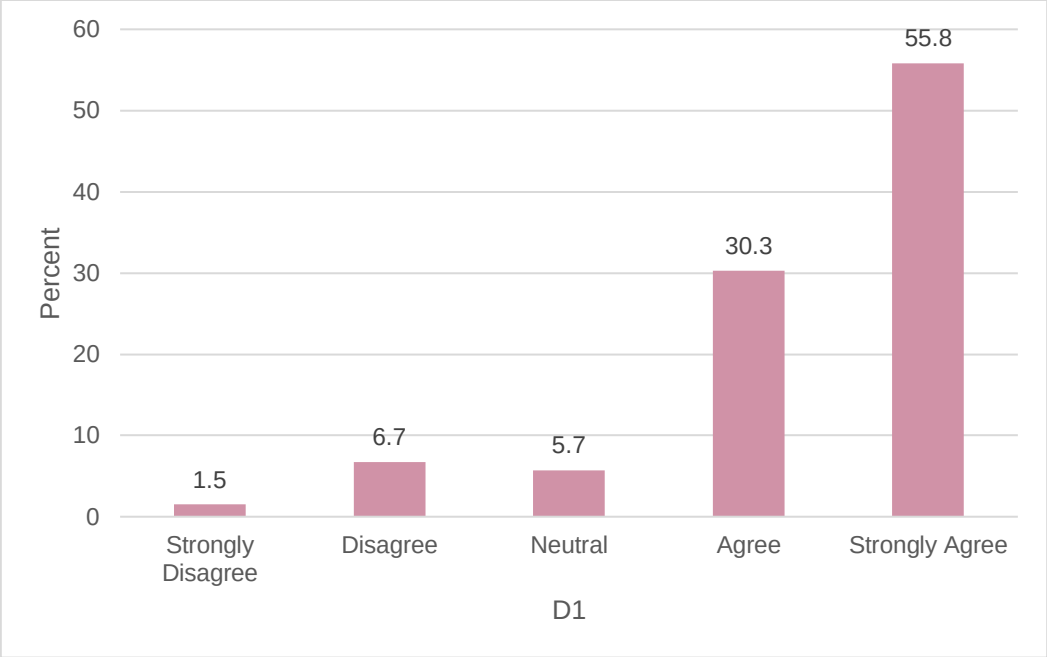


Figure 4.9: (D1) Lack of access to markets to market products affects digital technology use by agribusiness owners

As depicted (Table 4.13; Figure 4.9), the largest group of respondents (55.8 percent) strongly agreed, and 30.3 percent agreed lack of access to technology affects their access to markets to market their products. These findings are supported by a Chi-square test, where results indicated ($X^{2=}$552.532; df=78 P=0.001) for this variable, which means lack of access by farmers to markets to market their products affects digital technology use by agribusiness owners. An equal number (5.7 percent) respondents agreed and indicated neutral, respectively, while 1.5 percent strongly disagreed.

According to Dana *et al.* (2022), access to markets affect digital technology use by businesses; when businesses have access to markets, they turn a profit and perform more successfully, to where they can be more competitive and innovative. As a result, poorly functioning input and output markets erode the profitability of technology to the farmer (Jack, 2013).

4.5.2 Complementary theme: Marketing /advertising and buying

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-Tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba-Tseka districts of Lesotho.

To provide an analysis of how the lack of agribusiness access to digital technology has impacted agribusiness development in the Leribe and Thaba-Tseka districts, participants in the focus group were asked the following questions:

- How do you normally use digital technology for your business?
- How does the lack of access affect the development of your business and what are the past and present efforts by the ministry to promote digital technology use in agribusiness?

Key informants were asked the following question:

- What are the previous and new efforts by the government for digital technology use by agribusinesses?

Participants were found to have adopted digital technology in their agribusinesses to buy inputs online. Lerata expressed: "*I use phone to search for places to buy fertilisers,"* similarly, Mahapang stated, *"Phone to buy seeds and livestock".* Nevertheless, sometimes lack of mobile services create a problem, preventing farmers and agribusiness owners from connecting with their customers, due to poor signal. Lack of access to digital technology marketing further affects farmers' profits, forcing them to sell low to make a profit, which also impacts cash deposits. Second, participants in a focus group indicated they use digital technology for marketing their products on Facebook and WhatsApp using mobile phones, Itumeleng stated*: "I use phone to advertise, Lesotho is still backward with technology"*. Mosa, also stated *"...for marketing, especially WhatsApp and Facebook.*"

These findings concur with Schnebelin (2022), who mentioned digital technology enables access to information, through the use of digital platforms such as farming websites and social media networks, for example, YouTube and Facebook, which impacts production. When farmers, particularly in rural areas, have access to information, specifically through the use of mobile phones, they are in a better position to increase their incomes and livelihoods (Piabuo, Yakan, Puatwoe, Nonzienwo and Mamboh, 2020).

Nonetheless, Yusuf (2021) indicates factors such as infrastructure and expensive technology costs are barriers for farmers to access agricultural information. Senate expressed that social media use for agribusiness limits market access, she stated it *"limits markets because only immediate contacts get to see your advertised products because not everyone has access to technology / digital platforms."* However, literature argues social media marketers have various options to attract a vast majority of customers on different platforms (Shiratina, Rachbini, and Affini, 2024).

Respondents showed lack of access to digital technology inhibits their marketing of agricultural products, where Mosa, Itumeleng and Palesa pointed out: *"I cannot afford to be on social media /internet all the time therefore I often miss out requests for sales…" "…Lack of access means our customers can't access us, and we struggle to advertise*…" "*…Not having a phone that is able to use to connect to the internet."*

The empirical findings are consistent with the findings of Inegbedion, Inegbedion, Asaleye, Obadiaru, and Asamu (2020), who illustrated social media is very useful in agricultural marketing. The outcomes of the empirical findings and literature review reveal social media promotes agribusinesses through efficiency in information and marketing. Therefore, it is evident from the theme and the literature that social media enables agribusiness to promote themselves to reach their customers, regardless of their sizes. Similarly, Itumeleng and Mosa revealed they "*use digital technology for access to information and production*"; a lack of access to digital technology thus affects the marketing of their businesses, as well as access to information.

The findings are confirmed by Dörr and Nachtmann (2022), who aver digital technologies are tailored for production in agriculture, which is in line with Kassie *et al.* (2011) in their assertion that agricultural innovations also play a significant role in lowering production costs. Furthermore, digital technology use in agribusiness is emphasised to increase productivity for businesses (Basnet and Bang, 2018; Deichmann *et al.,* 2016, cited in Mikhailov *et al.*, 2022).

A study conducted by Obidike (2011), nonetheless reveals access to agricultural information is a result of poor signal for radio and television and the non-availability of electricity, which means lack of access to basic agricultural information results in limited knowledge. This constrains farmers in the use of modern technology, resulting in poor crop and livestock

production. Adio, Abu, Yusuf and Nansoh (2016) highlight agricultural information implies information changed into significant and helpful settings or structures, to ensure a viable dynamic in agribusiness or cultivating-related activities.

Concerning lessons learned from the challenges in digital technology use, participants stated they have learned marketing is the most direct benefit of digital technology access and adoption in agribusiness, while through advertising, the objective is to reach prospective customers and influence their awareness, attitudes and buying behaviour. The findings concur with Lashgarara, Mohammadi and Najafabadi (2011), who established digital technology has the capabilities to improve the marketing of agricultural productions, which is confirmed by Mbiku (2013). Furthermore, Tsekouropoulos, Koliouska and Andreopoulou (2013) illustrate agribusiness is investigating technology for marketing, through the use of the internet.

Uzir, Hamid and Latiff (2021) noted digital media is an excellent way to engage and interact with the target audience; however, according to Prayoga and Raya (2019), the main problem involves consumer culture, because the interest in buying and selling agricultural products online is not as high as for other products. Palo expressed: *"The ministry of agriculture through marketing department is about to implement an online platform called "Mmaraka" for marketing of products, where the farmers will register on the platform and upload their products for customers"*. Therefore, digital platforms should be used by the government and private sector, such as banks, for agribusiness promotion through discussion of businesses, linking farmers with markets, and connecting farmers from all the districts of Lesotho.

Table 4.14: Lack of professionalism in political offices affects digital technology use by agribusiness owners

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Lack of professionalism in political offices affects the use of	D2	12	3.1%	35	9.0%	55	14.1%	127	32.6%	160	41.1%	< 0.001

digital technology by agribusiness owners												

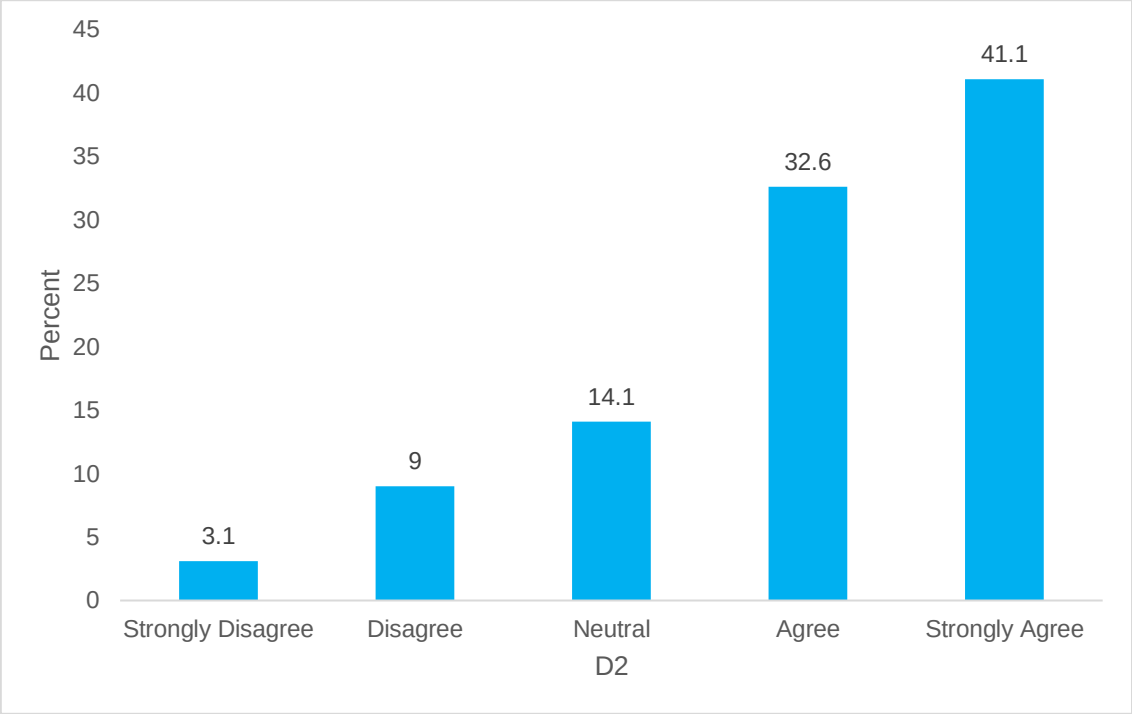


Figure 4.10: (D2) Lack of professionalism in political offices affects digital technology use by agribusiness owners

As depicted (Table 4.14 and Figure 4.10), the majority (41.1 percent) respondents strongly agreed, and 32.6 percent agreed the lack of professionalism in political offices affects digital technology use by agribusiness owners. These findings are supported by a Chi-square test, where the results indicated ($X^{2=}$552.532; df= 78 P=0.001) for this variable, showing the lack of professionalism in political offices affects digital technology use by agribusiness owners. The least number (nine percent) disagreed, and 3.1 percent strongly disagreed, while a significant number (14.1 percent) remained neutral.

This is consistent with the Action Aid International (2011) briefing, as cited in Smidt and Jokonya (2022), which highlights that government failure to implement digital adoption programmes for small-scale farmers is a result of insufficient skills in responsible ministries. Therefore, the lack of professionalism in political offices is an important factor in the lack of digital technology use for agribusiness development in Lesotho.

Complementary theme: Government initiatives

Research question: What are the past and present efforts and strategies in digital technology use for agribusiness development in Lesotho?

Research objective: To investigate past and present efforts and strategies in digital technology use for agribusiness development in Lesotho and their impact on agribusiness development.

Key informants were asked the following questions:

- What role does the government play in ensuring digital technology use in agribusiness?
- How has the government, through the ministry, shown executive understanding of digital technology channels in agribusiness?

To investigate government strategies influenced by policies to facilitate agribusiness development, the following question was asked: How has the government, through the ministry, shown executive understanding of digital technology channels in agribusiness? In responding, Tefo stated: "*The ministry is trying to expand the digital knowledge to the decentralised officers in the districts, but it is taking so long",* while Liteboho clarified: "*The ministry of agriculture, in collaboration with United Nations Development Programme, has introduced a programme to assist agribusiness in Mohaleshoek district, not Leribe and Thaba–Tseka district".*

Ashley and Gyekye (2020) highlight the performance of agribusinesses is dependent on the effectiveness of their growth and strategies derived from the governance structure. However, Rodrigues and Rodriquez (2013) established digital strategies in most developing countries focus exclusively on connectivity and do not include any vision for addressing barriers and constraints in a coordinated manner.

Focus group respondent, Liteboho, expanded on this, stating: *"We advertise our initiatives for agribusiness development through social media, especially for the youth"*. Kuira (2014) indicated agricultural institutions are utilising digital technology applications to disseminate agricultural information, whereas Adejo and Opeyemi (2019) highlight social media is the most effective tool for disseminating agricultural information among farmers. Governments, through their ministries, are also affording importance to social media (Thakur and Chander, 2018). Tefo agreed and stated: "*The ministry will soon introduce an online marketing app for the farmers*

where they will register and sell their products online", he further expressed that *"the ministry, together with Lesotho Revenue authority (LRA), is yet to introduce an online registration platform for the registration of agribusinesses."*

According to Akkoyunlu (2015), one factor that contributes to successful utilisation of digital technologies /innovations in agricultural policies, is that it encourages firms and individuals to adopt new technology and to innovate. Wu (2022) adds the perceived ease, positive impact, and usefulness of technology depend on the degree of promotion in the agricultural technology sector.

When asked regarding the government's role in ensuring digital technology use for agribusiness development, the majority respondents in the focus groups agreed the government does not play a significant role in ensuring and promoting the use of digital technologies. In the same vein, Pule added, "*The ministry of small businesses is focused only on non-agricultural businesses*".

Hartwich and Jansen (2007) observed many governments in developing countries try to foster agricultural development and innovation; however, governments sometimes find it difficult to design effective interventions and challenging to formulate policy measures that enhance the functioning and performance of complex agricultural systems. Furthermore, despite some countries' progress with strategies and initiatives for digital technology use, Rodrigues and Rodriguez (2013) found gaps in information, technical and economic resources remain, which delay the digital agenda implementation. Therefore, governments need to introduce several initiatives to assist agribusinesses and various domains in agriculture in digital technology use.

Table 4.15: Lack of infrastructure and electricity supply affects digital technology use

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Lack of infrastructure and electricity supply affects the use of digital technology	D3	27	6.9%	36	9.3%	20	5.1%	157	40.4%	149	38.3%	< 0.001

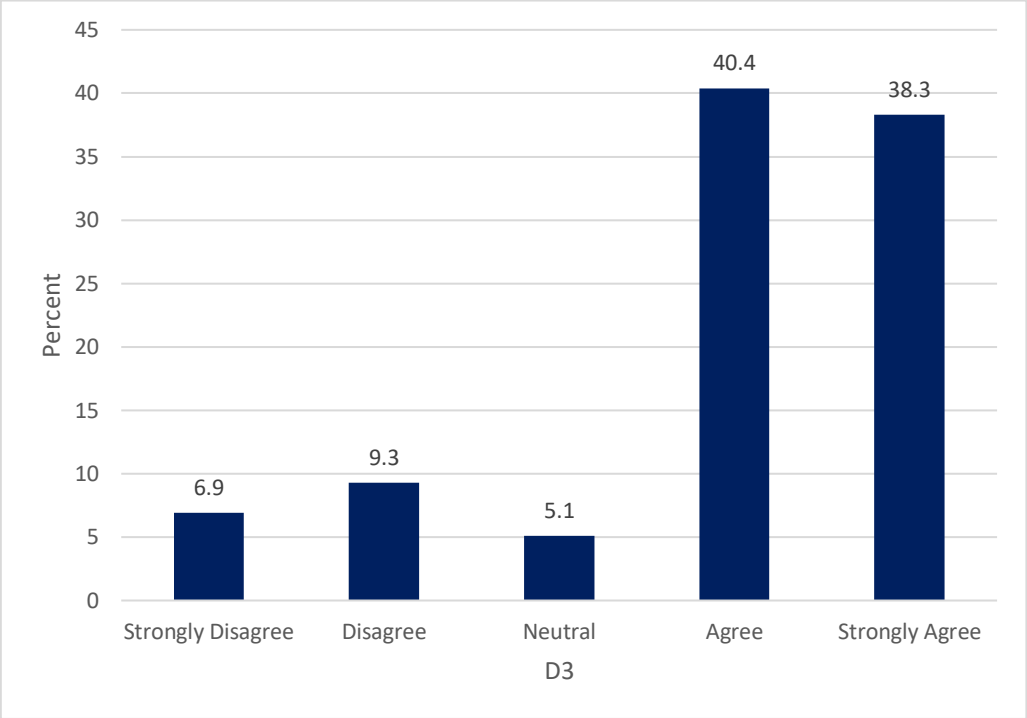


Figure 4.11: (D3) Lack of infrastructure and electricity supply affects the use of digital technology

As depicted (Table 4.15 and Figure 4.11), the vast majority (38.3 percent) respondents strongly agreed, and 40.4 percent agreed the lack of infrastructure and electricity supply affects digital technology use. These findings are supported by a Chi-square test, showing (X^2=552.532; df=78 p=0.001) for this variable. This indicates lack of infrastructure and electricity supply affects the use of digital technology for agribusiness development. A smaller number (5.1 percent) remained neutral, while 9.3 percent disagreed and only 6.9 percent strongly disagreed.

This is supported by the literature, as Hem *et al.* (2025) show the absence of critical infrastructure, such as electricity and internet connectivity, may hinder farmers' adoption of digital technologies, such as mobile phones and other precision agriculture tools. Therefore, digital technology use is constrained through a lack/fluctuation/inadequate electricity supply (Musakwa, 2009). Paul, Upadhyay, and Dwivedi, (2020) confirm poor infrastructure affects digitisation. Furthermore, Muhumuza, Zacharopoulos, Mondol, Smyth and Pugsley (2018, cited in Ali, 2021) indicate rural farmers in developing countries are often unable to enjoy the benefits of their agricultural business, because they lack adequate technology infrastructure to

communicate with their customers**.** Therefore, Goedde, Katz and Menard (2020) suggest infrastructure must be developed to enable technology use in farming.

Complementary theme: Infrastructure

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-Tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

The respondents in the focus group were asked:

- How does the location of your business affect the use of digital technology in your area?
- What can be done to improve the use of digital technology in your business?
- What are the important lessons you learned regarding the challenges in digital technology use?

In responding to the questions, participants in both focus groups in the two districts, Leribe and Thaba-Tseka, stated digital technology adoption failure in agribusiness is as a result of poor infrastructure in the rural areas. The responses from the focus group highlighted the lack of electricity infrastructure is a challenge in the use of digital technologies. This view was expressed by Thabo who mentioned: *"Money and poor infrastructure limit our potential to use digital technology."*

This is consistent with the assertion by Sihlobo (2021) that poor roads and unreliable electricity supply directly affect the profitability and sustainability of farming operations, particularly agribusinesses. Paramitha, Supriyadi and Zuber (2018a, b) explain agribusinesses are directly affected by electricity availability, because electronic media and the internet, commonly used for technologies, depend on electricity availability. In this regard, Musa, Githeko, and El-Siddig (2013) highlight electricity infrastructure as a key hurdle to agricultural information dissemination among farmers. According to Taele *et al.* (2012), the majority of Lesotho's population, primarily living in rural areas, lacks some basic facilities due to insufficient access to electricity, which influences the ability of poor people to escape poverty.

Naidoo and Loots (2020) reported most rural areas in Lesotho, where 82 percent are farmers, has the lowest access rate to electricity. Literature supports participant responses, where they highlight the lack of electricity limits their access to digital technology. When asked how the location of their businesses affects digital technology use, three participants, Nomvula, Ramatla and Tesello, pointed out the lack of electricity and network. Furthermore, when responding to the question "What limits your access to digital technology and how does that affect your business?", In response to this question, Mampho highlighted: "*Living in a place where we struggle with electricity and network."*

When asked "How does the location of your business affect the use of digital technology?", Mohapi expressed*:* "*Electricity, where I'm located there is no electricity",* additionally, Musa highlighted: "*People do not have proper electricity and network."* This aligns with the literature, which shows famers' use of agricultural digital platforms is hampered by lack of infrastructure, specifically lack of electricity or power outages in the rural areas (Mbaya, Tihanyi, Karaan and Van Rooyen 2011).

Baloyi (2010) shows infrastructure on and off the farm is highly significant for market production, however, compared to urban areas, the rural areas are notably lacking in physical infrastructure to produce for the market (Tadele and Gella, 2012). Consequently, Moseley (2003, as cited in Denis, 2018) determines infrastructure influences agribusiness growth to a great extent, as a result, inadequate/intermittent electricity supply, among other challenges, hinders farmers' effective digital technology use, particularly mobile phones for agribusiness. Furthermore, the FAO and ITU (2022) showed inadequate access to electricity in rural areas also contributes significantly to low digital technology skills, therefore, government and other stakeholders should provide adequate infrastructural facilities, particularly electricity.

In addition, when focus group participants were asked: What limits your access to digital technology and how does that affect your business? Thabo said the following, "*Money and poor infrastructure".* This theme shows infrastructure is a pressing need for farmers to be able to use digital technology because digital connect ivy depends on infrastructure, most importantly electricity, it further shows that poor infrastructure limits their connectivity to markets and communication

- **Section D Summary**

The results indicate a strong agreement pattern across all three statements. “Lack of access to markets to market their products” (D1) showed the highest agreement, with 86.1 percent respondents agreeing or strongly agreeing, and only 8.2 percent expressing disagreement. “Lack of professionalism in political offices” (D2) had 73.7 percent agreement, while 12.1 percent disagreed, and 14.1 percent remained neutral. Similarly, “Lack of infrastructure and electricity supply” (D3) reflected 78.7 percent agreement, 16.2 percent disagreement, and 5.1 percent neutrality.

These findings highlight that market accessibility is perceived as the most critical barrier, followed closely by infrastructure limitations. Political inefficiencies are also recognised as significant but slightly less pressing. The consistently low proportion of neutral responses reinforces that respondents hold firm opinions, underlining the need for structural and policy interventions to improve digital adoption in rural agribusiness environments.

4.3.8 Section E: Connectivity and Social Influence

The study is interested in identifying different challenges and barriers in agribusinesses digital technology. Section E thus evaluates the influence of connectivity and social factors on digital technology adoption in agribusinesses, focusing on broadband availability and the role of social influence.

Table 4.16: Lack of broadband connectivity affects the use of digital technologies by agribusiness owners

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Lack of broadband connectivity affects the use of digital technologies by agribusiness owners	E1	20	5.1%	45	11.6%	15	5.1%	157	3.9%	158	40.6%	< 0.001

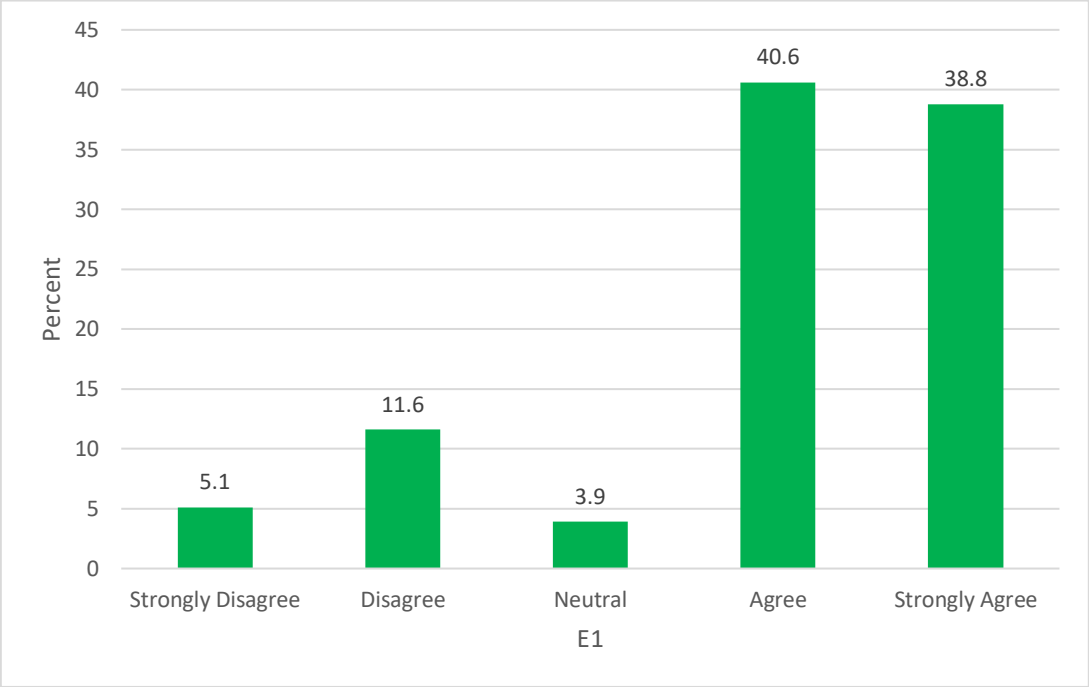


Figure 4.12: (E1) Lack of broadband connectivity affects the use of digital technologies by agribusiness owners

As depicted (Table 4.16 and Figure 4.12) the vast majority respondents (40.6 percent) agreed, while 38 percent strongly agreed lack of broadband connectivity affects the use of digital technologies by agribusiness owners. Ayim *et al.* (2022) show the reality where some farmers fail to benefit from digital technologies, with reasons for this that include a lack of broadband connectivity. These findings are supported by a Chi-square test, conducted to determine whether lack of broadband connectivity affects the use of digital technologies by agribusiness owners. These results indicated ($X^{2=}552.532$ df= 78; P=0.001) for this variable, which shows lack of broadband connectivity affects the use of digital technologies by agribusiness owners. Furthermore, 11.6 percent respondents disagreed, with the least respondent number (3.9 percent) indicating neutral, while only 5.1 percent strongly disagreed.

4.5.1 Complementary theme: Poor network connection

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

To provide an analysis of how the various challenges encountered in digital technology use and lack of access to technology affect agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked following questions:

- How has the location of your business affected the use of digital technology?
- What are the major challenges with digital technology use for your business?
- Do these challenges negatively impact the development of your business?
- What limits your access to digital technology and how does that affect your business?
- What can be done to improve digital technology use for your business?

Key informants were asked the following question:

- What are the challenges in digital technology use by the ministry?

When responding to the questions, Lineo, Tefo, and Selloane indicated the phone network is a challenge encountered in digital technology use, due to the location of their agribusinesses; they stated: *"A lot of people in my area do not use mobile phones due to poor network…" "...Poor network in my area, the last thing you think about when you live in a place that has no network is technology…", "...my project is based in the highlands of Lesotho, we still experience poor network coverage which affects our businesses"*

Similarly, Rorisang and Nthabiseng and revealed poor network has a negative impact on their interaction with farmers and agribusinesses: *"People who do not have a proper access to network do not see our products advertised online resulting in poor sales…" "...Our sales are not good due to lack of access to network*." This echoes findings by Hinson, Lensink, and Mueller (2019), emphasising many countries in SSA, particularly in the rural areas that host most agribusinesses, face the challenge of distance to networks. Mdoda and Mdiya (2022) concur, adding farmers are unable to use digital technology because of network challenges.

These findings are similar to those of Coggins, McCampbell, Sharma, Sharma, Haefele, Karki, and Brown (2022), who discovered when mobile networks are not available, not always fast, reliable or affordable, there is a limitation in digital agriculture. However, according to the UNDP (2020), there is 98.5 percent network coverage in Lesotho, making phone access the easiest. With regard to the challenges and their effects that influence technology use in Leribe and Thaba-tseka districts, Lebamang and Teselo also expressed that poor network affects agricultural service delivery, *"...Poor network sometimes it disappears, and GPS runs out batteries…", "...Network and electricity to use technology."* The findings concur with those of Oladele (2015), indicating network is a challenge for extension services in many African countries.

The respondents in the focus groups noted they use mobile phones as a type of digital technology; however, they are unable to properly access the internet for social media use and Google in marketing their products and for access to information, because of poor network coverage. Furthermore, when asked what can be done to improve digital technology use for agribusiness development, Thamae highlighted *"Improve network connection especially in the rural areas and provide electricity in the rural areas".*

This corresponds with Ruiz- Martínez and Esparcia (2020), who highlight the lack of internet access in most rural areas has become a challenge worldwide, attributed to the growing population of communication network users worldwide (Siaw, Jiang, Twumasi and Agbenyo, 2020); therefore, network operators establish network infrastructure in urban centres, leaving rural areas underserved. This means the government and private sector need to build sustainable network capacity in the rural areas for the use of digital technologies that will allow agribusinesses to explore business opportunities through technology use.

When asked: What are the major challenges with the use of digital technology for your business and how do these challenges have a negative impact on the development of your business? Lineo responded, *"Sometimes I buy data for my business and not use it all due to poor network".* The above is consistent with Pribe, Brooks, Hampton, and Bauer (2020), who show the gaps in broadband access impact negatively on rural economic activities of the communities. Mandioma (2007) further explained business in rural areas as a high-risk investment, because telecommunications companies continue to invest most in areas of high business, leaving rural

areas disadvantaged, with little or no telecommunications network. The author added the absence of electricity complicates matters, as telecommunication networks require an energy source to function. This theme shows that poor network is a challenge in the use of digital technology especially in the rural areas where there is np broadband connectivity, therefore this is a concern for farmers because it affects their businesses negatively.

Table 4.17: Social influence affects digital technology use by agribusiness owners

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree		Chi Square p-value
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Social influence affects the use of digital technologies by agribusiness owners	E2	21	5.4%	51	13.16%	35	9.0%	154	39.6%	128	32.9 %	< 0.001

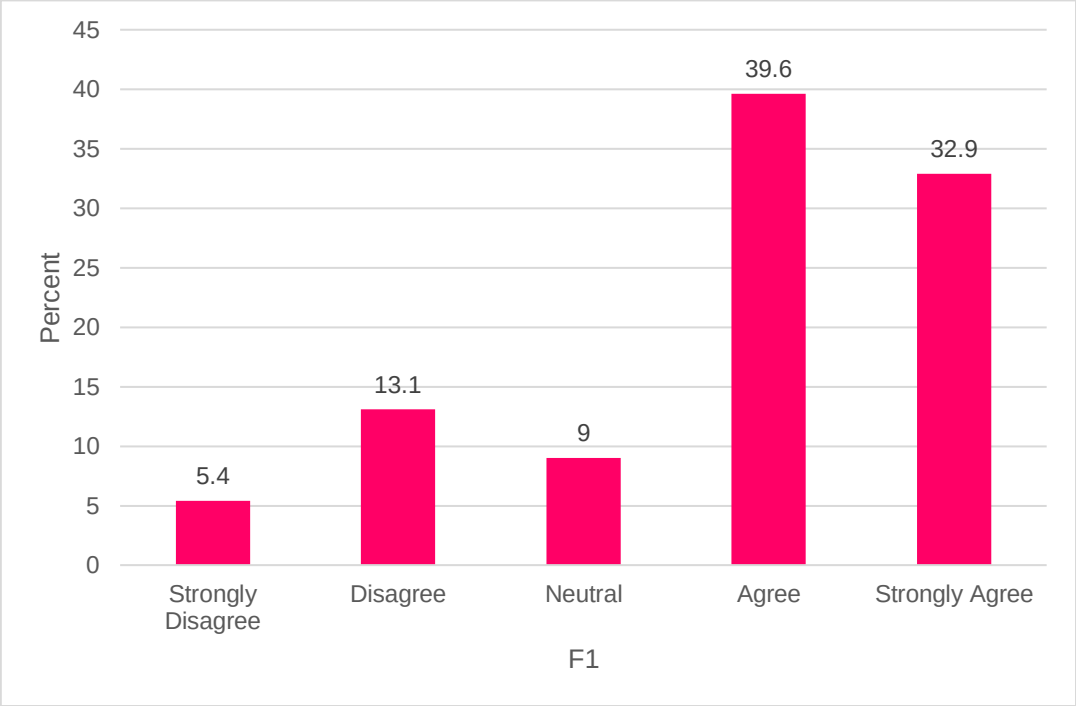


Figure 4.13: (F1) Social influence affects digital technology use by agribusiness owners

Social influence is a social factor that Mazman, Usluel and Cevik (2009), define as an external pressure that influences individuals' decisions to make use of an innovation, while being informed regarding it. Table 4.17 and Figure 4.13 show the largest respondent group (39.6 percent) agreed, while 32.9 percent strongly agreed social influence affects their decision to use digital technologies. The findings are supported by a Chi-square test, conducted to determine whether social influence affects the use of digital technologies by agribusiness owners. These results indicated ($X^{2=}$552.532=78 P=0.001) for this variable, illustrating that social influence affects the use of digital technologies by agribusiness owners. A significant number (13.1 percent) disagreed, while 5.4 percent respondents strongly disagreed, and 10.9 percent remained neutral.

The findings correspond with Ayim *et al.*, (2022), who emphasise farmers' decisions to adopt digital technology are significantly influenced by other farmers, their contacts and agricultural extension officers. Additionally, Wand and Dang (2023) posited that social influence is a main factor determining the decision to implement digital technology by farmers. Similarly, Díaz, Settele, Brondízio, Ngo, Guèze and Agard (2019, cited in Albizua, Bennett, Larocque, Krause, and Pascual 2021) discovered farmers in a privileged position of power influence other farmers, therefore, Bayer (2018, cited in Smidt and Jokonya, 2022) highlighted when farmers see these tools as relevant and trustworthy, the adoption of digital technologies is more likely to succeed**.**

- **Section E Summary**

The responses reveal a notable trend toward agreement for "Lack of broadband connectivity" (E1), as 79.4 percent respondents agreed or strongly agreed, with only 16.7 percent expressing disagreement and 3.9 percent remaining neutral. "Social influence" (E2) demonstrated a slightly lower level of agreement at 72.5 percent, with 18.5 percent disagreement and nine percent neutrality. These results indicate connectivity challenges are a dominant barrier to digital adoption, while social influence also plays a significant role, though to a slightly lesser extent. The low proportion neutral responses reflect that respondents largely have well-defined views on the importance of connectivity and peer influence in shaping digital technology uptake in agribusiness settings.

4.4 STUDY CONCLUSIONS

This study investigated the key factors influencing digital technology adoption among agribusinesses, with a focus on identifying locational, financial, experiential, and infrastructural, as well as social barriers. Using a structured questionnaire and a combination of descriptive statistics, factor analysis, and SEM via SmartPLS 4, the study produced several meaningful conclusions:

1. Digital Technology Adoption is constrained by Multiple Interconnected Barriers
    - o Five core dimensions were identified:
        - A. Location and Financial Constraints,
        - B. Government and Financial Support Deficiency,
        - C. Farmer Experience and Technical Skills,
        - D. Market and Political/Infrastructure Challenges, and
        - E. Connectivity and Social Influence.
    - o High levels of agreement across all items indicate agribusiness owners clearly recognise these challenges, with costs, infrastructure, and skills emerging as the most critical barriers.
2. Government Support and Financial Deficiency are widely perceived Barriers
    - o Respondents strongly agreed limited financial support, inadequate training, and lack of access to credit significantly hinder digital adoption.
    - o PLS regression results showed government and financial support (B) did not significantly predict connectivity and social influence (E), suggesting other factors more directly influence digital uptake.
3. Farmer Skills and Market/Infrastructure Factors Are Strong Predictors
    - o Farmer Experience and Technical Skills (C) and Market and Political/Infrastructure Challenges (D) were significant predictors of digital technology adoption, with D having the strongest effect ($\beta = 0.178$, $p = 0.003$).
    - o This implies improving infrastructure, market access, and political professionalism, alongside upskilling farmers, will drive the most meaningful improvements in adoption.
4. Connectivity and Social Influence depend more on Structural and Skill Factors

- Weak but positive correlations across the constructs (r = 0.193–0.320) indicate the barriers are related but not redundant, supporting the need for multifaceted interventions.
- R^2 = 0.104 demonstrates while the predictors collectively explain 10.4 percent variance in connectivity and social influence, digital adoption is influenced by additional unmeasured factors, such as technology availability, cultural practices, and market incentives.

5. Model Adequacy and Reliability
   - the five-factor model demonstrated good fit ($\chi^2/df = 1.85$; RMSEA = 0.047; CFI = 0.949) and adequate discriminant validity, even though Cronbach's alpha and composite reliabilities were modest due to the small number of items per construct.
   - the model provides a robust exploratory framework, forming a strong basis for further confirmatory research and refinement of measurement instruments.

Practical Implications:

- Policy and Infrastructure: Improving market access, rural infrastructure, and electricity supply is critical for enabling digital adoption.
- Farmer Training: Focused capacity-building initiatives to enhance technical and digital skills will have a direct, positive effect on adoption.
- Targeted Government Support: While perceived as necessary, financial interventions alone are insufficient without parallel improvements in infrastructure and skills.
- Integrated Approach: Digital technology adoption requires coordinated action across locational, infrastructural, experiential, and social domains, rather than isolated efforts.

4.5 QUALITATIVE DATA THEMES THAT DO NOT COMPLEMENT QUANTITATIVE RESULTS

4.5.1 Theme one: Digital magazines

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Participants in the focus group and key informants were asked the following questions:

- What can be done to improve the use of digital technologies for your business?
- In your opinion, can digital technology promote agribusiness development?

Media could serve as a suitable medium of dissemination of farm information and latest technical development (Malik, 2000), as the farmers can easily understand the operations, technology and instruction through media. A digital newspaper is the online version of a newspaper, either as a stand-alone publication or as the online version of a printed periodical (Süllü, 2019). The mass media has developed into an effective communication method in the world today and has been widely recognised as a catalyst for the development process (Khan, Siddiqui, Khan, Ullah, Ismail, Ali, Ahmad 2020). In addition, although newspapers are important for providing the public with vital information, concerns remain around the world that this medium will prioritise political, entertainment and advertising over development issues such as agriculture (Narayana and Kumar, 2009).

Among the mass media, newspapers and farm magazines are commonly used and known by the respondents. When asked whether digital technology can promote agribusiness development, Mosa stated, *"Yes, there is a digital newspaper called seahlolo that people use to market their products."* Furthermore, media outlets provide farmers with access to professional viewpoints, guidance and solutions to issues in agriculture, helping them to address obstacles more skilfully (Darji and Yada, 2024). Nonetheless, Appiah, Tham-Agyekum, Nimoh, Bakang, and Ankuyi (2024)) showed farmers need to be trained for mass media use. This mirrors the response by Thabiso when he stated, "*Farmers need to be trained to use digital magazines, and their information needs to be out there."* Additionally, Mamosa explained, *"the digital magazines are there but they do not approach SMES and farmers."*

4.5.2 Theme two: Climate change

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked following questions:

- What are the major challenges with the use of digital technology for your business?
- Do these challenges have a negative impact on the development of your business?

In Lesotho, climate determines the agricultural activities through seasons of the year due to favourable conditions needed to grow crops (Mokone, 2004), therefore, should agricultural activities such as sowing seeds be determined by climate change, extreme weather changes affect agribusinesses in Lesotho, because it affects production. As explained by Nuraddin (2025), climate change has numerous impacts on agriculture, many of which make it more difficult to ensure food security in agriculture.

In the SSA region it not only affects food security but is also closely linked to food accessibility and utilisation (Shi *et al*., 2024). The changing climate is characterised by more frequent and severe extreme events, such as heatwaves, droughts, and excessive rainfall. Bolster, Mitchell, Kitts, Campbell, Cosh, Farrigan, Franzluebbers, Hoover, Jin, Peck, Schmer and Smith (2023) highlight that these climatic changes are affecting all food supply chain aspects, including production, storage, processing, and distribution, as well as retail, and sales, leading to less income for farmers and less participation in markets.

This supports respondents who showed climate change affects their production, which impacts their ability to adopt technology. Letsema pointed out that, "*due to climate change, floods sweep away my produce as a result, my sales drop and I'm unable to purchase technology."* In addition, Tlotliso expressed, "*natural disasters such as floods in our area lead to poor harvest and less profits*." Literature further shows weather changes such as extreme rain rate increases attenuations of signal strength (Osahenvemwen and Omatahunde 2018). This is in line with Selimo, who expressed *"with new changes in climate, we usually go for months without network*." Climate change is thus shown to affect digital technology use by farmers in Lesotho. However, Shoaib (2024) shows, generally, the agricultural sector continues to grapple with

significant supply chain disruptions in 2025 that pose severe challenges to farming operations and profitability.

Kapoor *et al.* (2024) suggest modern agricultural extension services must equip farmers with strategies to adapt to these changes and mitigate their impact on crops and livestock, as climate change has introduced new challenges to agriculture, including erratic weather patterns, increased pest pressures, and water scarcity. These strategies, as Kapoor *et al.* (2024) suggested, include digital technology use such as smart sensors. Fuke (2021) describes these sensors as a first-class solution to the climate change problem, because it is a technology that enables farmers to monitor weather conditions, plant condition, water and soil moisture levels and to prevent crop and plant diseases, ensure smart farming and sustainable agriculture. Additionally, the IoT can also be applied for resource use monitoring and management, simultaneously providing early warnings for climate risks (Nuraddin 2025). This theme shows climate change is manageable through digital technology use; therefore, famers need to be educated on climate change, its impacts, climate smart agriculture, and how digital technology can be used to navigate climate change challenges.

4.5.3 Theme three: Data

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-Tseka districts?

Objective: To identify the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked following questions:

- What limits your access to digital technology and how does that affect your business?
- What are the major challenges with digital technology use for your business? Do these challenges have a negative impact on the development of your business?
- What is the size of your agribusiness and, how does the size of your agribusiness affect the use of digital technology?

Key informants were asked the following questions:

- What digital technology strategies are used to promote the development of agribusiness by the ministry?
- What are the major challenges with digital technology use for your business? Do these challenges have a negative impact on the development of your business?

High internet data cost is a challenge affecting the application of digital technologies in agricultural extension (Nyarko and Kozári, 2021). Digital technology use requires data; however, costs related to accessing the internet are a major obstacle where digital technology use by farmers is concerned. Farmers and extension workers have acknowledged the challenges they face while adopting new technologies, including availability and affordability.

When the technology is expensive, most farmers ae unable to afford data, with Mpoetsi and Stehuntsa indicating they cannot afford data: *"We lack resources such as data, sometimes I can't afford to buy it because we submit timesheet things midmonth without financial support..."* "…*The ministry buys us tablets but no data - that we struggle with."* On the one hand, Lipalesa showed his agribusiness allows him to buy data, which he uses for the marketing of his business. Lipalesa expressed, "*my business is small, but I can afford to buy data*." Mamosa highlighted: *"The ministry buys us tablets but no data".* On the other hand, for farmers who can afford data, the problem is poor internet connection, as Mahao expressed, *"sometimes I buy data for my business and not use it all."*

From this theme, it can be deduced that extension agents and farmers have the willingness to adopt digital technology and acknowledge the benefits to their use. Reeka (2018) confirms the findings that high data costs to access the internet on a mobile prohibits farmers' digital technology use.

4.5.4 Theme four: Radio

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-Tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked following questions:

- What are the major challenges with digital technology use for your business?
- Do these challenges negatively impact the development of your business?

Key informants were asked the following question:

- What can be done to improve the use of digital technologies for your business?

Farmers use other devices such as radio to receive information (Oladele, Gitika, Ngari, Shimeles, Mamo, Aregawi, Braimoh, and Olorunfem 2018). Although classified as traditional, Darji and Yadav (2024) show that radio still plays a significant role in rural areas. Where access to digital technology may be limited, it is a source of information and educational programmes, customised to local languages and cultures, thus enhancing understanding, particularly for rural agribusinesses, with the majority business owners and farmers being illiterate (Mtega, 2021). This is in line with Thibello, who stated, "*We cannot reach everyone due to the culture of people we serve; some do not have these technologies that we are using, however, some access radio for the programmes we do."*

In Lesotho, farm broadcasts covering issues related to organo-mineral fertiliser, bio fertiliser, and manure are "The Ultimate Breakfast Reloaded" and "Re bitsa lihoai – farmers call" on Lesotho National Broadcasting Services and are a major component of agricultural extension and advisory services (Nthama and Oladele, 2024). A study by Tenney and Trail (1985) showed radio stations are accessible, and famers preferred to listen to agricultural news and information interesting to them. However, Palo suggested that, for extension services, the Lesotho government needs to ensure radio stations are available nationwide for the dissemination of information: *"... the radio stations, must be available nationwide because some farmers still do not have access to radio in these years."*

Research conducted by Nthama and Oladele (2024) showed farmers recorded a high quantity of harvest when radio was used as a source of information. This indicates that other associated services and inputs might be required to effectively translate information and its utility to increase harvest, from production and productivity; without access to radio, farmers expressed a low record of sales. Mafa expressed: *"The challenge is to advertise because the community radio is closed*." Radio has been a significant tool in agriculture, providing farmers with vital

information and support, particularly in rural and remote areas. Its widespread reach, accessibility and ability to deliver timely information make radio an effective medium for agricultural communication (Darji and Yadav, 2024).

4.5.5 Theme five: Mobile Phones

Research objective: To investigate past and present efforts and strategies in digital technology use for agribusiness development in Lesotho and their impact on agribusiness development.

Participants in the focus group were asked the following questions:

- Are you aware of digital technologies used for agricultural practices?
- What type of digital technologies are you using?
- How long have you been using digital technology?

Key informants were asked the following questions:

- To what extent does the Ministry of Agriculture, through extension services, use digital technology for the development of agribusinesses and what are the challenges?
- What are the past and present efforts by the ministry to promote digital technology use in agribusiness?

When responding, most respondents mentioned they are aware of technologies in agriculture. However, the majority stated mobile phones are the most common technologies they know and utilise, they highlighted these devices are also easily accessible to them. This concurs with Melia (2019), who asserts the increase in the spread of mobile phones is the result of low costs, when compared to other technologies.

Martin and Abbott (2010) established farmers in developing countries use mobile phones for their agricultural businesses, while Kumar (2023) shows mobile phone use leads to greater social cohesion and improved social relations between farmers and the business community. Sekabira and Qaim (2017, cited in Mabika, 2019) state cellular phone technology has been broadly accepted in most developing countries since the year 2000, and studies have shown cell phone use has enhanced farmers' market access and income.

Mobile phone use is spreading rapidly in developing countries for business, education and agriculture development, nonetheless, while mobile phone use is increasing among farmers, a

gap remains among businesses (Razaque and Sallah, 2013). Nonetheless, the majority respondents showed they use mobile phones and smartphones for their businesses since their introduction to mobile phones.

Farmers adopt mobile phones on a massive scale, because they are cheaper than computers (Soulignanc, Pinet, Bodelet and Gross 2025). This assertion mirrors the respondents, who highlighted they use mobile phones for their agribusiness development through several ways, such as buying seeds, advertising, communication and creating apps, as well as sharing posters and improving their products. Their responses highlight advertising, in particular, as a main use.

Five respondents in the focus groups showed they use mobile phones for advertising. Lineo: "*I use a phone to advertise…"* Thabo: "*I use phone to advertise; Lesotho is still backward with technology…"* Lethabo: "*I use phone to sell on Facebook*…" Mahoana: "I *use phone to organise meeting with farmers."* This is in line with Bachhav (2024), who shows mobile platforms create virtual communities where farmers can interact. In addition, Garain, Sarma, and Bilaiya (2025) show mobile applications serve as transformative tools by enhancing farm productivity, fostering innovation in agricultural research, and optimising extension services.

Three respondents indicated they use mobile phones to buy "…*I use phone to search for places to buy fertilizers*…" "…*Phone to buy seeds and livestock."* For extension services, extension officers highlighted *"…use phones for my extension work, phone to submit timesheet…"* "…*Yes, phones for calls, research and report."* Therefore, this theme proves mobile phones are one of the existing and most adopted social media tools in agribusinesses in the Leribe and Thaba–Tseka districts.

Newly discovered agricultural practices, such as soil preparation and planting, irrigation and weeding methods, cultivation and harvesting, as well as storage methods, can be sent through texts messages or voice calls on a mobile phone by extension service workers, without travelling to farmers' locations to deliver face-to-face teachings (Aker, 2011).

Akintunde and Oladele (2019) argue extension workers have not taken full advantage of modern ICT tools in Lesotho, such as cell phones and the Internet, to make their jobs more effective, instead they rely on traditional communication methods. However, a study conducted by Barrett *et al.* (2010) reveals mobile phone use in developing countries such as Uganda, has contributed

to agribusiness development among rural farmers and other stakeholders. Therefore, this theme further highlights the importance of mobile phones for agribusinesses development as the most accessible type of digital technology.

4.5.6 Theme six: Computers and Global Positioning Systems (GPS)

Research question: What are the past and present efforts and strategies in digital technology use for agribusiness development in Lesotho?

Research objective: To investigate past and present efforts and strategies in digital technology use for agribusiness development in Lesotho and their impact on agribusiness development.

The key informants were asked the following questions:

- To what extent does the Ministry of Agriculture, through extension services, use digital technology for agribusiness development and what are the challenges?
- What are the past and present efforts by the ministry to promote digital technology use in agribusiness?
- What are the important lessons you learned regarding the challenges in digital technology use?

When responding to the questions, computers and GPS were shown to be a commonly used kind of digital technology in agribusiness and the ministry. Lipalesa expressed "*we use computer and GPS".* The findings are in line previous studies that revealed extension agents use GPS technology to map cocoa farms in Ghana (Bosompem, 2021). GPS has played a pivotal role in the implementation of a key concept in agriculture – precision (Stafford, 1999) by optimising field layout, leading to higher yields and faster task completion, thereby reducing farming costs (Maring *et al.,* 2024). One respondent highlighted *"GPS and sensors help with the accuracy to avoid waste."*

Similarly, Mosa, Tefello, Khalelo and Mmatefo expounded: "…*We use tablets, computers and phones in the office of agricultural marketing…"* "*...We use computer to store information about the type of trees farmers buy and why they buy them and which type…" "…We use GPS but sometimes it runs out of batteries..."* "*…Yes, tablets, computers and phones in the office of agricultural marketing."*

Manoharan and Ingrams (2018) find technology adoption is not a foreign concept in the public service sector, because it dates back to the use of microcomputers in the 1990's. However, Akintunde and Oladele (2019) show the use of computers (desktop or laptop) is comparatively low among extension workers. Despite the low usage, computers play a major role in extension work (Alfaifi, 2006). Therefore, Chiu, Xu, Wei, Huang, Schwing, Brunner, and Shi (2020) suggest the use of computers in agriculture, particularly extension services, due to the contributions of technology in agriculture, such as opportunities to obtain technical and economic information quickly (Bheenick and Brizmohum, 1998). The presence of technology is, nevertheless, a challenge for field agricultural extension officers to master computer skills and utilize the internet (Thamrin, Ibrahim, Sutawi, Barus, Latipun, Khan, and Purwanto, 2023).

4.5.7 Theme seven: National programmes and NGOs

Research question: What are the past and present efforts and strategies in digital technology use for agribusiness development in Lesotho?

Research objective: To investigate past and present efforts and strategies in digital technology use for agribusiness development in Lesotho and their impacts on agribusiness development.

Participants in the focus group were asked the following questions:

- Are there any government development partners that assist you in ensuring digital technology use?
- What role does the government play in ensuring digital technology use in agribusiness?

Key informants were asked the following question:

- What digital technology strategies are used to promote agribusiness development by the ministry?

While the majority respondents in focus groups showed the government does not initiate any strategies to assist them with the use of digital technologies, several respondents showed that ReNOKA, which is a national programme of the Lesotho government, assists farmers with agricultural activities for the development of their agribusinesses.

Four respondents Maliehe, Reabetsoe, Toka, and MMei, in a focus group highlighted that ReNOKA has assisted by training them to use social media. "*Renoka was teaching us about the*

use of community WhatsApp for forum…" "…Renoka teaches us about WhatsApp…" "…Renoka and khoi–khoi …" "… Renoka was teaching us about online meetings for farmers groups and online payments, as well balancing books online…" "…Renoka taught us how to use WhatsApp for agribusiness."

This aligns with Tsikplornu (2023), who proposes governments, multi-stake holders and NGOs can collectively improve digital agriculture (Chen *et al.*, 2021). Furthermore, Lawan (2013) shows NGOs have become an important ally in the development process of developing country sectors, including agriculture, by providing training and capacity building.

In agreement with the literature, Mafa expressed "*The ministry, together with NGOs, assist with training and gadgets like tablets, because it wants to venture into the use of digital technologies /digital platforms."* This shows the importance of NGOS in digital technology use by farmers.

Bertolini (2004) notes most farmers in Africa rely on intermediaries such as NGOs, and producer organisations to access and exchange information on innovations in crop varieties, pest management, soil fertility, and weather forecasting, along with irrigation, among others.

NGOs, or private sector partners can provide subsidies or financial assistance to help farmers access digital technology (Chateauviex and Baddache, 2024). This sector remains a key source of revenue for many developing countries, but farmers face various challenges, including a lack of resources, information, and markets. To ensure these rights are realised, NGOs necessarily intervene by offering technical training, particularly regarding farming, sustainable farming, credit, and farming inputs (NGO feedblock, 2025).

4.5.8 Theme eight: Lack of access to digital technology affects agribusiness

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked following questions:

- How does the lack of digital technology impact the development of your business?

- How was the performance of your agribusiness before using digital technology and when using it /after using it?

This theme is directly related to the research question of how access to digital technology impacts agribusiness development in the Leribe and Thaba-Tseka districts in Lesotho. For the analysis, the following questions were asked: How does the lack of digital technology impact the development of your business? How was the performance of your agribusiness before using digital technology and when using it /after using it?

Technology is a key principle of improvements of agricultural production and income growth of poor economies status (Hilowle, 2024). To this end, for example, Mafa expressed "*People who do not have access to network do not see our products, as a result the sales become low."* Similarly, Thapelo showed *"People who don't have technology such as phones do not see our products."* In contrast, when asked how lack of access to digital technology impacts agribusiness, Moremi stated, "*People who produce a lot agriculturally do not rely on technology, they should just be assisted with primitive ease, because they struggle due to lack of access to technology due to network and lack of skills., "*This shows that lack of access to digital technology is a concern to agribusiness because it affects their marketing and sale.

(Balakrishran, Sachinkanithkar, Janet and Reshma, 2017) assert this technology replaces some traditional methods, providing a better life to both farmers and people as a result, offering timely and precise information on input use and helping the farm decision-making process for resource allocation and management, thereby boosting production efficiency (Lopez, Perego and Romero, 2023). Nonetheless, Lebamang stated, "*It takes too long to water crops, as a result it affects my produce and sales, if I was using technology I would not take a long time".*

Digital technology such as drones for irrigation reduces implementation costs and the ability to execute tasks up to 68 times faster, allowing farmers to cover large areas quickly (Marinello, Pezzuolo, Chiumenti, and Sartori, 2016). Generally, digital technologies can lower information-related transaction costs associated with farmers' access to upstream and downstream markets, leading to improved allocative efficiency and equity in agrifood markets. Notably, digital technologies facilitate the transmission of market information, allowing producers to overcome persistent information asymmetries and reliance on market intermediaries (Deichman *et al*., 2016, cited in Mikhailov *et al.*, 2022).

It is evident from this theme that the government needs to prioritise training and investment in digital technologies that will increase production, quality of products, as well as profits agribusiness development. Furthermore, enhancing access to digital technology for farmers will remove different barriers for entry to markets and increase production, instead of depending on traditional farming and marketing systems.

4.5.9 Theme nine: Access to information

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked following questions:

- Are you aware of digital technology used for agricultural practices? What type of digital technologies are you using?
- In your opinion, can digital technology promote agribusiness development?
- How does the lack of digital technology impact the development of your business?

Information is a key resource for agriculture, it is also a major function of extension, aimed at the promotion of agricultural development (Sanusi, Petu-Ibikunle and Mshelia, 2010). To disseminate information to farmers' extension services, different tools including printed materials, radio broadcasts, television programmes, and mobile phones are used. This ensures farmers can access up-to-date information and make informed decisions (Raji *et al.* ,2024).

The respondents showed digital technology use enables them to have access to timely information through mobile phone use. Busang expressed, "*information travels fast"*, while Limphonyane also highlighted *"technology makes easy access to information."* This is in line with Jayathilake, Jayaweera and Waidyasekera (2008), who show mobile services are used to deliver agricultural information among farmers and extension workers to access information, farmers also use the internet.

Agriculture is an information intensive sector that demands farmers have access to information and knowledge in order to thrive (Mbaya, 2024). Nevertheless, when asked whether the "lack of digital technology impacts the development of your business", Molise expressed "*Lack of information about technology and accessibility".* This mirrors Okediran, Ganiyu, and Badmus (2019), who note the agriculture sector in Africa is disadvantaged due to deprived access to agricultural information. Haile, Kalkuhl, and Usman (2015) show information helps farmers and traders to make decisions regarding when and how to sell their products, whether they sell just after harvest or store products in expecting higher season prices. This theme suggests wider access to information for farmers and in a more cost-effective manner ought to be prioritised for agribusiness development.

4.5.10 Theme ten: Outdated policies

Research question: Which policies are in place to promote agribusiness development in Lesotho and what challenges do they pose?

Research objective: To examine the status and extent of existing policies concerning agribusiness development promotion in Lesotho, with specific reference to Leribe and Thaba-tseka districts;

The key informants were asked the following questions:

- What are the existing policies that enable digital technology use for the delivery of extension services?
- What digital technology policies are in place to facilitate agribusiness development in Lesotho?

When responding to the question of what digital technology policies are in place to facilitate agribusiness development in Lesotho? Lebohang, on the one hand, highlighted: "*I am not aware of new policies, the only policies I know are outdated and they are not inclusive of technology."* On the other hand, Thabang explained, "*Primitive policies", while* Mpho, Lerumo and Selia also revealed "I *am not aware of policies…"* "*…I don't know policies…"* "*…I don't know any policy".* This shows the respondents are not aware of the new policies regarding the use of digital technologies in the ministry of agriculture, they are only aware of primitive policies,

therefore, the implementation of new policies could also not be effective due to lack of knowledge regarding new policies.

According to the Kingdom of Lesotho Strategic Programme (2020-2025), the agricultural sector in the country suffers from a too limited number of strategies and policies; further to this, existing policies and strategies are also somewhat outdated or not implemented at all (IFAD, 2019). Moreover, Bayer (2018, cited in Smidt and Jokonya, 2022) emphasise countries' policies are significant when adopting digital technology. In this regard, Lebohang further explained: "*In Lesotho, there has not been a separate policy articulation for agribusiness or digital technology, other than brief objectives stated in strategic plans and other policies".*

The Lesotho government's statement of policy and strategy in the agricultural sector development is specified by Makoa (2014) to comprise The Agriculture Sector Strategy 2003, National Action Plan for food security 2007-2017, CAADP and NAIP. The strategy policies incorporate goals, objectives and outputs, with emphasis on developing the productive capacities of households/ farmers to engage with agribusiness. Nevertheless, despite huge government subsidies, implementation has proved inadequate, with very low agricultural productivity remaining evident in Lesotho (Makoa, 2014).

In addition to the above, the MAFS had set goals to achieve in the National Vision 2020, the strategy that emphasises development of productive capacities of households/farmers to tap into agribusiness through crops, livestock and subsistence production, as well as cross-cutting issues (food and nutrition, forestry, conservation and range management, along with land use, land tenure, rural finance and investment), in addition to Government services (extensions, training and research) (Makoa, 2014).

According to Maphephe (2014), as with many states in the African continent, Lesotho recognised the ICT sector is a key accelerator for development, which is the reason the Lesotho government adopted and launched an ICT policy in March 2005, as part of the mission to develop technology. The ICT policy measures include instruments and initiatives through collaboration of the government ministry and private sector to increase ICT usage, to disseminate information to farmers regularly, and encourage agriculturalists to advertise and conduct transactions of their products on the internet. Rantšo (2020) showed, however, despite recent policies oriented in favour of smallholder farmers, they still have to compete for markets

with the already developed commercial sector and, as a result, the survival of markets remains at stake. It is thus evident from this theme that policies are the primary levers governments have to stimulate digital technology use in agribusiness development.

4.5.11 Theme 11: Language Barrier

Research questions: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Research objectives: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked following question:

- What are the major challenges with the use of digital technology for your business? Do these challenges have a negative impact on the development of your business?

Language barrier problems surface in technology use as a lack of content, with farmers who can understand the language gaining access to adequate information and the opportunity to engage actively with buyers and explore markets.

The following questions were asked:

- What are the major challenges with digital technology use for your business and how do these challenges negatively impact the development of your business?
- How does your level of education affect your ability to use digital technology?

The main ramification reported by agribusiness owners and farmers directly relates to the language barrier in digital technology use for their businesses. Focus group participants, Lefa and Thabo, pointed out the first hardship is the language barrier: "*It is affected because of the language…"* "*…I do not understand English that is used on mobile phones…" "…It is affected, my children help me with using it because I can't use it because I do not understand English"*. Osborn (2006) determined the use of local language, coupled with illiteracy, is widespread, particularly in rural areas. On this note, Singh, Sunitha, Tripathi, Saikanth, Sharma, Jose and

Mary (2023) suggest local language use in technological software is also essential - particularly in decision-support applications.

The literature and findings correspond with the assertion that the language barrier is identified as a major hindrance to the use of ICT devices designed to promote development (Joseph and Andrew, 2007). Therefore, it is evident from this theme that language is a tool for communication and to utilise technology, which means the ability to understand English plays an important role in technology use by agribusiness owners and farmers in Lesotho. The use of technology such as AI could thus help bridge the language barrier and assist farmers with the development of their businesses.

4.5.12 Theme 12: Communication

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

The key informants were asked the following questions:

- What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts and how do these challenges impact your business?
- In your opinion, can digital technology promote agribusiness development?

Cereno (2023) highlights that communication is an indispensable agricultural transformation component, particularly within rural farming communities. For extension activities, Firmansyah and Awza (2015) highlight agricultural communication is the most crucial aspect to creating the conditions expected from agricultural extension by the farmers. Regarding the respondents view of the importance of digital technology to the promotion of agribusinesses, Tieho stated, "*we use phones to communicate with farmers*," while on the critical role of digital technology for communication, despite their inability to access it, Leeto expressed, "*It can promote it, because it makes communication and dissemination of information easy from the offices to the farmers, for instance digital satellites and google images save time."* In addition, agribusiness owners and farmers affirmed challenges in communication affect their timely access to information and,

therefore, the development of their businesses. In this regard, Ntaoleng expressed: "*Unreliable network, which enable the use of internet, I lose customers because of poor communication and have late reports."*

This echoes findings by Maulana and Antriyandarti (2022), who showed lack of technology access limits farmers' access to information or knowledge regarding agriculture-related issues. Arokoyo (2005) states a strong agricultural extension linkage, complemented by flawless information flow and enhanced by effective ICT use, will significantly boost agricultural production, productivity, and income, thus improving rural livelihoods in developing countries.

4.5.13 Theme 13: Internet

Objective: To identify the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-Tseka districts?

Respondents were asked the following questions:

- What are the major challenges with digital technology use for your business? Do these challenges have a negative impact on the development of your business
- What can be done to improve the use of digital technologies for your business?
- Do you have a phone able to connect to the internet?
- What kind of skills do you have to use digital technology?

Respondents have shown familiarity with internet use for their businesses for different purposes. Regarding their skills with the use of digital technology, Nneko explained: *"I know how to identify crops on the internet."* While Mmatli stated, *"I buy fertilizer on the phone using internet"*, this is in line with the literature. According to Darji and Yadav (2024), the internet has a positive impact on agriculture and is also an economic growth accelerator in different sectors, including agriculture. Internet use, furthermore, enables e-commerce, which is described by Chaudhury and Kuilboer (2002) as an industry where buying and selling of products and services are made through electronic systems such as the Internet. However, Liu (2011) shows bad customer experiences were indicated as a significant challenge when owners

were asked what the major challenges are with technology use for their businesses; where customers frequently have to deal with fraudulent online shopping activities, such as false information.

On the one hand, Leballo stated, "*The type of products I receive after buying on the internet sometimes it is not what I have ordered*". On the other hand, Dong and Toaha (2024) show the majority people who buy and sell have a different level of skill in using IT and the internet, which impacts the way they use technology. In addition, it affects how a customer goes through the process of the online buying decision-making process (Dong and Toaha 2024). Moepo explained, "*I don't reach big sales because I do not to use internet fully*." While a number of respondents showed they use the internet for their businesses despite the challenges, three respondents in the focus groups showed they do not use the internet due to barriers such as network and limited resources; without internet their businesses do not reach full potential.

Without access to internet, famers have limited market access, and this obstacle impedes broader digital technology adoption by farmers (Hem *et al.* , (2025). For example, Likate and Malepa expressed, "*Unreliable network, which enable the use of internet, I lose customers and have late reports. I am not able to advertise my products on the internet…" "…I cannot afford to be on social media /internet all the time, therefore, I often miss out requests for sales…" "…I don't reach big sales because I do not to use internet fully"*. This is because the internet serves as a platform for farmers to access market information (Wang, Chen and Du 2024). Furthermore, it is also an important tool for small businesses to increase sales by selling their goods and services to a large number of people (Sevilla, 2014). This theme shows that internet has the potential to change agribusinesses because farmers will engage with their customers and participate in markets.

4.5.14 Theme 14: Efficiency

Research question; What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Key informants were asked the following question:

- What are the important lessons you learned regarding the challenges in digital technology use?

Agribusiness involves interactions, such as seeking technical assistance, gathering market, communication and accessing information, which need to be done in an efficient manner (Ogbeide and Ele, 2017). In developing countries, agricultural markets tend to be inefficient due to poor information flow between buyers and sellers (Barret 2018), therefore, the adoption of ICT has been an attempt by these countries to use technology for information and modern agricultural practices (Schmidt, Lyytinen, Keil and Cule 2005).

According to Maring, Langkhun, Kaushik and Kuma (2024), digital technology saves farmers time and money through increased efficiency and visibility. As example, Gouroubera, Adechian, Segnon, Moumouni-Moussa and Zougmoré (2025) show that mobile phones save time and costs for farmers by offering a scalable, cost-effective means to overcome or address limitations and provide real-time, tailored support to farmers. This concurs with findings by Wyche and Steinfield. (2016).

The literature resonates with respondents, who highlighted the following benefits of digital technology, Mpho, "*Technology saves times and costs",* Mamello, "*It makes work easier and faster,"* and Mookho, *"It makes work easy some countries are now using are now using robots."* The responses show that digital technology use in agribusiness is efficient and benefits agribusinesses. This is in line with Chhachar and Hasson (2013), who show that digital technology such as mobile phones saves energy and time of farmers and ultimately, improves their income. This theme shows digital technology use for agribusiness and extension services enhances efficiency and socioeconomic challenges.

4.5.15 Theme 15: Lack of access to Digital technology does not affect agribusiness

Research question: What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?

Research objective: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Participants in the focus group were asked following questions:

- What can be done to improve the use of digital technologies for your business?
- What are the major challenges with digital technology use for your business? Do these challenges negatively impact the development of your business?

When asked how lack of access to digital technology affects agribusiness development, Teboho indicated he does not use digital technologies; however, he highlighted that his businesses is not affected because of several reasons. "*I don't use technology because I sell wool and mohair and is not affected"* Wool and mohair farmers indicated they know where to find their brokers in the marketplace without access to technology, because they have been selling for many years and have also never used digital technology. Although some participants were not familiar with the technologies; some had used them before to introduce their business to the customers. However, Letsie stated, "*People who produce a lot agriculturally do not rely on technology, there should just be assisted with primitive easy, because they struggle due to lack of access to technology due to network and lack of skills."*

These responses show that lack of access to digital technology does not affect agribusinesses, it does not affect marketing and sales and the farmers who produce massively do not rely on digital technology therefore, lack of digital technology is not a concern for agribusinesses.

The above statements concur with Briggeman and Whitacre (2010) in their findings that, on the one hand, the reasons for no technology use in agricultural activities include unfamiliarity with the technology, particularly among older farmers (Srivetbodee and Igel, 2021), as well as poor internet service, or its use is simply considered as unimportant. On the other hand, Klerkx and Rose (2020) find another reason could be scepticism from some farmers with regard to the benefits of farming technologies.

Mghenyi *et al.* (2022) illustrate poor technology adoption for production, nevertheless, results in quality inconsistence that subsequently complicates matters, creating difficulties for agribusiness in providing consistent quality products for their markets. However, when the demand to adopt technology for business increases, farmers will be compelled to adopt technology to be competitive, transform their businesses and explore opportunities in local and international markets in sectors such as wool and mohair, because the world is digitalising agriculture and agribusiness.

4.6 IMPLICATIONS

The findings of the study will bring practical and theoretical implications, first they provide a clear understanding of the status, challenges and success of digital technology use by agribusiness in Lesotho relating directly to the topic; they are in alignment with the issues surrounding global digital technology use, Africa and Lesotho. In addition, the findings highlight digital technology use in modern and in a rural area thus relating to the wider field of development Studies, therefore , the findings and theories will be used as a guiding tool for future research and policies for policy makers ,scholars and new entrepreneurs in the agribusiness sector .

4.7 CHAPTER CONCLUSION

This chapter presented the quantitative and qualitative study results, as well as those from the inferential tests, calculations used to test the study and the qualitative data, which were also presented in the form of themes and analysed with due consideration of the reviewed literature. The qualitative findings have mostly complemented the quantitative findings; therefore, themes that complement each other were presented at the same time to avoid monotony in presenting the study findings.

The main findings are derived from the analysis based on the research objectives. These include that agribusinesses and extension services have adopted digital technology for their businesses, mainly used for communication and marketing; however, there are different challenges that include poor network, lack of broadband, lack of sufficient infrastructure, and online scamming, as well as the language barrier, digital divide and digital skills upgrade, which emerged as themes from the analysis.

The characteristics of agribusinesses that include their size and locations were also revealed to affect agribusiness adoption, because the majority agribusinesses were revealed to be small, while some are located in the rural areas. With regard to past and present efforts and strategies in digital technology use for agribusiness development in Lesotho, government is currently implementing a new app that will facilitate product marketing for agribusinesses, as well as the introduction of computers for extension workers, in addition to collaboration with NGOs to assists farmers with technology use. Last, where the status and extent of existing policies

concerning agribusiness development promotion in Lesotho is concerned, the study discovered agricultural policies are outdated and do not include digital technology use for agribusiness development.

Chapter 5 discusses key findings intensively in terms of research objectives, compares and discusses the findings of the study to past research. It will also present the theoretical framework to support the key findings of the study

CHAPTER 5
DISCUSSION OF KEY FINDINGS IN TERMS OF THE RESEARCH OBJECTIVES

5.1 INTRODUCTION

Chapter four presented the analyses and presentation of data derived from qualitative and quantitative study in the form of themes. In this chapter, the research findings are discussed to confirm, extend and challenge the existing study and why each is important in connection to the study objectives, literature review, theories and research questions, with the study findings also summarised. Generally, the study objectives were achieved successfully through the data collected with the use of interviews and questionnaires, in accordance with the objectives stated in chapter 1.

The overarching research objective was to investigate digital technology use in promoting agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho, with the following sub-objectives, based on the study questions.

Sub-objective 1: To examine the status and extent of existing policies concerning agribusiness development promotion in Lesotho, with specific reference to the Leribe and Thaba-Tseka districts;

Sub-objective 2: To investigate past and present efforts and strategies in digital technology use for agribusiness development in Lesotho and their impact on agribusiness development;

Sub-objective 3: To assess how agribusiness characteristics impact digital technology use in the Leribe and Thaba-Tseka districts;

Sub-objective 4: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Sub-objective 5: To recommend policies towards digital technology use in the promotion of agribusiness development in Leribe and Thaba-Tseka districts and Lesotho as a whole.

5.2 THEMES DERIVED FROM OBJECTIVES

5.2.1 Theme one: Outdated Policies

This theme emerged from objective one; to achieve this objective, the status and extent of existing policies concerning agribusiness development were examined through a qualitative approach using key informant interviews. Data analysis discovered no policy support specifically designed and implemented for digital technology use in agribusiness development. In this regard, the empirical findings show Lesotho needs new digital technology that will align with the use of digital technologies, because these are now a global trend in agribusiness development; however, policies play a critical role in its use in agribusiness. These findings are also supported by the literature review, with Ayim *et al.* (2022) establishing that agricultural development in most African countries has been undermined by poor policies that constrain market entry and effective resource allocation.

Gillard, Gouldson, Paavola and Van Alstine (2017) argue political actors, rather than constructing arguments regarding the nature of a given problem, instead link these to the solutions (policies) when in their favour. Appropriate conceptual frameworks do not exist that can guide developing countries to make meaningful policy choices in this regard (Singh, P., 2018). However, Tripp (2001) suggests the mostly likely available technology can be reviewed, followed by policy, to support the technologies. The study further revealed clear policies are a useful tool to push funding for agribusiness digitisation; which leads to the conclusion that gaps exist within the policy formulation process. This, furthermore, results in the need for updated policies and strategies in Lesotho, which could influence change for a new direction in agricultural and business policy for development, in addition to influencing digital technology use for agribusiness development Lesotho.

Notwithstanding these findings, the study further suggests appropriate policies may advance agribusiness development through digital technology, because policies foster growth of digital culture in the country. The influence on farmers to adopt technology is revealed to be based on the potential benefits digital technologies offer farmers. The study, therefore, suggests digital policies should be developed with a concern to assisting farmers adopt digital technologies, which will empower their business more than empowering technology suppliers and innovators.

The study concludes updated policies will contribute to digital technology use for the development; however, policymakers ought to incentivise the wide-scale application of these technologies among farmers and agribusinesses.

5.2.2 Theme two: Infrastructure

This theme emerged from objective four, to establish the various challenges encountered in the use of digital technology and how lack of access to technology affects agribusiness development. The objective was achieved through focus groups and key informant interviews. Similarly, quantitative data revealed the lack of infrastructure and electricity supply affects digital technology use.

Specifically, the study shows the lack of electricity and road infrastructure are the main infrastructural challenges in digital technology use. While emphasising the challenges of digital technology use, several authors highlighted infrastructure as a challenge, where farmers are reluctant to adopt digital technology due to lack of infrastructure such as electricity that enables technology use. These findings suggest the lack of electricity and infrastructure has the potential to affect agribusiness utilisation and digital technology adoption; therefore, the study concludes infrastructure such as electricity, positively impacts digital technology adoption. The primary challenge to stimulating agribusiness development through digital technology use is thus poor infrastructure.

Trendov *et al.* (2019) emphasised road infrastructure is a challenge in digital technology use in developing countries, particularly in rural communities with large populations; as a result, smallholder farmers and agribusinesses without appropriate infrastructure are disadvantaged in every aspect of business. In addition, Kiarie (2020) confirmed the successful adoption of digital technologies is influenced by technological infrastructure and connectivity. Compared with the study findings, Rantlo *et al.*, (2020) determined smallholders in Lesotho still experience difficulties participating in commercial markets, due to poor infrastructure.

These findings also complement results obtained from the quantitative study, which showed a significant number (78.7 percent) participants agreed, 38.3 percent strongly agreed, and 40.4 percent agreed a lack of infrastructure affects digital technology use. This means digital technology adoption and use are a challenge for agribusinesses; therefore, infrastructure is

necessary for digital technology use. Specifically, the shortage of electricity (Musa *et al.*, 2013), is a disadvantage in every aspect of a business. Kiarie (2020) confirmed technological infrastructure is one successful digital technology adoption determinant.

Similarly, Rantlo *et al.* (2020) call attention to poor infrastructure that makes it difficult for smallholders in Lesotho to participate in commercial markets. With access to electricity, agribusinesses will easily adopt digital technologies, because the majority digital technologies depend on electricity, particularly for charging. This corresponds with Mellor (2017), who emphasises rural infrastructure improvement, such as electricity, promotes the use of digital technologies, for instance, cell phones, due to their low cost and great utility. Based on the findings and literature reviewed, the study concludes lack of electricity in the areas where agribusinesses operate affects their overall business growth. Therefore, for agribusiness to gain a competitive advantage, farmers, owners and managers require the necessary infrastructure support to benefit from technology use.

5.2.3 Theme three: Poor network connection

This theme emerged from objective four, to establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development. The study findings revealed agribusinesses are unable to utilise digital technology due to poor network. Where there is poor network, agribusinesses are reluctant to adopt digital technology, therefore, based on the findings, the study suggests network connection is a digital technology use facilitator, where poor and unreliable network limits farmers' technology access and use. Consequently, the study concludes for agribusiness to develop in today's modern environment, network connection is vital to access and explore digital technology potential for agribusiness. The quantitative analysis also revealed the lack of broadband connectivity affects the use of digital technologies by agribusiness owners.

The study findings also showed lack of broadband connectivity affects digital technology use by agribusinesses, which concur with Tayo, Thompson and Thompson (2016), who maintain the lack of broadband connectivity affects digital technology use. However, these findings are not consistent with Levy and Powell (2002, cited in Ghafoor and Iqbal, 2007), who argued most SMEs do not use the internet as a key to their business strategy, compared to larger businesses.

These findings also complement results obtained from quantitative study, which showed the lack of broadband connectivity affects the use of digital technologies by agribusiness owners. The majority (64.8 percent) respondents (34.2 percent strongly agreed and 30.6 percent agreed) identified the lack of broadband connectivity affects digital technology use by the agribusiness-sector.

The findings support Iskandar, Amanah, Hubeis, and Sadono (2020), who show although farmers use mobile phones as digital technology, they are unable to access the internet properly to use available information, because of the poor network. Balkrishna and Deshmukh (2017) argue, regardless of farmers using social media due to the ability to connect them, over a geographical distance, with several advantages, there is limited access because of network unavailability. Without access to broadband connectivity, agribusiness owners are unable to participate in wider markets to reach a large audience through digital tools that rely on the internet; this becomes a technology use challenge for agribusinesses development. Therefore, Olesky (2023) suggests one strategy for successful technology use is to ensure cheaper and effective nationwide access to broadband.

The study concludes it is economically sensible for the government to invest in broadband connectivity for agribusiness use and development, since increased access to broadband connectivity will have a remarkable impact on digital technology use for agribusiness development, particularly in the rural areas. Most importantly, the study further concludes broadband connectivity advancement strategies need to align with agricultural and small business strategies.

5.2.4 Theme four: Marketing /advertising and buying

This theme emerged from objective four, to establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development. The study adopted a qualitative approach and sourced information through a focus group discussion, where data analysis discovered agribusiness that have encountered challenges in digital technology use, are hindered from marketing their products to a larger audience of buyers, such as on social media.

These findings established that mobile phones are used for marketing by agribusinesses, where those who have used mobile phones to market their products and then, subsequently stopped, have seen the difference in sales from when they market their products on social media, compared to when they do not. Therefore, this study suggests digital technologies facilitate marketing of agricultural products. The findings also complement those from quantitative analysis, which showed the lack of access to markets, in order to market their products, affects farmers' digital technology use.

Westerman, Bonnet and McAfee (2014), show despite market exposure advantages for farmers and agribusinesses, businesses still new in technology use are experiencing problems, since market access enables farmers with increased income, through their customer base and marketing channel expansion, to purchase technology (Payne, 2020). The results of this study indicated a large respondent number (82.2 percent) in agreement. Mbaya *et al.* (2011) discovered lack of access to markets is a challenge perpetuated by the inability to secure contracts with companies; which is the primary goal for agribusiness and farms. However, Mohlehli and Rantlo (2016) point out, when an agribusiness manager/owner has market access, opportunities to develop the business increase.

In alignment with objective two, an investigation of past and present efforts and strategies in the use of digital technology for agribusiness development in Lesotho was made through key informant interviews. The empirical findings revealed the ministry of agriculture, through the department of marketing, has made several efforts in Lesotho in recent years to ensure marketing and agricultural production for agribusinesses development, by means of the use of technologies. However, without digital technology training for agribusiness, digital technologies will not be adopted by all the famers due to their challenges, such as illiteracy and the language barrier; therefore, these findings suggest farmers need to be trained to be proficient in the use and adoption of digital technologies, to enable using those applications aimed at connecting them with buyers.

The findings are supported by the literature, with Rantšo (2015a) and Turner (1978) who maintain several trade strategies and the use of previous technologies such as the Green Revolution, have been adopted in the past. The study further discovered the ministry is now in the process of implementing a digital marketing platform named "*Mmaraka*", which will

connect agribusiness with customers nationwide. This will benefit many farmers and agribusinesses, because as Johane *et al.* (2021) indicate, many fresh food and fruit farmers sell their produce to street vendors and in informal community markets, as opposed to formal buyers that offer better prices. This is due to few and limited processing facilities and limited markets. The first step to the implementation of Mmaraka is providing officials with tablets to ensure easy digital technology access; the second step will be to train farmers and agribusinesses regarding digital technology use, such as phones, computers and tablets to access the digital platform.

Access to markets emerged as a theme, which similarly revealed agribusinesses have a challenge in accessing markets that affects technology use by farmers. Most farmers, particularly in the rural areas of Leribe and Thaba-Tseka districts, are unable to access digital technology, since they have no market for their products, subsequently, they do not have sufficient income to afford technology. These farmers, therefore, sell their products for survival and to sustain their businesses. The findings further suggest farmers need to be assisted with market opportunities or how to access markets, particularly in the rural areas. This can be achieved by introducing various marketing opportunities, such as exhibitions by the government and the private sector, inclusive of rural famers, as well as government buying farmers' products in bulk, and providing training on digital technology use by farmers.

The findings on the lack of access to markets for agricultural products resonate with those of Skjöldevald (2012), who showed markets in developing countries are flawed; as a result, farmers do not generate sufficient income. Linking smallholder farmers to markets can, however, help drive sustainable productivity and profits (Sennuga, 2019). In addition, the study findings also illustrate the importance of digital technology for accessing markets. Nevertheless, Trienekens (2011) argued gaining access to markets is not a sufficient condition to develop country value chains that will enable agribusinesses to sell their products; this means supporting infrastructure, as well as resources, including knowledge and capabilities, are conditional for these chains to be successful.

The conclusion from the findings is that the lack of digital technology adoption for agribusiness growth and development is due to the lack of a solid market for their products, because when farmers do not have access to markets, digital technologies do not become a business priority.

Based on these findings, the study concluded the government is implementing strategies aimed at assisting farmers in technology use, even though at a very slow pace, considering how rapidly digital technologies are adopted and used regionally and globally for marketing, production and trade. Furthermore, the study concludes these strategies need to be designed along with complementary policies and training of agricultural officials and extension workers that will ensure successful implementation.

5.2.5 Theme five: Technology Costs

This theme emerged from objective four, to establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development. Quantitative data also revealed digital technology costs affect its use by agribusiness owners/farmers in the Leribe and Thaba–Tseka districts of Lesotho.

Findings that emerged from focus groups indicate the cost of technology is a challenge in digital technology use. Farmers cannot afford to buy digital technologies due to low income generated by their businesses; those farmers who purchase digital technologies have purchased the less costly technologies, such as mobile phones, mainly used for marketing and money transactions.

The literature review confirms digital technology costs are a challenge in the adoption of digital technologies by agribusiness and accounted for high rates of non-adoption among farmers and agribusinesses. For instance; Ngibe (2020) points out, because technology adoption is costly, the adoption rate is generally low. Nevertheless, the study findings diverged from the literature, as some respondents showed, despite the costs, they are willing to buy and adopt technology within their financial capacity or after realising the potential of digital technology for agribusiness development. These findings complement the quantitative analysis results, which show agreement by 71 percent (43.9 percent strongly agreed and 27.1 percent agreed) respondents that indicated digital technology cost is a barrier to its use. It is, therefore, suggested by Anitei *et al.* (2021) that this requires support by authorities and programmes for the technologizing of farms, because it is costly and many farms cannot afford such revamping projects.

The findings are supported by the literature, with the International Telecommunication Union (ITU) reporting, regardless of technology affordability, such as ICT, Africa remains faced with

the challenge of the least affordable prices in many regions (ITU, 2010). According to a study conducted by Khanal and Mishra (2013), where small farm households were able to access the internet, they were better off, in terms of total income from the household and that generated off-farm. Due to technology costs, well-off farmers can afford various technologies, compared to poor farmers (Jack, 2013).

In this regard, the findings suggest lower costs for technologies could offer farmers easier access to digital technologies. With access to information regarding various types of technology, farmers may have many options to choose from a variety of affordable technologies. Therefore, the study concludes the costs of digital technologies may create challenges to technology use, however, agribusinesses who can choose affordable technologies could still adopt technology for their businesses. Second, agribusinesses and farmers, through their affiliation to, for instance, wool and mohair organisations and co-operatives, can collectively contribute to purchasing a technology they can afford, which they will identify as important in the agro-service chain for the development of their agribusiness.

Based on these findings, the study suggests agribusinesses should be included in formal credit. In this regard, the government can also investigate the role of agricultural banks in Namibia for agribusiness development, as discussed in the study. In addition, the government could establish financial institutions to provide credit services, allowing farmers/ agribusiness owners to pay little interest, based on the credibility of the agribusinesses/farmers and expansion into the rural areas. This will motivate farmers to improve their yields and marketing, through digital technology use, to pay interest that will lead to agribusiness development. It must be noted this will, nonetheless, require professional advisory committees/consultancies to guide agribusiness owners and farmers, regarding the type of credit they would need and the digital technology type best-suited for their businesses, depending on the agribusiness characteristics.

5.2.6 Theme six: Computers and Global Positioning Systems (GPS)

This theme emerged from objective two: to investigate past and present efforts and strategies in the use of digital technology for agribusiness development in Lesotho and their impact on agribusiness development. The findings reveal one strategy implemented by the ministry of agriculture is the introduction of computers and GPS for the ministry.

The computers are to have replaced the primitive methods of manually capturing data and information storing by the ministry of agriculture and mapping through site visits on the type of trees farmers buy, why they buy them and which type. Officials were, furthermore, provided with tablets, which will assist with marketing strategies for agribusiness development, although they have not reached their intended purpose, due to lack of training for the agricultural officers and extension workers. Nevertheless, GPS technology is said to improve agribusiness development, because of its efficiency in the ministry.

This is in line with Bonilla, Coombes, Romney and Winters (2024), who show developing countries have recognised the need to strengthen their agricultural services and extension through technology use, while the FAO (2023) indicates computers and tablets are emerging technologies in the digitisation of agriculture. However, these findings diverge from those of Akintunde and Oladele (2019), which show computer use remains low and face-to-face interactions are still considered the best method of effective communication in Lesotho due to farmers' unfamiliarity with technology.

These findings align with the research, as it aimed to investigate digital technology use for agribusiness development, concluding computers and GPS technology are one of the digital technologies the ministry is adopting to facilitate service provision for agribusiness development. The findings further indicate, should the extension services encourage farmers who can afford to use digital technologies to adopt computers for their agribusiness, there will be an increase in the number of technologies used for agribusiness; as a result, the outcome will be a spread of digital technology.

The study findings have revealed no evidence of digital technology use by the farmers in Lesotho's rural areas of Leribe and Thaba-Tseka; showing a gap in computer application for agribusiness development, regardless of its importance. According to Mellor (2017), the rural infrastructure for computers has historically received little attention in low- and middle-income countries. The study concludes extension workers need to keep up with technology use, such as computers, so they can pass on information, to cut the costs of meeting farmers in-person, while lagging in technology use, compared to farmers and agribusiness owners who have particularly intensified their technology skills.

The study further concluded the use of computers can be influenced by infrastructure, specifically in the rural areas. Attainment of computer use among agribusiness would additionally be influenced by extension workers. Furthermore, the pursuit of GPs can be influenced by resource availability for extension workers, because of their role in transforming rural agriculture. Kroma (2003) supports the study conclusions by showing agricultural extension officers contribute to transforming rural and agricultural systems in sustainable ways. Although GPS is only used by extension services, however, due to its importance, the study suggests farmers should also be equipped to use GPS, because of its importance in increasing yields through its efficiency in monitoring crops and fields.

5.2.7 Theme seven: Rural areas

This theme emerged from objective three, which assessed how agribusiness characteristics impact digital technology use. The assessment of the characteristics was achieved by establishing the agribusiness characteristics in Leribe and Thaba-Tseka districts. The data analysis revealed that the majority agribusinesses are located in the rural areas, where some are hard to reach for product marketing in populated areas.

Many challenges are encountered in keeping up with agribusiness development through technology use, with the most noteworthy among these network connection, road and electricity infrastructure, and broadband connectivity. The findings further suggest agribusinesses in rural areas also need to be developed into modern agriculture enterprises, because they remain dependent on traditional agriculture for production. Moreover, the majority rural area residents depend on agriculture, due to high unemployment and poverty levels. These findings complement the quantitative study phase results, which indicated 64.8 percent respondents agreed (34.2 percent strongly agreed and 30.6 percent agreed) agribusinesses are located in rural areas.

Farmers in rural areas, particularly, are not connected, and operate in isolation. Hence, there is a need for well-coordinated support structures from both government and the private sector to assist with much needed resources, such as financial assistance and digital technology infrastructure. The findings disagree with Stern and Adams (2010) and Putnam and Leonardi

(1994), who emphasise digital technology increasingly permeates rural areas, improving their social interactions and expanding their social networks.

The World Bank (2016) confirms agribusiness is located in rural areas and is the main source of income and employment; however, there is an interface between farmers and markets. Augustino (2017) shows the majority agribusinesses in rural areas are characterised by abundant raw materials and poor living standards of people. Furthermore, the literature showed agribusinesses, predominately located in rural areas, are restricted to technology access due to the lack of or problematic infrastructure and network (Trendov *et al.*, 2019). As indicated by Li *et al.* (2022), agribusinesses located in rural areas and small agribusinesses do not fully reach the potential of adopting technology for their business.

One contributing factor is social influence in the rural areas, with Venkatesh, Morris, Davis, and Davis (2003) describing social influence as the extent to which an individual perceives important others believe he or she should use the new system. This conclusion from these findings complements the quantitative data findings, which showed a significant respondent number (69.1 percent) agreed (34.4 percent strongly agreed and 35.1 percent agreed), indicating social influence persuades farmers and agribusiness owners to adopt digital technology. With regard to agribusiness located in the rural areas, the conclusion is a greater inequality exists between agribusiness in the rural and the urban areas; agribusinesses in the rural areas are less likely to adopt technology compared to those in the urban areas, due to challenges such as infrastructure and poor network.

In accordance with the theory, these findings are supported by the DoI theory, which states persuasion in DoI occurs when the individual has a negative or positive attitude toward the innovation; however, attitude does not determine whether technology will be adopted or rejected (Rogers, 2003, cited in Sahin, 2006).

Rogers (1962) focuses on the adoption of new ideas and social forces that, in turn, influence the implementation of new ideas, defining diffusion as a process in which innovation is communicated through a social system, with Sahin (2006) in agreement. Based on the empirical findings of this study, social influence is identified as a factor that influences the implementation of new ideas and the commencement of technology use. Rambe and Khaola (2021) find the realisation of increased productivity may be destabilised by social variables. The adoption of

DoI theory, thus fosters innovative leadership in dealing with innovative engagements and will, in addition, provide critical steps in new technology adoption.

5.2.8 Theme eight: Agribusiness operates in small spaces

This theme emerged from objective three, which considered how the characteristics of agribusinesses impact digital technology use. During this assessment, the study findings also showed agribusiness characteristics include small businesses/agribusinesses that operate in small spaces. While explaining how these characteristics affect digital technology use by agribusiness, the respondents indicated they do not generate sufficient income to purchase digital technology due to the size of their agribusiness; however, their agribusinesses are not affected by the lack of technology access. These findings complement the quantitative study results, which indicated 68.2 percent respondent agreement (40 percent strongly agreed and 28.2 percent agreed) that agribusinesses operate in small spaces.

Ha, Bosch and Nguyen (2015) assert the majority agribusinesses operate in small spaces, while the FAO and OECD (2016) report the majority farmers on the African continent are smallholders operating at subsistence level; due to this; they possess informality characteristics that hinder them from attracting financing and investment in their farms. The literature emphasises many small companies have failed to leverage or even adapt to digitalisation (Karltorp, 2017). Additionally, Fosty, Eleftheriadou, Combes, Willemsens, Wauters, and Vezbergiene (2013) determined SMEs with limited resources are faced with digitalisation challenges. Their findings further showed small agribusinesses are still able to adopt technologies they can afford, aligning with Khanal and Mishra (2013), who discovered small farm households with access to the internet are better off in terms of total household and off-farm income.

Where the agribusiness characteristics are concerned, the study concluded they influence the willingness of agribusiness owners/farmers to adopt digital technologies, because agribusinesses that operate in small spaces are less likely to adopt technology, compared to businesses that operate in large spaces. The study concludes small agribusinesses need to be capacitated, in order to be able to adopt digital technology, because digital technologies enable small agribusiness farmers to participate in local and international markets, similar to big

agribusiness. When small agribusinesses adopt new technologies, they are likely to increase income and production, as well as change the perspective on technology use in small agribusinesses.

5.2.9 Theme nine: Training

This theme emerged from objectives two and four: To investigate the past and present efforts and strategies in digital technology use for agribusiness development in Lesotho; and to establish the various challenges encountered in digital technology use; this objective was achieved through focus groups and key informant interviews.

The study findings revealed extension workers in the agricultural sector lack recent technology skills, such as for mobile phones and mobile applications; therefore, this is a challenge in digital technology use for them and the farmers. Without a technology skills upgrade, they are less likely to adopt and transfer technology skills due to a rapid change of technology, furthermore, when extension workers do not upgrade their skills, there is a mismatch between their skills and the farmer's skills, leading to slow adoption among farmers.

Literature shows agricultural extension work is large and complex, because it also includes transfer of agricultural technologies (Altalb, Filipek and Skowron, 2015). Furthermore, Listiana, Efendi and Rahmat (2019) state extension workers need to remain competent and provide good quality services, by increasing their technology capacity, as well as improving their skills. These findings complement the quantitative data findings, which showed a significant 81.2 percent respondents agreed (46.5 percent strongly agreed and 34.7 agreed) the lack of technical skills or workshop training by government affects digital technology use.

The findings agree with Oyedemi and Mogano (2018, cited in Aruleba and Jere, 2022), who argue providing technologies does not automatically lead to skills. Several studies have shown, even when technology devices and infrastructure are made available, a digital skills lack remains a challenge in technology use; therefore, specific skills are integral to digital technology use. Odendaal, Duminy and Saunders. (2008, cited in Aruleba and Jere, 2022) emphasise digital training is required to use digital technology.

The study findings similarly showed digital skills and literacy influence farmers' ability to utilise digital technology, because it also includes critical thinking and the ability to

communicate. The study concludes the ability to read and write constrains the use and desire to adopt digital technology; farmers long for skills to utilise technology such as smartphones, as they believe when they have digital skills, they will be in a better position to adopt digital technology, in addition, those who are trained with demonstration were able to use the technology.

Conclusions drawn from the study are supported by the literature, which shows training in digitalisation will equip extension workers to be prepared for the 4th Industrial Revolution, due to the knowledge they possess (Keba, Moremedi and Zwane 2023). The literature further shows farmers can master the essential operations of digital technology services through simple training or instructions (Gong *et al.*, 2024).

The study suggests government must include digital technologies in the training workshops offered to farmers and extension services, nationally. Social education by government and the private sector regarding digital technology use should be provided, and workable digital technology ideas identified for technology in agribusiness. This will include illiterate and elderly farmers, as well as farmers in the rural areas, which will motivate farmers and improve their general capabilities in technology use. The study further suggests farmers need to be trained by demonstrations on digital technology use for inclusion, as there is a digital literacy gap. This suggestion is supported by Egie and Sharif (2025), who show demonstrations offer farmers the opportunity to observe first-hand the differences between a recommended new technology and traditional practices. Therefore, the study concludes where there is a need; it is recommended big agribusinesses employ people with skills and recommends skills sharing among other employees.

5.2.10 Theme 10: Lack of government financial support

The study findings show agribusiness is highly dependent on financial support for digital technology adoption; without financial support from the government agribusinesses cannot flourish in the use of digital technology use. Several authors have mentioned the significance of governmental support for agribusinesses in technology adoption. First, Denis (2018) showed the majority farmers are poor, particularly in rural areas. Second, Moseley (2003) found poor financial support and lack of access to finance for agribusiness, as a result, it is impossible for

farmers/agribusiness owners to adopt new technologies. The empirical findings of this study showed a significant number (77.9 percent) respondents agreed (51.2 percent strongly agreed and 26.7 percent agreed) the lack of government support affects their access and digital technology use. This means government financial support is a prerequisite for agribusinesses to fully explore the potential of digital technology for their businesses.

McCarthy (2021) unpacks two types of financing for agribusinesses to boost the use of digital technology and transform the prospects of smallholder farmers. Financing for smallholder agriculture is the first mentioned, which takes place at structural and personal levels. The second is structural financing, which encompasses investments in creating coherent and enabling policies, building infrastructure roads, water supplies, and electricity systems, as well as strengthening supply chains, and anything else that impacts broader populations. Personal financing includes the loans and grants that allow farmers to buy what they need to be successful—seeds, tools, machines, and technology, as well as refrigerators, among others. Therefore, the study suggests the government invests in supporting farmers for profitable means of increasing production.

The study concludes government support is a significant catalyst for agribusiness success. Without government support, most small, rural agribusinesses and farmers cannot afford technology for the promotion and development of their businesses, with a lack of private sector support also a factor. Therefore, agribusinesses need financial support from the government, because without government support, digital technology use is not inclusive to all, which is in contrast with UN Sustainable Development Goal 9 (SDG9). The study results suggest farmers' use of digital technologies will increase, should they have financial support for agribusiness. The findings also propose farmers need to develop their practices for information and training, as this will create the opportunity to access the critical agricultural insights they need to farm more effectively. It is, therefore, suggested financial support can be offered by the government in several ways:

By financing technology development in the agribusiness sector, these finances should include all deserving farmers. Literature shows the minister of finance in Lesotho indicated US$ 800 million is pledged to adopt appropriate technology and advanced mechanisation, as well as climate-smart technologies in agriculture, aimed to increase the yield of basic grains, legumes

and vegetables (Matlanyane, 2023) for the financial year 2025. The ministry of agriculture pledged US$ 760 million, which will serve as a robust and efficient tool for providing smart subsidies on agricultural insurance, in response to the escalating climate change impacts that adversely affect agricultural output, and to commission irrigation systems in Leribe district (Matlanyane, 2025). Therefore, this financial support will influence technology use by agribusiness.

The Lesotho government, NGOs and donor agencies should, in addition, create programmes specifically aimed at providing financial assistance, in the form of funds to farmers and agribusinesses, along with funding to entrepreneurs and software developers, in order to develop successful technologies that can be integrated into small-scale farming. However, should the government provide financial support for the farmers; they need to be guided how to access the finances by eliminating the red tape that prohibits the majority citizens from accessing government finances.

Both the government and private sector should, furthermore, provide social education for business developments as support, which will assist agribusiness to identify workable agribusiness ideas regarding what is profitable and what is not. Therefore, the study concludes government financial support is a significant catalyst for successful digital technology adoption by agribusiness. The study also concludes the government support role should be extended to ensure efficient use of present resources available for support, because digital technologies are key to productivity and sustainability where there is government support.

5.2.11 Theme 11: Lack of access to credit

The study findings showed access to credit to assist farmers increases their purchasing power to acquire the necessary production inputs and finance their operating expenses. Without access to credit, the majority farmers are unable to purchase digital technology, due to its costs. Poor access to credit is seen as a key barrier to the adoption of these technologies (Balana and Oyeyemi, 2021). As Jack (2013) explained, many farmers have difficulty accessing credit and face high-interest rates, which prevent investment in profitable technologies.

A study conducted by Mohlehli and Rantlo (2016) confirms agribusiness in Lesotho lacks access to credit, due to insufficient collateral and awareness regarding the existence of those

financial institutions willing to help producers in need of credit. The study findings show a significant respondent number (78.4 percent) indicated agreement (48.1 percent strongly agreed and 30.3 percent agreed), which means lack of access to credit affects digital technology adoption by farmers and agribusinesses. These findings suggest the bank should eliminate the red tape, where small loans for small-scale farmers are concerned, with a 'dedicated desk in a bank' for dealing with famers' business loans and advice; this will provide farmers access to credit and a better vision how to achieve the objectives of their loans.

In agricultural economics, it is believed access to finance is one effective way of empowering farmers to make them self-dependent, which is because, when farmers lack access to finance, they may be unable to engage in large-scale agricultural activities that will generate the needed income to meet their financial need (Onah, Enete, Okoye, Ume and Onyia 2024). Therefore, the study concludes a positive relationship exists between access to credit and digital technology use. This is verified by 60 percent respondents that indicated they have no credit access, as they cannot be granted bank loans for their agribusinesses. The conclusion is thus, technology adoption by farmers/business can be improved through access to credit, which will promote digital technology use by reducing financial constraints. Despite the digital technology adoption costs, the advantages and growth are essential, with the government urgently required to implement support measures.

5.2.12 Theme 12: Agribusiness owners/farmers lack experience in using digital technology

As revealed by the study findings, farmers lack experience in digital technology use, irrespective of the digital technology penetration level in the country, the majority farmers revealed they did not have experience in digital technology use, as a result, this becomes a barrier in its use. Abdulai *et al.* (2023) show many farmers are without experience in digitalisation, because they are rarely passive participants in farm innovation (adopters). Rather, they are transformation agents through resistance and negotiation with other humans such as peers, developers, promoters, and practitioners, as well as non-human agents such as plants, animals, machines, and computer programs (Hidalgo, Birkenberg, Daum, Bosch and Quiñones-Ruiz 2024).

On the technological front, farmers' experience with technology can support familiarising themselves with digitalisation and increase their likelihood to adopt technology (Schimmelpfennig and Ebel, 2016). Cash, Borck and Patt (2006, pp. 465–494) argue new technologies are not adopted "as if they were ready-to-wear fashion but rather sewn, in bits and pieces, into the fabric of the users' social setting and existing practices." This is in line with the study findings that show cumulative agreement from a significant respondent number (64 percent), with 34.4 percent that strongly agreed and 29.6 percent that agreed farmers' experience with technology can be inspired by their recognition of technology's offers and benefits. One reason for their lack of experience in digital technology use is their discomfort at learning how to use new digital technologies; they were overwhelmed by how much they had to learn (Srivetbodee and Igel, 2021).

The findings suggest farmers' needs, particularly in the rural areas, should be integrated into strategies to enhance digital technology use, as this will motivate them to gain experience in using technology, which will stimulate the farmers' technology use and perception. However, the study also suggests technology adoption might be low and slow, as a result of harmful impacts revealed in technology use, while also due to social influences in technology use.

5.2.13 Theme 13: Lack of professionalism in political offices

The study findings revealed the lack of professionalism in political offices affects digital technology use. According to Milner (2006), political institutions matter for the adoption of new technologies, because they affect the manner and degree to which winners and losers from the technology can translate their preferences into influence. The findings show 73.7 percent respondents agreed (41.1 percent strongly agreed and 32.6 percent agreed) lack of professionalism in political offices affects digital technology use.

With specific reference to local government authorities, who are politically appointed to political offices, Nyane (2016) shows functions of office include to ensure improvement of agriculture, and to ensure market provision and allocation. Nevertheless, McCarthy (2021) shows the lack of political professionalism affects agribusiness development, because farmers often lack political power. The author points out, farmers still manage to produce food despite

all the odds, as a result, politicians see no need to help them and, once the budget has been allocated to more seemingly urgent priorities, there is no money left for farmers.

The study, therefore, concludes the lack of professionalism in digital technology use and knowledge affects its use, attributing this to digital technology use in agribusiness not being promoted by influencing policy-making and assisting farmers in their political regions with technology use, assisting with their challenges in agriculture. The conclusions are supported by Keba *et al.* (2023), who show the role of leaders in agriculture, as with those in politics, should be to take a stance in support of transformational skills.

5.2.14 Theme 14: Climate change

This theme emerged from objective four, which considered to establish the various challenges encountered in the use of digital technology and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho. The findings further revealed that increased floods cause crop failures and lower yields, leading to economic loss of the agribusinesses, thus affecting their ability to buy technology. In addition, increased floods also cause damage to infrastructure such as electricity, with farmers' ability to use digital technology also affected. Prolonged duration of a particular cropping season, resulting in the destruction of the crop, may have serious implications on farmer income. Mots'oeneng (2025) shows Lesotho's agriculture is vulnerable to climate variability, such as droughts and floods, which have severely impacted food security and rural livelihoods, highlighting the urgent need for effective risk management solutions.

Awotodunbo and Adewumi (2012) observed that rural, resource-poor farmers, who depend on natural resources for their livelihood, are the most vulnerable to environ-mental shocks and stresses, the climate survival as they do not have extra resources to boost their agribusinesses. There is, therefore, a need for strategies to help farmers cope with climate change. These strategies, as explained by Mgbakor, Nnenna and Onwubuyae (2020), include enhancing farmers knowledge, practices and belief systems regarding climate change.

The study thus concludes farmers need to be trained on climate change and the dangers it imposes, as well as emerging adoption methods they are unaware of, in order to bridge their gap in knowledge of climate change. The farmers also need to be trained on improved crops and

livestock that are tolerant to adverse conditions associated with climate change. The new information regarding resilient crops will also assist them with the choice of crops they grow for better results. It will also assist farmers in dealing with climate change effects to improve yields and sales, which will enable them to afford technology.

5.2.15 Theme 15: Resources

This theme emerged from objective four, which considered to establish the various challenges encountered in the use of digital technology and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho. The study found resources limit extension workers to improve on the technology they already have and constrains them from adopting new technology, they specifically mentioned resources such as data and material resources that limit report submission. Furthermore, the study found farmers and extension workers believe they can perform their extension duties effectively with digital technology use. In addition, resource allocation will enable extension services to perform demonstrations for farmers, which will assist with easy technology transfer and increased adoption. The lack of these resources limits extension officers' ability to provide hands-on training and practical demonstrations, which are crucial for effective knowledge transfer (Arowosegbe *et al.*, 2024).

5.3 DISCUSSIONS OF FINDINGS COMPARED TO PAST RESEARCH

This study confirms the study conducted by Mohlehli and Rantlo (2016), in relation to agribusiness development and technology use, which shows the agribusiness manager /famers do not use technology for their businesses. However, this study goes to the extent of showing factors that contribute to the lack of technology use for agribusiness development, such as insufficient skills, lack of experience in using technology, the language barrier, and inadequate infrastructure. Further factors include the challenges agribusiness owners experience while using digital technology, such as online scamming and delay of payments, due to poor network in their areas, particularly in the rural areas.

This study, furthermore, confirms findings from a previous study by Akintunde and Oladele (2019) that show the commonly used digital technologies are mobile phones, because of the price of computers; nonetheless, it extends this knowledge, showing computers are also used

by extension services to provide modified services. These include mapping the fields used for agriculture and agribusiness, in particular. In addition, the study shows how the Lesotho government aims to assist farmers with technology use for development of their agribusiness, particularly through marketing.

Concerning extension services, the study findings also diverge from those of Keba *et al.* (2023) that show the minister of agriculture in Botswana saw it appropriate to upgrade the education level for frontline agricultural extension workers. That decision corresponds with the register of the Ministry of Agriculture, established to ensure extension workers have the capability to deal with technological services in addressing agricultural issues.

The study, however, determined extension workers lack digital skills for digital technology use. Although the ministry aims to upgrade these officers' technology use, digital skills are lacking among extension workers, which shows they will be unable to transfer skills to the farmers for initiating digital adoption. Many agricultural extension officers are, furthermore, faced with restrictions, such as in-person visits to farmers, due to infrastructure and financial limitations. This means they cannot ensure continued and constant interaction, communication, support, as well as information and knowledge sharing, through digital technology adoption that can positively impact the income gap in rural areas.

Literature shows the government has a prominent role to play, should small commercial farmer dominated agriculture grow rapidly. Should government not be explicit regarding the importance of agriculture and make extensive funding available to swiftly build key government institutions in order to foster agricultural growth, the sector will not grow rapidly (FAO, 2017). The study findings confirm this assertion, because the majority respondents showed the lack of government support hinders digital technology adoption for agribusiness development. This is particularly true for the small agribusiness; where the government does not provide the necessary infrastructure, agribusinesses are less likely to adopt digital technologies and will remain less productive than those agribusinesses with access to digital infrastructure. Moser, Barrett and Minten (2009) corroborate that good infrastructure leads to more traders in a particular area and, hence, greater competition and lower margins, leading to more favourable prices at farm level.

This study further confirms the findings of Subejo, Untari, Wati, and Mewasdinta (2019), who provided a case study that describes how digital technology use by farmers impacts agriculture and agribusiness. The authors found farmers primarily use ICTs to access agricultural information around technical production, marketing, policy, and financing access, along with human interest and success stories. These findings confirm the study results, which revealed agribusinesses have adopted digital technology such as ICT to assist with product marketing. In addition, the findings confirm agribusinesses use this technology to access payments from their customers. They also mentioned lack of access to technology affects their ability to market their products to a larger audience.

The findings of this study are, however, not in alignment with the conclusions by Subejo *et al.* (2019) that farmers share success and human-interest stories, as well as policy, because the majority work in isolation in Lesotho, particularly in the rural areas. This means the use of digital technology could connect farmers nationwide and globally for more updates, specifically in agribusiness development.

The literature also shows large commercial farms tend to have technically competent management, relatively small labour forces, substantial mechanisation, and a high productivity level factor (Mellor 2017). In addition, computers are mainly adopted by large agribusiness with the capacity to employ computer scientists, who operate daily farm activities through digital technology. The CCARDESA (2021/2022) report, furthermore, showed radio remains a popular tool to reach farmers, while innovative social media platforms have been used, such as Facebook and WhatsApp, although typically by urban farmers. In contrast, the study findings showed farmers in the rural areas have also adopted the use of mobiles phones, which enables access to applications such as WhatsApp and Facebook as a marketing tool for their businesses; nonetheless, lack of infrastructure and poor network affect technology use in the rural areas.

The findings of this study confirm the results by Ekwere and Edem (2014), whose study examined the affect credit facilities have on crop production and rural development. The researchers found credit facilities result in an improvement in farm size, as well as input and output quality, adding that credit facilities contribute to rural area development. Their findings differ from the current study, because they reported on the usefulness of agribusinesses, with these enterprises expressing their lack of access to credit.

Mojaki and Keregero (2019) revealed in their study that extension officers are unable to keep up-to-date with technologies, such as smartphones and computer software that provide access to the most recent information. This discovery confirms the findings of the current study, which show extension workers are lagging with digital technology use by agribusinesses, regardless of the ministry strategy to upgrade their digital technology use to computers.

These findings challenge the verified previous findings of Warwimbo (2017) that Lesotho's agricultural contribution to GDP could be enhanced by improving agricultural operations. The challenge is for deeper investigation of digital technology application in agricultural operations and its contribution to GDP, because the ITA (2024) shows agriculture's contribution to GDP has declined over the last five years. However, there is potential for accelerated economic growth through digital technology use by agribusinesses.

The study conducted by Tenney and Trail (1985) on agricultural information sources for farmers in Lesotho showed radio and extension services as their main information sources. These authors show farmers depend on radio for information, as it was ranked first by participants in the study, followed by village meetings and then, extension agents. The findings by Tenney and Trail (1985) are in alignment with the current study, as a few participants highlighted the importance of radio for information dissemination and marketing their products, notwithstanding the lack of access to radio in many parts of the country, particularly in rural areas. However, the previous study's findings differ from the current study findings, because in the previous study, 90 percent respondents in each area reported their radios in working order, while the participants in this study indicated the lack of access to radio stations and how this lack affects their agribusinesses.

5.4 THEORITICAL FRAMEWORK TO SUPPORT KEY FINDINGS

This section explores relevant theories relating to the study findings.

5.4.1 Schultz' agricultural development theory

The theory developed by Schultz suggests the transformation of traditional agriculture production ways is through the modern way of production (Schultz, 1964). The author believes traditional agriculture can be transformed into a highly productive and profitable type of farming. It is thus a theory of modernisation, with Schultz proposing technological change and

human capital involvement in agriculture (Sahi, 2022). The empirical study findings show agribusinesses have adopted digital technology to transform their agriculture and agribusiness. The study sees digital technology as an important factor that influences agribusiness development from traditional to modern agriculture. In this regard, the findings show agribusinesses have adopted digital technologies such as mobile phones and computers, which assist with product marketing. The findings also showed lack of access to digital technology affects their access to markets.

Agricultural Development theory complements modernisation theory, which states modernisation of agriculture in developing countries, such as Lesotho, promotes agricultural development (Climate-Smart Agriculture Profile, 2020). This development, however, goes through stages and faces a series of challenges, including technical skills, outdated policies, and inadequate digital infrastructure. The study findings challenge modernisation theory, because it neither considers how quickly technology changes, nor does it account for factors such as technical training, and human and financial resources that will enable the modernisation process in developing sectors such as agriculture and agribusiness.

5.5 ASPECTS OF DIGITAL TECHNOLOGY ADOPTION UNCOVERED BY THE FINDINGS

This study reveals important results that contribute to the body of new literature. First, the study showed the importance of resources that enable effective technology use, without access to adequate resources such as data. Second, extension workers are found to be limited in digital technology use, also due to lack of financial support when submitting timesheets. Third, the findings confirmed the necessary resources must also be available for modern service delivery by extension workers in improving access to technology for agribusinesses. Fourth, farmers indicated the importance of financial resources, which contribute to digital technology adoption; however, the lack of financial resources was stated to limit their access to technology. Therefore, these findings are important as an outcome for determining the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

It was also revealed by this study that Lesotho has agricultural digital magazines, which extension workers and farmers are aware of as an information source. Nonetheless, it is also observed as a tool to improve digital technology use in promoting agribusiness development, when farmers are encouraged and trained in their use. The study reveals only extension workers expressed the importance of these digital magazines for marketing and further recommend their use in training farmers. A digital magazine could be more accessible compared to in-person or information-related training; however, farmers expressed that they are not provided an opportunity to participate in the magazines through advertising that is inclusive to all farmers, regardless of their location and education level. These findings are important as an outcome for investigating the past and present efforts and strategies in digital technology use for agribusiness development in Lesotho and the impact on agribusiness development, as well as what can be done to improve the use of digital technologies for agribusiness development.

The study further revealed that climate change affects agribusiness significantly by damaging crops, which results in income loss for the farmers to adopt technology, due to the heavy rains that erode crops, affecting the harvest. These findings provide insight on the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho. While farmers are using known, primitive ways of combating climate change, they also need to adapt more strategies to combat current climate change trends.

This study also determined important results on the significance of political professionalism, where the majority respondents strongly agreed professionalism in political offices affects digital technology use. The findings on political professionalism are important, because they specifically contribute to the unique aspects of literature on political professionalism in the context of this study. The term “political professionalism” is referred to, according to the explanation of Evetts (2013), as the knowledge-based category of a services occupation, and this usually follows a period of education/training. Farmers and agribusinesses are shown to be dependent on political offices, such as local government. The findings are thus important, because while local government capabilities are to expand development of agriculture for the citizens, technology use without digital technology integration is unlikely to enable farmers and

agribusinesses to experience digital technology use for agribusiness development. Furthermore, policies are also influenced by political professionalism.

While the world is promoting digital technology use by agribusiness, the findings reveal important insights on digital infrastructure issues and the digital divide. The insights from the literature and findings show the importance of digital inclusion for all agribusinesses (Waswa, Mursalzada, Wanisheti, Atieno, Ayra, N'dova and Daniel 2021), which will also empower digital technology use by agribusiness, despite their location in rural places. These findings fulfil the overarching research objective namely, to investigate digital technology use in promoting agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho, because it shows there are agribusinesses affected by the digital divide and lack of infrastructure that limit digital technology use by agribusiness. The findings will motivate digital inclusion through policies and strategies that will promote technology accessibility, including agribusiness in the rural areas; therefore, farmers will not work in isolation, due to communication challenges from technology use, such as mobile phones.

This study further revealed the extent to which technology costs influence technology use, while investigating the use of digital technologies in agribusiness. It was also important to assess the factors impinging technology use. It shows why agribusinesses adopt certain technologies compared to others, with the findings further revealing the costs of technologies affect its use, showing the importance of these findings in identifying the scalable and affordable digital technologies to increase digital technology adoption for agribusiness development nationwide.

The study revealed the main challenge in Lesotho's agribusiness development is no policy support specifically designed and implemented in digital technology use for agribusiness development. These findings are significant, because they provide insights on how policies guiding agribusiness development and technology use would promote agribusiness development and how suitable policies could be made to facilitate this. Efforts will, therefore, be made to integrate digital technologies within agribusinesses through a guiding policy or strategy that integrates the use of technologies and services. The potential of digital technologies for agribusiness could result in transformation and a new direction in the policy regarding agricultural and business development.

5.6 CHAPTER CONCLUSION

This chapter presented a discussion of key findings in relation to the qualitative and quantitative study sections, as well as the conclusions, based on the findings and important insights from the study. The next chapter sets out the summary of key findings, outlining the study, theoretical and policy implications, as well as policy recommendations stemming from the study.

CHAPTER 6
SUMMARY OF KEY STUDY FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

6.1 INTRODUCTION

This research investigated digital technology use in agribusiness for the promotion of agribusiness development in the Leribe and Thaba-Tseka districts, in Lesotho. This section first presents a brief recap of the introduction, research objectives, methodology and literature review, then a summary of key findings and the study as a whole, with last, policy implications and recommendations for further study, in accordance with sub-objective 5.

6.2 OUTLINE OF INTRODUCTORY STUDY CHAPTERS

This study is structured into six chapters.

Chapter one: The first chapter comprised the introduction to the study, presenting the agribusiness concept, the importance of agribusiness development, a global overview of the importance of digital technology use in agriculture, and the goal of digital technology for agribusiness. The background to the study provided contextual information regarding digital technology globally and in Lesotho, along with a review of strategies adopted in Lesotho for agriculture development through technology. The research questions, designed to provide a detailed investigation in digital technology use to promote agribusiness development in Lesotho, as well as the accompanying challenges, characteristics, and strategies, were in alignment with the research objectives.

Chapter Two: The literature review was designed to provide an extensive appraisal of published work on the study topic, in order to provide a clear understanding of digital technology and agribusiness and how technology adoption has varied in different countries globally, as well as its influence in Lesotho. The review also examined digital technology for agribusiness development in different countries, types of digital technologies used in Lesotho, and the challenges in its use in Lesotho. Regardless of the challenges in the use of digital technology in Lesotho identified in the literature review, farmers and agribusiness owner are

adopting technologies to promote the development of their businesses. Also discussed were the major contributors to agribusiness development, including investment in infrastructure, transport and communication, in addition to industrial development. It was further highlighted that agribusiness development is reliant on the government in Lesotho fulfilling its role, as without it, agribusiness in Lesotho will be neither competitive nor will they effectively adopt digital technologies.

Chapter Three Methodology: For this study, the analysis and results were dependent on the methodology, discussed in chapter 3, which guided the study and its outcomes, based on the research questions and objectives; to investigate the use of digital technologies by agribusiness to promote agribusiness development in Lesotho. The study adopted a pragmatic approach as a mixed-methods study, where key informant interviews enabled the researcher to answer the questions related to the use of digital technologies for agribusiness development, while focus groups enabled the researcher to find answers to questions in a group, where participants were allowed to express themselves as a collective. The 5-point Likert scale questionnaire comprised data tested using inferential statistics to test variables identified in the questionnaire. However, with the questionnaire, the participants seemed less interested in answering the questions, particularly when they had to select answers from the 5-point Likert scale response range.

6.3 SUMMARY OF QUANTITAVE AND QUALITATIVE KEY FINDINGS

This section presents the summary of the study findings; first, it sets out the qualitative findings summary, followed by the quantitative study findings.

Agribusinesses and extension services in Leribe and Thaba-Tseka districts adopt digital technologies, however, the adoption differs according to location, affordability and size of agribusinesses, with the various types of digital technologies adopted making different contributions to digital technology use, such as communication and marketing. Nonetheless, barriers in the use of technologies include lack of access to credit, digital technology costs, and poor network coverage, particularly in the rural areas, where network coverage limits interaction with customers, as well as delaying access to information from extension services, which affects their ability to implement new knowledge.

From these findings, the researcher concluded the results of using digital technologies will be visible and motivate the use of different types of technologies, should agribusiness owners purchase less costly and easy to use digital technologies. In addition, digital technologies have the potential to improve agribusiness development in Lesotho, while there is also a need to intensify rural area development, with more efforts required to urgently provide basic infrastructure. Considering the current speed, the world is digitising agriculture, necessary resources such as data and alternative solar energy also need to be provided for extension workers based in rural areas. This will, furthermore, bridge the digital divide the study found in Lesotho, which contributes to challenges for farmers working in isolation and isolated areas, since information was also found to not reach the majority farmers.

Last, extension workers and agricultural officials need ongoing training in digital technology use, because there is a mismatch between skills and technology; as a result, the officials and extension workers do not fully utilise the digitals technologies provided to them by the ministry. This affects agribusiness development, because the majority farmers, in particular those in the rural areas, depend on the extension workers for new knowledge and information. Availability of relevant technology will also enable farmers to remain a step ahead and contribute to addressing challenges such as climate change, limited market access, and sourcing relevant information of seeds and cropping methods. These technologies need to be easily maintained and affordable. The findings further provide useful insights to the research topic - the investigation of the digital technology use for agribusiness development - with the findings correlating global challenges in technology use, such as climate change, the impact of technology on society, infrastructure, as well as digital skills.

The dominion of various technologies is found in big agribusinesses, as they generate sufficient income to run the business and purchase technology, while the majority small agribusinesses appear dependent on government financial support and credit; with neither of these factors thus far available in Lesotho. In both districts, digital technology use by agribusinesses is highly dependent on farmers and agribusiness managers, since there are no technicians for technological innovations in the businesses, apart from one agribusiness, which showed they have a specialist to assist them with digital technology. Nonetheless, some agribusinesses

depend on the owner's limited skills in technology use, therefore, training in technology for agribusiness would improve technology use for agribusiness development.

The study also examined the challenges agribusinesses encounter in digital technology use, including the language barrier and illiteracy, where those managers able to read and write can adopt a few technologies, compared to those who are illiterate. Furthermore, challenges such as lack of digital infrastructure, insufficient broadband and the digital divide create an uneven experience in digital technology use by farmers. The majority farmers and agribusinesses located in areas where they lack proper infrastructure and network, expressed reluctance to adopt digital technology. Therefore, should the government invest in infrastructure that enables digital technology use, agribusiness would develop through digital technology. The study claims agribusinesses adopt technology despite these challenges; however, digital technology adoption relies solely on government efforts to improve infrastructure, such as broadband and electricity coverage, inclusive of rural areas, to promote equal technology access.

Addressing these challenges, however, requires well-coordinated support of both the government and private sector. While the Lesotho government is developing several initiatives to promote technology use, the strategies might not succeed in implementation without policy support and access to credit or financial support. The majority farmers and agribusiness are still struggling to maintain their day-to-day operations financially and thus might not consider adopting digital technology, regardless of its benefits. In addition, the findings revealed agribusiness characteristics are a contributing factor in determining successful technology use. Although some barriers are controllable, such as social influences, others are not manageable, for example, access to credit and lack of broadband connectivity.

The results indicated 83.2 percent respondents believe, should the government offer training in digital technology use, they would be better equipped in its application, considering their lack of skills and the continuous release of complex digital technology used for businesses and agriculture. This suggests farmers acknowledge their lack of technology use skills; as a result, they are accommodative of government training. The findings imply government training is necessary for digital technology use by farmers and agribusinesses. Moreover, the agribusinesses and farmers have demonstrated their reliance on government to offer digital technology training.

According to the study findings, lack of access to markets to sell their products affects digital technology use by agribusiness owner respondents indicating they lack access to markets. This access enables farmers to sell their products and generate sufficient money to purchase technology. These findings are also linked to 69.9 percent respondents that showed digital technology costs affect its use by agribusiness. Moreover, the findings further imply digital technology use is important to agribusiness development; however, these businesses are unable to afford technologies such as updated ICT, due to high costs.

The findings of the study confirmed 77.9 percent respondents strongly agreed with the statement indicating the most significant challenge impacting successful digital technology use, is the lack of government financial support for agribusiness. Due to their inability to afford technologies on their own, agribusinesses fail to adopt new technologies for their businesses. This suggests government financial support is a significant catalyst for the success of digital adoption in agribusiness development promotion.

The study showed access to broadband and digital technology adoption are necessary factors that complement each other in digital technology use by agribusiness. The lack of broadband was indicated by 79.4 percent respondents to affect digital technology use, particularly in rural areas, due to the rural area terrain and inadequate infrastructure. Nonetheless, although broadband was emphasised as a nationwide problem, respondents highlighted the lack of broadband varies with the geographical location, specifically rural and urban locations; consequently, those without access to quality broadband do not use digital technology effectively for their agribusiness activities.

Poor infrastructure is also found to be a component among the challenges in digital technology use; supported by 78.4 percent respondents. Participants believe suitably fit infrastructure; specifically, electricity, could enable their adequate access to technology and modernisation of agriculture. The findings further suggest infrastructure has the potential to enable easy product transportation to markets. In addition, the ability to participate in markets depends on infrastructure mainly for two reasons: safety standards and quality of products.

In terms of agribusiness characteristics, the study shows 64.8 percent agribusinesses are also located in rural areas. Furthermore, notwithstanding the number of agribusinesses in the rural areas, digital technology is not effectively adopted, because the rural areas are disadvantaged in

digital infrastructure and sufficient knowledge regarding agribusiness. Digital technology is, furthermore, not promoted sufficiently in rural areas, with the majority people in rural areas remaining dependent on traditional methods of agriculture.

The study findings show 72.5 percent respondents agreed social influence affects digital technology adoption and use among farmers and agribusiness owners. These findings indicate the decision to adopt technology is not only an individual decision but could also be due to the influence of certain groups, such as farmers' associations or community members, based on their respective experiences and attitudes to technology as a modern concept among many communities and associations.

6.4 STUDY SUMMARY

The intention of this study was to investigate digital technology use in promoting agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho. The broad research objectives include: to examine the status and extent of existing policies concerning agribusiness development promotion in Lesotho, with specific reference to the Leribe and Thaba-Tseka districts; to investigate past and present efforts and strategies in digital technology use for agribusiness development in Lesotho and their impacts on agribusiness development; to assess how agribusiness characteristics impact digital technology use in the Leribe and Thaba-tseka districts, and; to establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho; in addition to recommending policies towards digital technology use in agribusiness development promotion in Leribe and Thaba-Tseka districts and Lesotho in its entirety.

The purpose of this study was to answer the following research questions: Which policies are in place to promote agribusiness development in Lesotho and what challenges do they pose?; What are the past and present efforts and strategies in digital technology use for agribusiness development in Lesotho?; How do the characteristics of agribusiness in Leribe and Thaba-tseka districts impact digital technology use?; and, What are the challenges and their effects that influence digital technology use in Leribe and Thaba-tseka districts?; as well as, What policies

can be implemented towards digital technology use in agribusiness development promotion in Leribe and Thaba-tseka districts and Lesotho as a whole?

A comprehensive literature review was undertaken to establish gaps and identify variables to be addressed, which among others, include:

6.5 DIGITAL TECHNOLOGY USE CHALLENGES BY AGRIBUSINESS IN LESOTHO

- Limited access to funding for digital initiatives in agriculture;
- Application of digital technologies in agribusiness;
- Characteristics of digital technologies used in Lesotho agribusiness;
- Digital technology use barriers in Lesotho agribusiness development.

The study used both quantitative and qualitative techniques in the research design to supplement each other; an advantage of mixed-methods research, as opposed to using only one technique. A questionnaire was developed and distributed to the participants for the quantitative phase, while a focus group was conducted for the qualitative study aspect. Data collected were analysed using SPSS version 29.0 for quantitative data and TA for the qualitative data. The study findings were presented in graphs and tables, with conclusions drawn and recommendations made based on the findings and in relation to the research objectives.

The tested variables provide a picture of barriers that present challenges in digital technology use, with the empirical study findings discussion also supported by the literature. The findings showed the lack of technical skills, government and financial support, as well as access to credit, are key challenges in digital technology use. Generally, the findings reveal digital technology has the potential to promote agribusiness development, evident from the outcome of the use of technologies that farmers have adopted, such as mobile phones and computers for marketing, communication and mapping of the land. However, training for agribusiness owners, government initiatives, support through corresponding policies, and supporting infrastructure, should be present for successful digital technology adoption.

6.6 POLICY IMPLICATIONS

The study filled a gap identified in the literature, concerning digital technology use for development in Lesotho, while it also conveys the importance of polices for agribusiness development, particularly through digital technology, revealed as uncommon among distinguished ministry workers who are policy makers. The study findings present an opportunity for policy makers to enhance policies, considering the impact of outdated policies and lack of appropriate policies aimed at digital technology use for agribusiness development, as well as the correlation of the study findings and literature review on the impact. This will be motivated by policy implementation through strategies that will improve digital technology adoption, along with government prioritising support for agribusinesses, regardless of their characteristics.

NGOs also play a critical role in facilitating technology use with financial assistance and infrastructure. The study findings can potentially enable practitioners and policymakers to improve digital technology use for agribusiness development in Lesotho. Concerning policy interventions for agribusiness development, the policy recommendations based on the objectives and study findings are discussed in the next section, in accordance with objective five of the study.

6.7 POLICY RECOMMENDATIONS PER SUB-OBJECTIVE

This section presents the policy recommendations per sub-objective, based on the findings from both qualitative and quantitative data, as shown in chapter 1. Should these recommendations be considered and implemented, there is a possibility for immense accelerated development of agribusiness through digital technology use in the Leribe and Thaba-Tseka districts of Lesotho and the country in general.

Sub-objective 1: To determine the status and extent of existing policies concerning agribusiness development promotion in Lesotho, with specific reference to the Leribe and Thaba-Tseka districts

Outdated Policies: The study recommends agricultural policy should be included in the current policy reform process to fill the gap in policy, specifically by designing new policy objectives and goals that include how digital technology will be used, for agribusiness in particular. This

will improve farmers' access to markets and selling in bulk, since many respondents showed access to markets is one outcome of access to digital technologies. Furthermore, the study counsels for effective innovation policies to enable digital technology adoption and use by various actors in the agricultural value chain, as well as agribusinesses in different geographical locations.

Sub-objective 2: To investigate past and present efforts and strategies in digital technology use for agribusiness development in Lesotho

The study revealed the government is making several efforts towards digital technology use for farmers and agribusinesses nation-wide, however, the adoption of technologies by government officials and famers remains low, which limits their participation in regional or continental markets, such as provided by the African Continental Free Trade Area (FAO, 2020b). Therefore, the study recommends policies, strategies and programmes to foster the use of digital technologies, through internet and broadband connectivity.

Sub-objective 3: To assess how agribusiness characteristics impact digital technology use in the Leribe and Thaba-Tseka districts

The study showed agribusiness characteristics include their location in the rural areas, along with their size. The challenges in digital technology use that agribusinesses face are attributed to infrastructure and network problems in rural areas. These agribusinesses and farmers operate in small spaces/land. Consequently, the study recommends the Lesotho government should pursue policies that support the private sector and agribusiness development and not allow rural areas to lag in the policy.

Sub-objective 4: To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho

To establish the various challenges encountered in digital technology use and how lack of access to technology affects agribusiness development in the Leribe and Thaba–Tseka districts of Lesotho.

Climate change - The study discovered climate change affects production of those farmers with less resources to combat climate change effects, thus affecting their ability to purchase technology. Based on farmers inability to afford technologies that predict weather changes and risks, due to their costs, the study recommends climate change policies to keep farmers in the value chain, and agricultural risk management insurance for farmers when they face unforeseen weather challenges.

Lack of technical skills or workshop training by government - It was established the lack of government support significantly impacts digital technology use by agribusinesses, at 0.746 significance; therefore, this variable has a positive relationship with agribusiness development. The study thus recommends policies that include digital technology integration into mainstream education and training, as this is inclusive of every citizen; policy approaches may include the provision of digital literacy training.

Lack of access to credit - A significant impact was found on digital technology use by agribusinesses, due to insufficient access to credit, at 0.495 significance. This variable, therefore, has a low relationship with agribusiness development, however, the study recommends policies to reduce the budget constraints of agribusiness owners and farmers to purchase digital technology. These policies should include government and private sector policies, such as direct assistance transfers and removal of barriers to financial inclusion for both farmers and agribusinesses in Lesotho.

Costs of digital technology - The lack of access to credit has been found to significantly impact digital technology use by agribusinesses, at 0.633 significance; therefore, this variable demonstrates a positive relation with agribusiness development. The study shows technology cost is a challenge in digital technology use, with some agribusinesses able to afford technology that can no longer do so, due to a lack of resources. Consequently, the study recommends technology subsidies for farmers as an instrumental part of policy-making for technology use in agriculture; with this subsidy policy also promoting the effectiveness of government investment subsidies for agribusiness development.

Lack of government financial support for agribusiness - It has been found the lack of government support significantly impacts digital technology use by agribusinesses, at 0.732 significance; therefore, this variable has a strong positive relationship with agribusiness

development. Based on these findings, the belief is government financial support can assist agribusinesses and farmers in digital technology adoption. Thus, the study recommends government offers financial support to agribusinesses, in the form of state and commercial banks, in order to assist farmers in digital technology adoption and use. Policy consideration is, therefore, recommended to promote the proper funding of extension services from government funds.

Lack of infrastructure and electricity supply - Insufficient or non-existent infrastructure and electricity supply were found to significantly impact digital technology use by agribusinesses, at 0.598 significance; therefore, this variable shows a positive relationship with agribusiness development.

The study thus recommends the current Lesotho public–private partnerships (PPPs) policy should include infrastructure opportunities that will enable digital technology use in the rural areas of the country, for agribusiness development through digital technology use.

Lack of broadband connectivity - The lack of broadband connectivity was found to significantly impact digital technology use by farmers, with the highest score of 0.859. This score shows a more dependable and consistent reliability, it shows agribusiness lacks network and when there is no network connectivity, businesses suffer. Lesotho is, in addition, shown to be experiencing a deep network crisis. The study, therefore, recommends government and private sector policies that support modern technology, including satellite network connectivity such as Elon Musk's Starlink, instead of towers, due to the geographical, mountainous setting of the country, where the majority agribusinesses operate.

Digital magazines - The study discovered while there are digital magazines aimed at assisting farmers with digital technology for the development of their businesses, the digital magazines do not create a platform for farmers, agribusiness and SMEs to market their products, although they perceive this medium to be the most easily available tool that could boost agribusinesses. Therefore, the study recommends media policies that will promote effective, profitable use of digital magazines that will specifically promote agribusiness development, providing a platform for farmers to advertise their products, as well as providing them with information that will also lead to agricultural sector development in general.

Agribusiness operates in small spaces - It was discovered by the study that agribusiness operate in small spaces, with a score of 0.724, which demonstrates a positive relation with agribusiness and the study objectives. Since the farmers/agribusiness owners do not generate sufficient income to utilise digital technology, the study recommends policies that will influence more training in organic farming and more technologically commercialised farming. This will produce more quality and seasonal planting for all seasons, as well as irrigation systems and diversification to increase produce to compensate for small spaces and land.

6.8 STUDY LIMITATIONS

The study depended on participant availability and willingness to take part in the study; therefore, a limitation is the total participant number. Although 389 may be regarded as representative of the total population, a larger number could still have been achieved, however, some agribusiness owners and farmers were reluctant to participate in the quantitative study. This was mainly because they were not eager to sign the consent form, even after the researcher explained confidentiality and privacy issues, while some could not sign as a result of their illiteracy. Furthermore, some participants were reluctant to participate, due to their lack of technology understanding and experience in digital technology use, while others were not interested at all in participating in technology discussions, as technology seemed a modern concept they cannot relate to and technology the last thing they would think about.

The study, therefore, lacks sufficient opinions and views from agribusinesses with less/no digital technology knowledge. Additionally, many agribusiness owners in rural areas refused to participate without incentives, specifically in the form of food parcels and seeds; the researcher clarified why participants cannot be offered incentives and bribes to participate in the study. More data from the agribusinesses in the rural areas could have provided more divisive data to interpret. The geographical setting of the rural areas in Lesotho is a limitation for this study, because some agribusinesses were difficult to reach. Even where questionnaires were distributed, collection was a challenge, with some agribusiness owners unavailable on the agreed questionnaire distribution and collection dates, while others were completely unavailable.

The study was conducted in agribusinesses and farms in two districts in Lesotho, therefore, these findings may not be generalisable to all agribusinesses in the country; nonetheless, the similarities in agribusinesses characteristics in the two districts may not limit generalisability of the study findings in Lesotho.

6.9 SUGGESTIONS FOR FURTHER RESEARCH

Further research on the following aspects is recommended:

- Using digital technology for climate change mitigation affects agribusiness development, requiring further study. This is because agribusinesses are often affected by climate change, as also revealed by this study, with changing climatic conditions that affect agricultural production yields and, as a result, sales, along with agribusiness development. Climate change resilience and environmental sustainability are anticipated effects of digitalisation in African agriculture.
- Research may also be undertaken on the history of previous technologies used in Lesotho for agribusiness development. The technological gaps offer an opportunity for researchers to explore and investigate how technology can be useful in Lesotho's future.
- A study on the design and implementation of digital technology policies in agriculture is recommended as an area for future research in Lesotho, as the study determined policies are either not implemented or not inclusive of digital technology. Until now, there has been no dedicated research on digital technology in Lesotho’s agricultural policy. A study on the policy will also depict the policy gaps and limitations of the policies necessary for agribusiness digitisation in Lesotho.
- Further research should expand the study focus by employing a broader sample that includes agribusinesses that are co-operatives and block farmers, because block farming is a partnership between farmers and the government. The broader sample may present an opportunity to show the Lesotho government perception of digital technology adoption and its implementation.

6.10 RESEARCH CONTRIBUTIONS

The study makes numerous contributions to knowledge; it shows how social influences affect digital technology use by revealing that, even when the government introduces and provides

support for technology use for farmers and agribusinesses, when social influence is not well managed, it still impacts digital technology use. With regard to policy, the study adds additional cyber security policies are needed to protect farmers in digital technology use.

The study, furthermore, highlights how digital technology policies could be integrated with education and training to include all citizens of Lesotho for digital literacy, because without digital literacy, digital technology adoption among farmers and agribusinesses will remain very low. The study also shows the recent technologies used for agriculture and agribusinesses in Lesotho that were not adopted in previous years and how they contribute to agribusiness development, and the role digital technologies play in free trade deals/agreements.

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APPENDICES

Appendix A: Ethical clearance

UNISA university of south africa

College of Human Sciences_CREC

NHREC Registration # : (Rec-240816-052)
Ref #: 5719
Name: Ms Nthabeleng Lekhanya
Student #: 69113319

Date: 30/04/2025

Dear: Ms Nthabeleng Lekhanya

Decision: Ethics Approval from 30 April 2025 to 29 April 2026

Researcher: Ms Nthabeleng Lekhanya

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An investigation of the use of digital technology in promoting agribusiness development in Lesotho .The case of Leribe and Thaba-tseka districts

Qualification: Doctor of Philosophy (PhD) in Development studies

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Thank you for the application for research ethics clearance by the College of Human Sciences_CREC or the above-mentioned research study. Ethics approval is granted for one year.

The **low-risk application** was **reviewed** by the College of Human Sciences_CREC on **30 April 2025** in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the College of Human Sciences_CREC.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.

Appendix B: Informed Consent for informants of the study

CONSENT TO PARTICIPATE IN THIS STUDY

Research title: An investigation of the use of digital technology in promoting agribusiness development in Lesotho: The case of Leribe and Thaba-Tseka district

Researcher:

Nthabeleng Lekhanya

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty (if applicable).

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the <insert specific data collection method>.

Appendix C: Survey Questionnaire



Please indicate your response to the following questions regarding agribusiness development and the use of digital technology. Please place (X) for each statement that truly reflects your response where:

1=strongly disagree

2= Disagree

3=Neutral

4=Agree

5= strongly agree

Ka kopo bontsha likarabo tsa hao mabapi le ntlafatso le tshebeliso ea. technology. Ka kopo beha sekere (X) bakeng sa polelo e bontshang karabo ea. hao.

1= Ho hanana ka matla

2= Ho hana

3= Ho ba mahareng

4= Ho lumela

5= Ho lumela ka matla

Statement	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
The following are barriers to the use of digital					

technology by agribusinesses *Tse latelang ke litshitiso tse bakaong ke mmuso tshebelisong ea marang –rang*					
1.a) Lack of government financial support for agribusiness affect the use of digital technology *Ho hlokahala hoa tsehetso ea mmuso ka chelete*					
1b) Lack of technical skills or workshop training by the government *Ho hlokahala hoa tshehetso ea mmuso ka li thupelo le*					

boikoetliso ba technology					
1.c) Lack of infrastructure &electricity supply Ho hlokahala hoa lintlafatso le motlakase					
2.The following are questions based on technical skills of agribusinesses owners/managers 2 a) Lack of technical skills affect the use of digital technology Ho hlokahala hoa litsebo mabapi le tshebeliso ea technology ho ama tshebeliso ea ona					
2.b) Agribusiness owners /farmers					

lack experience in using digital technology Lihoai halina boiphihlelo ba ho sebelisa technology					
3. **The following are barriers that affect the use of digital technology in agribusiness** *3.* a) Lack of access to credit *Ho hlokahala hoa menyetla ea ho nka mokitlane*					
3b Cost of digital technology *Litjeo tsa technology*					
4.**The following are characteristics of agribusinesses**					

The latelang ke tsela eo li khoebo li bopehileng ka teng					
4 a. They operate in small spaces *Li sebeletsa libakeng tse nyane*					
4. b They are located in rural areas. *Li sebeletsa mahaeng*					
5. **The following statement is based on technological viability by agribusinesses**					
5. a) Lack of broadband connectivity affects the use of digital technology *Ho hlokahala hoa khokahanyo ea marang rang a lifono ho ama*					

tshebeliso ea marang rang					
6.The following questions are based on the social factors that affect the use of digital technologies					
6a) Social influence affects the use of digital technology *Tsusumetso ea Sechaba e ama tsela eo technology e sebetsang ka eona*					
7. **The following are economic factors that affect the use of digital technology** 7(a)lack of access to market their products					

Ho hlokahala hoa mmaraka oa lihlahisoa					
8.The following statement is based on political situations that affect the use digital technology *Polelo e latelang e ipapisitse le maemo a lipolotiki hore na aka ama joang tsebeliso ea technology* 8. a. Lack of political professionalism affects the use of digital technology by agribusiness					

Appendices D: Interview guides



Focus groups interview guide for Thaba-tseka focus groups

Questions about challenges and their effects that influence the use of digital technology in Thaba-tseka district.

Question 1: What are the major challenges with the use of digital technology for your business? Do these challenges have a negative impact on the development of your business……
……
……..

Question 2: How does the lack of digital technology impact the development of your business?.....
.....
.....

Question 3: How do you deal with these challenges?.....
.....
.....

Question 4: What can be done to improve the use of digital technologies for your business?.....
.....
.....

Questions about access to digital technology and its impact on agribusiness development in Thaba-tseka district

Question 1: How do you normally use digital technologies in your agribusiness? (For Marketing, for production, for packaging) And how does the lack of access affect the

development of your business?.....
.....
.....

Question 2: What kind of skills do you have to use digital technology? At limits your access to digital technology and how does that affect your business……
……
…….

Question 3: How does your level of education affect your ability to use digital technology?.....
.....
.....

Questions about the agribusiness characteristics in Thaba-tseka district

Question 1What is the size of your agribusiness? and how does the size of your agribusiness affect the use of digital technology?.....
.....
.....

Question 2: How does the location of your business affect the use of digital technology?.....
.....
.....

Questions about the role of government in promoting the use of digital technology in agribusiness in Thaba-tseka district

Question 1: What role does the government play in ensuring the use of digital technology in agribusiness?.....

.....
.....

Question 2: Are there any government development partners that assist you in ensuring the use of digital technology?

Questions about skills

Question 1: What kind of skills do you have to use digital technology?.....
.....
.....

Question 2: How does your level of education affect your ability to use digital technology?.....
.....
.....

Questions about policies in place to promote agribusiness development in Lesotho and what challenges they pose

Question 1: What are the digital technology policies in place to facilitate the development of agribusiness in Lesotho?.....
.....
.....

Question 2: How has the government through the ministry shown executive understanding of digital technology channels in Agribusiness?.....
.....
.....

Focus groups interview guide for Leribe focus group

Questions about challenges and their effects that influence the use of digital technology in Leribe district.

Question 1: What are the major challenges with the use of digital technology for your business? Do these challenges have a negative impact on the development of your business?.....
.....
.....

Question 2: How does the lack of digital technology impact the development of your business?.....
.....
.....

Question 3: How do you deal with these challenges?.....
.....
.....

Question 4: What can be done to improve the use of digital technologies for your business?.....
.....
.....

Questions about access to digital technology and its impact on agribusiness development in Leribe district

Question 1: How do you normally use digital technologies in your agribusiness? (For Marketing, for production, for packaging) And how does the lack of access affect the development of your business?.....
.....
.....

Question 2: What kind of skills do you have to use digital technology? At limits your access to digital technology and how does that affect your business ……
……
……..

Question 3: How does your level of education affect your ability to use digital technology?.....
.....

Questions about the agribusiness characteristics in Leribe district

Question 1What is the size of your agribusiness? and how does the size of your agribusiness affect the use of digital technology?.....
.....
.....

Question 2: How does the location of your business affect the use of digital technology?.....
.....
.....

Questions about the role of government in promoting the use of digital technology in agribusiness in Leribe district

Question 1: What role does the government play in ensuring the use of digital technology in agribusiness?.....
.....
.....

Question 2: Are there any government development partners that assist you in ensuring digital technology use? ....
.....
.....

Appendix E: Turnitin Report

Appendices F: Editor's Professional certificate

24 July 2026

To whom it may concern:

CERTIFICATE OF EDITING & AUTHENTICATION

I have proofread and language edited the updated corrections to the PhD thesis titled:

"An investigation of the use of digital technology in promoting agribusiness development in Lesotho: the case of Leribe and Thaba-Tseka Districts"

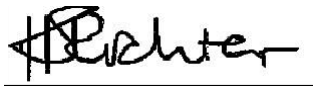
by

Nthabeleng

Lekhanya

The work remains the author's own work, to the best of my knowledge, and is free of spelling, grammar, and structural and stylistic errors.

With thanks.



H. S. Richter (Ms)