AN ASSESSMENT OF MALAWIAN SMALLHOLDER FARMERS' READINESS TO START USING FEE-PAYING DIGITAL MEDIA FOR EXTENSION SERVICE DELIVERY

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By

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DECLARATION

I, Augustine Sinforiano Mulomole, declare that this dissertation is my original work. Where other sources of information have been used, they have been duly acknowledged. I hereby certify that this work has not been submitted before in part or in full for any other degree or examination.

Signature: _____

Date: _____

CERTIFICATE OF APPROVAL

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Malawi University of Business and Applied Sciences a dissertation titled **An Assessment of Malawian Smallholder Farmers' Readiness to start using Fee-paying Digital Media for Extension Service Delivery.**

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DEDICATION

I dedicate this work to all Development Communication Specialists in Malawi and across the globe.

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ABSTRACT

Digital media for extension service delivery are currently being utilized by smallholder farmers in Malawi, at subsidized rates. Digital extension service delivery in Malawi has for a long time, been championed using subsidies from the donor agencies such as the Government of Flanders, the World Food Programme (WFP), the United States Agency for International Development (USAID) and GIZ. Currently, three institutions in Malawi are running the farmers' call centre: Farm Radio Trust (FRT), the Agriculture Commodity Exchange (ACE), and Airtel Malawi. Malawi's annual budget, however, depends on foreign aid, which accounts for around a quarter of the annual income. Since donor support has not been very steady, funding for extension service delivery in Malawi continues to dwindle, as evidenced by the annual budgetary allocation vote no. 190 for the Ministry of Agriculture, which has been getting smaller every financial year. The dwindling funding for the extension service delivery in Malawi is a signal that indicates the need to start seeking funding from other sources. This study, therefore, was motivated by this general donor fatigue which could hit the extension service delivery in Malawi, specifically digital extension. A sample of 782 smallholder farmers that were already exposed to digital media for extension service in Nkanakhothi Extension Planning Area (EPA) in Kasungu district in central Malawi, and Malosa EPA in Zomba district in southern Malawi, participated in this quantitative study by completing a closed-ended questionnaire. The descriptive method of data analysis was conducted, using IBM® SPSS® statistics version 22. Farmers reported higher levels of awareness about the existence, usage and knowledge about the benefits they got from using the digital media for extension services, their capacity to access agricultural content using the digital platforms, and their readiness to start using fee paying digital media for extension services. A Pearson correlation coefficient was computed to assess the linear relationship among the variables of awareness, knowledge and capacity, with readiness as a dependent variable in the study, and it found that there was a significant positive correlation between the capacity of the farmers and their readiness to start accessing agricultural content using fee-paying digital media. The main findings of the study, therefore, were that farmers in Malawi were ready for the introduction of fee-paying digital extension services, with those having enough financial capacity indicating more readiness and willingness than those with less capacity.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABREVIATIONS AND ACRONYMS

ACE	Agriculture Commodity Exchange
ADVANCE	Agricultural Development and Value Chain Enhancement
AEDC	Agriculture Extension Development Coordinator
AEDO	Agriculture Extension Development Officer
AGRA	Alliance for Green Revolution in Africa
ANOVA	Analysis of Variance
ASWAP	Agriculture Sector Wide Approach
BES	Block Extension System
CABI	Centre for Agriculture and Bioscience International
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
COVID	Corona Virus Disease
DAENR	Director of Agriculture, Environment and Natural Resources
DAES	Department of Agriculture Extension Services
DLEC	Developing Local Extension Capacity
DOI	Diffusion of Innovation Theory
EAS	Extension and Advisory Services
EPA	Extension Planning Area
ESOKO	Electronic Market (Swahili translation)
ETISD	Extension, Training and Information Services Division
FAO	Food and Agriculture Organisation
FICA	Flanders International Cooperation Agency
FRT	Farm Radio Trust
GDP	Gross Domestic Product
GIZ	German Agency for International Cooperation
ICT	Information and Communication Technology

IDRC	International Development Research Centre
IVR	Interactive Voice Response
LUANAR	Lilongwe University of Agriculture and Natural Resources
MUBAS	Malawi University of Business and Applied Sciences
NAP	National Agriculture Policy
NCST	National Commission for Science and Technology
NGO	Non-Governmental Organisation
NRC	Natural Resources College
RADA	Rural Agricultural Development Authority
RAC	Reasoned Action Theory
RLG	Radio Listening Group
SAPP	Sustainable Agricultural Production Program
SD	Standard Deviation
SMS	Short Message Service
SRIEED	Scaling up Radio and ICTs for Enhanced Extension Delivery
T/A	Traditional Authority
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TCO	Total Cost of Ownership
UTAUT:	Unified Theory of Acceptance and Use of Technology
USAID:	United States Agency for International Development
VSL	Village Savings and Loans
WFP	World Food Programme

CHAPTER 1: INTRODUCTION

1.1 Background to the study

Digital media enable farmers in Malawi and across the globe to access real-time information regarding farming, including markets. This technology, called digital extension services, is the dissemination of agricultural-related information through digital tools or platforms such as mobile phones, the internet, or interactive radio programmes, and is built for agricultural knowledge brokering (Craig, 2020).

Digital media are an online space where exchange happens between the producers of products, services, and their customers (Craig, 2020). Digital platforms have enabled the rapid response by service providers to customer requirements. Agriculture is one sector that has quickly embraced digital technology in providing real-time information to the farmers, through extension services. Such services are provided through mobile technology, such as SMS and the call centre, including interactive radio programmes enhanced by Information and Communication Technology (ICTs).

The provision of digital media for extension services in Malawi heavily relies on donor funding. With the current economic downturn being experienced across the globe, the African continent is slowly feeling the pinch, and the extension services sector is likely to suffer (World Economic Prospects, 2023). Due to the limited number of extension workers in Malawi, taking out digital media for extension service delivery would deny a lot of farmers from accessing information on good agricultural practices, a development that would result in poor agricultural productivity. According to the Agriculture Sector Wide Approach (ASWAP) 2010 report, and the Sustainable Agricultural Production Program (SAPP) 2010 report, there are 2, 884 establishments in the Ministry of Agriculture, but only 1, 788 have been filled, leaving a shortfall of 1, 096 establishments. This shortfall in man power is being taken care of by digital media for extension service delivery. Since Malawi relies hugely on agriculture as its main economic backbone (Steinfield et al., 2015 & Kundhlande et al., 2014), it is important to have the digital media for extension service provision in place, for better agricultural practices and adoption. A study by Jameel (2018) has shown that “approaches like using technology to reach farmers directly with timely and tailored information, incentivizing trainers, and leveraging social networks to increase diffusion of information, have all been effective ways to increase the impact of agricultural extension programs.”

ICT and development efforts use mobile phones to help smallholder farmers improve their access to information, financial services, and markets. A study by Steinfield et al. (2015) has shown that "as much as 70% of the world's food is produced by smallholder farmers, many of whom lack access to such resources as affordable transport, credit, and quality information on farming practices, farm inputs, weather, and market prices." A smallholder farmer is "someone who rears livestock, raises fish, or cultivates crops on a limited scale on a family-owned enterprise or land, and mostly relies on cheap labour to meet production needs, and they keep a portion of their harvest for household consumption" (Knight, 2022). The total number of smallholder farmers in Malawi "stands at approximately 3.1 million farm families, with 6.5 million hectares of land, with the average farm size at 0.7 hectares, and about 60% of smallholder farmers cultivating less than 1.0 ha of land" according to the Centre for Coordination of Agricultural Research and Development for Southern Africa CCARDESA, 2018).

In Malawi, some of the providers of digital media for extension service delivery include Airtel Malawi, a privately owned mobile network provider that has partnered with the Government of Malawi; the Agriculture Commodity Exchange (ACE); Farm Radio Trust (FRT), a non-governmental, non-profit organization that exists to foster rural and agricultural development in Malawi and beyond through radio and other ICTs; and Self-Help Africa. FRT provides farmer advisory services through radio programming; trains and builds Developing Local Extension Capacity (DLEC); builds the capacity of broadcasters and radio stations; and promotes participatory radio campaigns facilitated using ICTs.

According to Kemp (2020) "there were 8.58 million mobile connections in Malawi in January 2020, and the number of mobile connections was equivalent to 45% of the total population." This gives an assurance that households in Malawi have access to mobile phones, and that the potential is there for these households to be able to receive or to access agricultural information in one way or the other.

The Ministry of Agriculture in Malawi, through the Department of Agriculture Extension Services (DAES), in partnership with Airtel Malawi, launched what is known as the "Mchikumbe 212, a platform for audio agriculture content and access to market information," which is also known as the Interactive Voice Response (IVR) platform. The 212 service is a dedicated number which when dialed, provides information locally in Malawi either in Chichewa or English, on maize, soya, groundnuts, poultry, sweet potatoes, and livestock in dialogue formats. In terms of the charges, the

first three calls are free each month, and users thereafter pay MWK 40 (US$ 0.05) for the fourth call. The popularity of this service, therefore, needs to be assessed since farmers are required to pay for the service.

Talking to an extension officer over the telephone, however, is the fastest way of getting information on agricultural advisories by the smallholder farmers, in real-time, hence the introduction of the farmers' call centre in Malawi by institutions such as ACE and FRT. With funding from the donor partners, ACE is managing a farmers' call Centre which is providing agricultural and market information. By dialing 223, farmers can access information locally on the ACE platform through the organization's e-extension agents. Each mobile phone is allowed access to only one phone call in a day.

Based on this background, it was assumed that farmers were aware of the importance of digital extension services in Malawi, but what was not clear was whether the farmers were aware of the importance of financially sustaining such services if donor funding was no longer available. It was important, therefore, to assess the readiness and willingness of the farmers to pay for the agricultural-related information they were accessing through the digital platforms.

Farm Radio Trust has introduced what is known as the 'Mlimi Hotline,' which is accessed by farmers during working days and hours. This is a donor-funded initiative that enables farmers to access agricultural information in near to real-time so that they can make informed decisions on their farms. By dialing 8111 on the Airtel network, or 7111 on the TNM network, farmers can talk to either an E-extension agent or access information on recorded audio content on the IVR platform. The calls are free of charge on the farmer's end, who can stay on the call for as long as they want, and they can make as many calls in a day as they wish. This service also relies on donor funding, hence there was a need to find out from the farmers if they were ready to pay for the agricultural-related information, as one way of financially sustaining the digital media for extension service delivery in Malawi.

1.1.1 Call centre services in Malawi

A call centre is "a department or an office which deals with incoming and outgoing telephone calls, from both new and existing customers, through a team of agents" (Harrison, 2022). It offers customer support; handles their queries; and conducts market research. The clients for a farmers' call centre, therefore, are the farming communities.

Farmers in Malawi enjoy subsidised digital media for extension services, through which they access agricultural advisories, but they are not made adequately aware of the financial constraints the service providers experience. The absence of a guarantee that the available donor support for the sustenance of the farmers' call centres would always be there, motivated this study to assess the Malawian farmers' readiness for the introduction of fee-paying digital media for extension services in Malawi. Currently, three institutions in Malawi are running the farmers' call centre: Farm Radio Trust (FRT), the Agriculture Commodity Exchange (ACE), and Airtel Malawi. FRT introduced the 7111 (using the TNM mobile network) and 8111 (using the Airtel mobile network) hotlines for the farmers call centre with funding from the donor partners, some of which are the Government of Flanders, the World Food Programme (WFP), the United States Agency for International Development (USAID) the Open Society Initiative for Southern Africa (OSISA), and the Alliance for Green Revolution in Africa (AGRA). The call centre is promoted among the smallholder farmers in Community ICT hubs, also known as Radio Listening Groups (RLGs) across Malawi. The ACE introduced the 223 farmers' call centre, while Airtel Malawi introduced the Mchikumbe 212 farmers' call centre.

Usage of mobile phones can "improve access to information, reduce the cost of searching for information, improve coordination between various parties and increase market efficiency" (Simelane et al., 2019). It is with mobile phones that farmers can communicate faster with extension staff for assistance with agricultural advisories. Mobile phones have lessened the time needed by an extension worker to visit farmers physically for extension service delivery. Mobile telephones have "effectively reduced the distance between individuals and institutions, making the sharing of information and knowledge easier and more effective" (Simelane et al., 2019).

Simelane et al. (2019) proved that ICTs play a crucial role across the agricultural value chain. For instance, ICTs could assist with "providing or sharing information related to crop selection, land selection, and access to credit facilities during pre-cultivation; they could be used during the cultivation and harvesting phase for sharing techniques related to land preparation, sowing, and irrigation techniques; and during the post-harvesting stage, ICTs could be useful in sharing information related to marketing, transportation, packaging, and food processing."

1.1.2 Radio and mobile phone usage in agriculture extension in Malawi

Agriculture is Malawi's economic backbone, which contributes about 39% of the Gross Domestic Product (GDP), and most Malawians who live in rural areas rely on agriculture as a source of

income for their livelihoods (Kundhlande et al., 2014). Studies have shown that 80% of the smallholder farmers in Malawi use agricultural land, which means that "80% of the country's population depends on agriculture, and more than three-quarters of all farmlands are devoted to maize production, making it the primary food staple of the country" (Steinfield et al., 2015; Kundhlande et al., 2014; Manda & Chapota, 2015).

Extension is a dynamic concept, and its definition keeps changing, hence "there is no single definition of extension which is universally accepted or applies to all situations" (FAO, 1993). Nonetheless, extension is described by the Food and Agriculture Organisation (FAO) of the United Nations (1993), as "a process of working with rural people to improve their livelihoods, by increasing the efficiency of the farming family, production, and the standard of living of the farming family, which also involves helping farmers to improve the productivity of their agriculture and developing their abilities to direct their future development".

According to the International Telecommunications Union (2022) report, "there were a total of 12.28 million connections, among them were 12.27 million mobile phones, which corresponds to an average of 0.60 per person." This still shows that mobile penetration in Malawi is a bit on the lower side, as compared to developed countries.

The importance of mobile phones in Malawi cannot be overemphasized, as Katengeza et al. (2013) recommended in their study, that "farmers' access to mobile phones and use of such forms for agricultural marketing should be encouraged because it presents an opportunity to resolve the market information problems common in Malawi."

The history of agricultural extension in Malawi, therefore, can be traced back to 1907 (Knorr et al., 2007), when the British colonial powers established the Department of Agriculture, using Master Farmers, group approaches and the Block Extension System (BES). During this time, the BES was the official extension approach in Malawi's public extension service, with limited means by the field assistants to reach farmers, using the top-down communication approach.

A study by Farm Radio International (2020) found out that "radio, in combination with other ICTs such as mobile phones, offers an inclusive, personable and multi-dimensional communication platform." Radio programs give a platform to farmers to express issues of their concern, thereby engaging the duty bearers and holding them accountable.

Extension service delivery in Malawi is done by extension officers, who are known as Agriculture Extension Development Officers (AEDOs). These are frontline extension officers who are trained to use both face-to-face and electronic methods, to deliver agricultural advisory information (Masangano & Nthinda, 2012). Currently, there is a shortage of these frontline staff in the agriculture sector. According to the Agriculture Sector Wide Approach (ASWAP, 2010) and the Sustainable Agricultural Production Program (SAPP) 2010 reports, there are 2, 884 establishments in the Ministry of Agriculture. Out of this total number of establishments, 1, 788 have been filled, leaving a shortfall of 1, 096 establishments. This shortfall is being taken care of by digital media for extension service delivery.

A study by Erlangga et al. (2023) has shown that "Information Communication Technology (ICT) in agriculture plays a critical role in assisting the smallholder farmers to reach on-farm efficiency, and also stimulating producers to optimize their agriculture products' value, by connecting producers with retailers, agro-dealers, wholesalers, end-users, or even directly to urban or international markets." Such benefits can motivate farmers to start using fee-paying digital media for extension services for their agricultural needs.

The "rural populations in Malawi often lack reliable and accessible information sources that can help increase their agricultural productivity" (Steinfield et al., 2015, Masangano & Nthinda, 2012, Manda & Chapota, 2015), and radio is the most used ICT channel for rural Malawians to access agricultural information, enhanced with other ICTs such as mobile phones. The National Agriculture Policy (NAP) encourages the use of innovations to increase agricultural productivity. The NAP's Policy Priority Area No. 1 focuses on sustainable agricultural production and productivity, through the promotion of innovative and high-quality agricultural extension and advisory services, involving both public and non-state extension service providers. This is the genesis of digital extension service delivery in Malawi.

The recommended farmer-extension agent ratio in Malawi is 300/800:1, "depending on the farm size, and mode of settlement of farmers" (IDRC, 2019), but currently, the ratio stands at 3,000:1. This has necessitated the introduction of digital media for extension service delivery in Malawi, to complement the shortfall of extension officers.

1.1.3 Financial sustenance of digital technology for extension service delivery

The Extension and Advisory Services (EAS) system in Malawi is continuously receiving little or no funding at all, as evidenced by the annual budgetary allocation vote no. 190 for the Ministry of Agriculture. Information sourced from the Ministry of Finance, specifically the budget department, indicates that in 2012 – 2013, the Malawi government "spent US$ 4.2 million on agricultural extension, which constituted 1.6% of its annual agricultural spending".

From the 1980s, extension "tended to promote capital-intensive technologies which most low-resource farmers could not afford" (Masangano et al. 2017). This changed farmers' perception, and they started looking at extension as something "for the resource-rich and credit-worthy club members only." This could explain the low technology adoption by smallholder farmers since only the targeted farmers were the ones that were directly reached out to with extension services.

The International Telecommunication Union (2022) report indicated that "a monthly budget for mobile phone usage in Malawi was averaging US$ 7.70 (about MWK12,956)." This amount is a bit on the higher side for an average Malawian from the rural areas.

A study by Katengeza et al. (2013) recommended that the government in collaboration with mobile phone providers should work on reducing the calling/tariff rates to enhance use of mobile phones in Malawi." This was a direct recognizance of the fact that mobile phone charges in Malawi are expensive, and therefore not affordable to every Malawian, more so people that live in rural areas.

From 2017 – 2022, the budgetary allocation to extension services, according to the Malawi Government budget documents, has been going down, with zero funding in the 2017 – 2018 financial year; getting 2% of the total budgetary allocation for the Agricultural Productivity and Risk Management in the 2018 – 2019 financial year; 0.9% in the 2019 – 2020 financial year; 0.8% in the 2020 – 2021 financial year; zero funding in the 2021 – 2022, and 2022 – 2023 financial years (Budget Statements, n.d.).

The dwindling funding from the annual budgetary allocations, towards the Ministry of Agriculture, for the extension service delivery in Malawi, is a signal that indicates the need to start seeking funding from other sources, hence the coming in of international donor agencies, which are providing substantial resources for improving the agricultural extension, through the introduction of digital media extension services. Some of the key donors providing financial contributions

towards the extension services through the public and the private sectors are Flanders International Cooperation Agency (FICA); Irish Aid and USAID.

Before the emergence of digital platforms in the agriculture sector, the whole responsibility of extension service provision was left to the public sector, hence the consistent dwindling of public sector resources for extension (Masangano et al. 2017). The budgetary allocation, therefore, according to the budget documents, "has been sufficient only for staff salaries, with very little left for operational costs." For example, in the 2010/2011 financial year, "96% of the spending for extension was on salaries since the government could not maintain the provision of high-quality extension services with limited resources" (Budget Statements, n.d.).

The private sector has not been spared from the dwindling donor support. The ACE introduced the 223 farmers' call centre with funding from the GIZ and USAID. Currently, the call centre at ACE is being run with financial support from the Government of Flanders only.

The funding levels at FRT, however, have not been stable since 2017, an indication that there is a need to find stable and sustainable means of running the call centre. For instance, in 2017, FRT secured funding from 4 donor partners to the tune of US$1 million, surpassing its annual budget of US$750 thousand, representing 133.33%; but only managed to source 40% of funding in the 2018 financial year; 114% in the 2019 financial year; 147% in the 2020 financial year; and 8.5% in the 2021 financial year.

As proof of donor fatigue in the region, Somalia is on the verge of receiving reduced humanitarian aid, "due to donor fatigue compounded by multiple crises around the world that also require humanitarian support" (Maruf, 2023). Somalia, just like most African countries, "has been receiving humanitarian assistance for over three decades, but the economic situation does not seem to change for the better." Elongué et al. (2021) argued that "aid to Africa has made the poor poorer and growth slower, and that the aid culture has left African countries debt-laden, inflation-prone, more vulnerable to the vagaries of the currency markets and unattractive to higher-quality investment." While aid recipients are looking for more grants, donors are rethinking their strategies. Such changes in funding strategies motivated this study as one way of being proactive and getting ready with alternative means of making digital extension services still available for smallholder farmers in Malawi.

1.2 Problem statement

The importance of digital media for extension services to smallholder farmers in Malawi cannot be overemphasized, given the benefits that farmers get from such services, such as agricultural advisories and linkages to reliable and profitable markets. The over-reliance of subsidies from donor funding, however, is posing a threat to the sustenance of the subsidised digital media for extension services, such as the farmer call centre, since Malawi's annual budget depends on foreign aid, which accounts for around a quarter of the annual income (Pump Aid, 2023).

This study was, therefore, motivated by the general donor fatigue, including the lack of sustainability plans for the digital media for extension services, in order to ensure continued service provision for the smallholder farmers in Malawi. If the fee-paying digital media for extension services were to be introduced in Malawi, then there was a need to conduct a study to assess the readiness or preparedness of the smallholder farmers for the same.

1.3 Aim and objectives

1.3.1 Aim of the study

This study aimed to assess the level of readiness by the smallholder farmers to start utilizing the fee-paying digital media for extension service delivery in Malawi, as opposed to their over-reliance on free services, whose sustainability is not certain.

1.3.2 Study objectives

The objectives of this research were as follows:

i. To assess the level of awareness and knowledge among smallholder farmers about the existence of digital extension service delivery in the agriculture sector.

ii. To assess the level of importance attached to the digital extension services by the smallholder farmers for their agricultural activities.

iii. To assess the level of affordability of fee-paying digital media for extension services by the smallholder farmers in order to access agricultural-related information.

iv. To assess the smallholder farmers' readiness to start utilizing the fee-paying digital media for extension services.

1.3.3 Research questions and hypotheses

The research questions for this study are:

a. Are the smallholder farmers aware and knowledgeable about the existence of the digital media for extension services offered by players in the agriculture sector?
b. Do the smallholder farmers find the digital media for extension services beneficial for the enhancement of agricultural productivity?
c. Do smallholder farmers have the financial capacity to spend money on call charges to access agricultural-related information?
d. Are the smallholder farmers ready to start utilizing the fee-paying digital media for extension services for their agricultural needs?

Hypothesis

Smallholder farmers that have the financial capacity will be ready and willing to start utilizing fee-paying digital media for extension service delivery in Malawi.

1.4 Study rationale

Scholars have written about the importance of digital media for extension service delivery, and how such services are being utilized by smallholder farmers (Kamasweri et al. 2011; Cai et al. 2019; Tata and McNamara, 2016; Gebreegziabher et al. 2020; Manda and Chapota, 2015; Steinfield et al. (2015). Smallholder farmers in Malawi continue to enjoy accessing these subsidized digital media for extension services. With donor fatigue slowly creeping in, as evidenced by the dwindling budgetary support from the Malawi government towards extension service delivery between 2017 and 2022, it became necessary to start looking at other options that would make the provision of digital media for extension services more sustainable and viable to the service providers, while at the same time being accessible to the farmers.

As argued by Maruf (2020), “most African countries have been receiving humanitarian aid for decades and are on the verge of receiving reduced humanitarian aid, due to donor fatigue compounded by multiple crises around the world that also required humanitarian support.” Elongué et al. (2021) argued that “aid to Africa had made the poor poorer and growth slower, and that donors are now rethinking their strategies to make the grants more sustainable.” To avoid losing their money to leaky baskets, donors are shying away from unsustainable projects, and are opting for viable ones.

This study, therefore, was very important because it would give insights to the service providers of digital media for extension services to be proactive by putting in place semi-commercial services for purposes of sustainability. Such a model was encouraged by Manda and Chapota (2015), who

supported proposals that were enshrined in the Malawi Agricultural Extension Policy (2016) on cost sharing, demand-driven public-private partnerships and the farmer-pays approach to extension. The two scholars further cautioned that as the National Agriculture Policy (NAP) was being implemented, stakeholders had to determine "how much and the means through which the smallholder farmer could contribute, among other means, emphasizing the role of the Malawi government in devising strategies for funding agricultural extension without overburdening the poor smallholder farming communities."

The study would also help the policymakers, in this case, the Malawi Government, specifically the Department of Agriculture Extension Services (DAES), to put in place policies that would ensure the sustainability of the digital media for extension services. These digital media for extension services came in to complement the work of extension workers, who were very few as compared to the number of smallholder farmers that needed to be served (ASWAP, 2010; Manda & Chapota, 2015; Masangano & Nthinda, 2012). Taking out digital extension service delivery, therefore, would deny a lot of farmers the opportunity to access information on good agricultural practices, a development that would result in poor agricultural production and productivity. Furthermore, a study by Makate et al. (2016) had shown that "approaches like using technology to reach farmers directly with timely and tailored information, incentivizing trainers, and leveraging social networks to increase diffusion of information, had all been effective ways to increase the impact of agricultural extension programs."

1.5 Limitations of the study

The study was conducted in two Extension Planning Areas (EPAs): Malosa in Zomba district; and Nkanakhoti in Kasungu district, out of 9 EPAs and 8 EPAs in Zomba and Kasungu districts respectively. Given enough resources, the study would have been conducted in more than two EPAs. However, the two EPAs were randomly picked among six EPAs which were catchment areas for NGOs such as Farm Radio Trust, Agricultural Commodity Exchange (ACE) and Self-Help Africa, which were implementing projects on the usage of digital platforms. This excluded the possibility of any biases that would have affected the selection of the EPAs. Likewise, the two districts were randomly picked among four districts which were catchment areas for the same NGOs, which were championing digital extension services in Malawi. The results were therefore generalized for the rest of the EPAs in Malawi, since there were no significant differences among the study's variables of awareness, benefits, capacity and readiness.

1.6 Chapter summary

In this chapter, literature has shown that digital extension has enabled farmers to access real-time information through mobile technology, such as SMS and the call centre, including interactive radio programmes enhanced by Information and Communication Technology (ICTs). Some of the digital extension providers that have been highlighted in the chapter include the Department of Agriculture Extension Services, Farm Radio Trust, Self-Help Africa, the Agricultural Commodity Exchange, and Airtel Malawi. The problem, however, is that these services are running using funds from donor partners, such as the Government of Flanders, the World Food Programme (WFP), the United States Agency for International Development (USAID) and GIZ. Currently, the Government of Flanders is the only donor agency that is bankrolling the farmer call centres in Malawi. This is a signal that the donor support for digital extension delivery in Malawi will not be there forever, hence the need to find alternative financing options for the service.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter discusses the literature that underpins this study and has been categorised as follows: digital technology for agricultural extension service delivery; sustenance of digital media for extension services; farmers' readiness to start utilising the fee-paying digital media for extension services. The literature outlines the digital media for extension that are available as per this research study, how they are utilised by farmers, and the readiness of farmers to start utilising fee-paying digital media for extension services elsewhere.

2.2 Digital media for agricultural extension service delivery

AL-Sharafat et al. (2012) defined agricultural extension as "the dissemination of information, building the capacity of farmers using a variety of communication methods and helping farmers make informed decisions." These scholars have further observed that "agricultural extension has the potential to promote the adoption of new technologies and innovations, thereby bringing about changes through education and communication in farmers' attitudes, knowledge, and skills." It involves the "application of scientific research and new knowledge to agricultural practices through farmer education, organised by professionals from different disciplines".

The importance of using ICTs in the agriculture sector in Malawi is recognised by the Malawi Government, which developed policy documents such as the Malawi Growth and Development Strategy; the National ICT Policy; and the Communications Policy; and further observes that "ICT can stimulate and modernise national development sectors such as that of agriculture" (Manda & Chapota, 2015). The two scholars further argued that "while the Malawi Agricultural Extension Policy encourages cost-sharing and public-private partnerships and advocates for a demand-driven and farmer-pays approach to extension, the Malawi government was not very committed in terms of funding towards extension service delivery."

In Malawi, extension service delivery is done by extension officers, who are known as Agriculture Extension Development Officers (AEDOs), and they work in both government departments and the NGO sector (Masangano & Nthinda, 2012). These are frontline extension officers who are trained to use both face-to-face methods and electronic methods, to deliver agricultural advisory information.

The recommended farmer-extension agent ratio in Malawi "ranges from 300/800 farmers to one extension agent depending on the farm size, and mode of settlement of farmers, but currently, the ratio stands at 1:3,000" (IDRC, 2019), hence the introduction of ICT-enhanced initiatives to complement the efforts of the few extension workers. One such initiative is the introduction of a project known as Scaling up Radio and ICTs for Enhanced Extension Delivery (SRIEED) by Farm Radio Trust, a local non-profit organisation, with funding from the Flanders International Cooperation Agency.

The SRIEED project disseminated information for supporting ground nuts, soya beans, legumes, potatoes, and dairy value chain to over 500,000 farmers in Lilongwe, Mchinji, Nkhotakota, Kasungu, Mzimba, Salima and Mangochi districts in Malawi, using the digital platforms such as the SMS, IVR and call centre. The use of the multiple channels by the SRIEED project for information dissemination improved access to extension services. While trying to prove that digital platforms were a powerful tool for information dissemination, the study did not establish the sustainability mechanisms for such platforms, such as assessing the level of willingness by smallholder farmers to start paying for the digital extension service delivery, or any other commercial strategies that could be developed for the sustenance of the service.

2.3 Benefits of digital media for agricultural extension delivery

Mobile phones, which were once objects of luxury and privilege, have now become "a necessity, and a potent force for economic development in Africa" (Aker & Mbiti, 2010). This is an indication that even smallholder farmers value the importance of accessing information using various digital platforms. The Malawi Population and Housing Census of 2018, attested to this, as it found out that "out of the total households in Malawi (3,984,981), 51.7% had a mobile phone, 33.6% had a radio, 11.8% had a television and 16.4% had access to the Internet" (Kanyuka et al., 2020). At the regional level, "66.0% of households in the Northern Region had a mobile phone, 48.5% in the Central Region and 51.0% in the Southern Region." In the Northern Region, "16.4% of households had access to the Internet, 10.0% in the Central Region and 23.2% in the Southern Region." Access to the radio was at "37.1% in the Northern Region, 31.3% in the Central Region and 34.7% in the Southern Region. The landline was at 1.5% at the national level."

While the census delved into the purpose of mobile phones, radio, and TV, such as communication, it did not dig deeper to find out the type of information these gadgets were used for, including the means used to sustain the gadgets. This information would have been very helpful in determining

the users' preferences for such gadgets, and their levels of economic empowerment for the sustenance of the communications gadgets.

A project known as the Digital Integration to Amplify Agricultural Extension, Digital Green and Farm Radio International, was implemented in Ethiopia (IDRC, 2019), with funding from USAID, "to provide ICT-enabled improved agronomic practice information to over 800,000 farmers in Ethiopia's three largest regional states (Oromia, Amhara, and Tigray Regional State Governments), using radio, IVR, and videos." Household surveys conducted by the project showed that "about 130,000 farmers adopted improved agronomic practices promoted through the IVR." These are donor-funded initiatives, but the results of the study could not be attributed to the capacity of farmers to finance digital extension service delivery. While the study was able to prove that digital platforms had the potential to enable farmers to adopt Good Agricultural Practices (GAP) it failed to prove the farmers' capacity to sustain such services without the help of the donors, including the strategy to sustain the same in the absence of subsidies.

In Ethiopia and the Caribbean (Cai et al., 2019; Tata & McNamara, 2016; Gebreegziabher et al. 2020) digital extension "has proven to be a success, especially in participatory approaches in the agriculture sector, where it was used to facilitate training and adoption of agricultural technologies by supporting farmer learning, problem-solving, and accessibility to profitable markets for their crops." Going through the study, however, there was nothing that was talked about regarding the role the farmers were playing in making sure that they financially supported the service delivery system. It was not clear as to how the digital extension services were being supported, including the role being played by the government in making sure that smallholder farmers accessed the services with ease.

ESOKO, a for-profit private company in Ghana, "provided farmers with market information (primarily crop), weather information and climate-smart agricultural tips through voice messages, SMS messages (push and pull) sent to farmers' mobile phones or to a direct response to questions that the farmers submitted through IVR to ESOKO call centre." Through its Business-to-Business model (IDRC, 2019) ESOKO works with "donor-funded projects such as the USAID-funded Ghana Agricultural Development and Value Chain Enhancement (ADVANCE) project, with government entities such as the Ministry of Agriculture and with privately owned agribusinesses, which pay for farmers' access to ESOKO services." ESOKO ICT-mediated services reach an "estimated 1 million farmers of which 500,000 are in Ghana and the remaining in other parts of

Africa (Kenya, Tanzania, Benin, Burkina Faso, Nigeria, Malawi, Zimbabwe, Uganda)" (IDRC, 2019). Much as the service provision by ESOKO was working well for the smallholder farmers, the study did not dwell so much on the exit strategy for such donor-funded activities. The study should have touched on whether extension service delivery would be affected if USAID stopped funding such activities, including the smallholder farmers' production and productivity.

In Uganda, a project known as "The Enhancing Resilience to Water-Related Impacts of Climate Change, also known as Climate Change Adaptation and ICT" (CHAI) disseminated climate and agricultural information to over 250,000 farmers (IDRC, 2019), with funding from the International Development Research Centre, Canada, using interactive radio, SMS, IVR. A Total Cost of Ownership (TCO) was conducted by the project, however, for a full national rollout of the system in Uganda, and "was pegged at US $3.59/household/year, with US$3.17 of the amount supporting the dissemination of information via SMS only" (IDRC, 2019).

The IDRC report further stated that "a survey involving 640 households indicated that only 35% of the respondents were willing to pay for climate and agricultural information services in Uganda." In contrast, the remaining "65% were of the view that such information was a public good and should've been provided free of cost by the government." The study owed the success of the digital extension service delivery to the donor support in the agriculture sector and showed huge investment being made in digital extension service delivery but did not give an indication as to how long the donor support would last. There was a need to show the financing options that government would come up with, as an exit strategy. This was a gap that could be addressed in future studies.

Aker and Mbiti (2010) argued that "while the proliferation of mobile-based services and projects had the potential to promote economic development, there was a tendency by development agencies and donors to just focus on the provision of information technology, without properly assessing its effects." This scenario is like the current situation in Malawi where digital extension services are provided to the smallholder farmers for free, without focusing on future consequences if the donor funding dries up. This is where this research study tried to alert both the service providers and the beneficiaries to be proactive by having in place sustainable means of financing digital extension service provision in Malawi.

Just like in Malawi, the task of providing agricultural information to farmers in India was "primarily vested with the government agencies or the Public Extension System, and extension activities in India were carried out by state agriculture departments, private agri-business companies and NGOs, using mass-mediated broadcasts supported by trained agricultural extension personnel" (Kameswari et al., 2011). While India went for digital extension service delivery, the country still relied on funds from other sources to finance access to agricultural information by the farming communities, an area which remained a gap in terms of determining the willingness of farmers to pay for agricultural information. This is a gap that was also identified in Malawi, where the government was not adequately financing agricultural extension, hence the reliance by the players in the agriculture sector on donor funding.

Except for very few, "almost all the Agricultural extension departments in Africa are faced with several challenges and constraints that are common to many extension institutions in developing countries, such as inadequate finances and funding; lack of qualified and trained extension staff; poor, weak, and deteriorated infrastructure; lack or weak coordination mechanisms and functional linkages with the other institutions in both the public and private sectors; absence of quality control and impact assessment mechanisms; unclear extension mandates and lack of job descriptions for staff" (Qamar, 2005). Issues of inadequate funding for extension service delivery are a gap that needs to be addressed through this research.

The use of digital platforms has become very necessary to enhance the dissemination of agricultural information. In India for example, the government "acknowledged that knowledge deficits constrain agricultural productivity" (Kamasweri et al., 2011), and went further to recommend the use of Information and Communication Technologies (ICTs) for agricultural extension, "as one way of addressing the information needs of farmers, to ensure that agricultural extension becomes more diversified, knowledge-intensive, and demand-driven, thereby meeting the farmers' information needs." Digital extension has become part and parcel of the farmers' lives.

In China, Pinduoduo.com operates the country's "biggest agricultural platform, connecting more than 12 million farmers to its user base of 788 million consumers" (FAO, 2021); creating integrated programmes that address the value chains; organising what the smallholder farmers can plant and where they can sell; improving the agricultural practices of the local farmers. The FAO report has further indicated that these economically empowered farmers are willing to finance access to agricultural information through digital information due to the benefits they are getting from the

usage of such platforms, an indication that commercialisation of digital platforms is possible. The report, however, did not give an indication of the ranges of affordability for such services by the smallholder farmers, despite their capability to afford them. Such information would be very helpful to players in the agriculture sector to have an idea of what services to be introduced, and at what cost.

2.4 Farmers' readiness to utilize fee-paying digital media for extension services

Donor-funded initiatives for farmers have proven to be very useful in countries where the economy is not doing well, indicating that farmers would only be ready to start utilising fee-paying digital extension services if they saw economic value and benefits from them. In Latin America and the Caribbean for example, the Plantwise platform led by the Centre for Agriculture and Bioscience International (CABI) used a series of digital tools to "reach smallholder farmers with timely diagnosis of crop problems and recommendations to reduce the impact of pests and diseases on yields, including live online plant clinic sessions on Facebook which were launched by the Extension, Training and Information Services Division (ETISD) of the Ministry of Agriculture of Trinidad and Tobago to reach farmers during the lockdown caused by COVID-19 pandemic; SMS messages were used in Jamaica by the Rural Agricultural Development Authority (RADA) to quickly reach 2,553 farmers throughout the island with information to control the lettuce pest complex; Social media such as Facebook, YouTube and WhatsApp were widely used in Latin America and the Caribbean to increase farmers' reach, especially during the COVID-19 restrictions" (FAO, 2021).

Value addition has a higher likelihood of attracting farmers to pay for information based on their needs. In East Africa (Ethiopia, Kenya, and Tanzania), a mobile-phone agricultural platform called iCow was popularly used to "support smallholder farmers to address their farming priorities across livestock and crops virtually, in languages such as English, Kiswahili, Amharic, Tifygna and Orimiffo" (FAO, 2021). In addition to providing e-AEAS on livestock and crop production, iCow also "connected farmers to input providers, agricultural financial service providers, veterinary experts, agricultural extension service providers, NGOs, governmental and other value chain actors. Digital extension service delivery has proven to be a very powerful tool for information dissemination in the agriculture sector."

The commercialisation model for digital extension service delivery has been tested in other countries, but not in Malawi. In Ethiopia and Nigeria where studies on the commercialisation of

digital extension were conducted, factors like "demographic, institutional, socioeconomic factors, age, household income, frequency of extension contacts, farm size, credit access and family size, were noted to be some of the determining issues for the commercialisation of agricultural extension services" (Gebreegziabher et al., 2020), and farmers in Ethiopia were "willing to pay for extension services in exchange for profit-guaranteed specific advisories for their farms, hence the conviction that fee-based agricultural extension services would bring good service delivery."

In Kenya and Uganda, smallholders faced various barriers to accessing digital extension services, among others, "prohibitive calling rates and very high subscription fees for some services" (Frontiers of Agricultural Science and Engineering, 2021). While the study indicated that the smallholder farmers found the calling rates very prohibitive, it did not get the farmers' feedback on the calling rates they were comfortable paying for. This is a gap that needs to be addressed in future research.

In Ghana, a survey conducted by ESOKO/Ghana and the Agricultural Development and Value Chain Enhancement (ADVANCE-II) project involving 479 households found that "farmers' willingness to pay in cash for ICT-mediated information services was at 61%" (IDRC, 2019), the majority (71%) indicated that they were "willing to pay below US $0.18 per month, and in kind rather than cash." The study, however, did not give any hints on donor-funded projects, specifically on extension service delivery. The study should have done a comparison of the smallholder farmers that enjoyed subsidised services, and their reaction to fee-paying services, including their preference for the mode of payment for the same.

While analyses have been done in other countries cited above such as Ethiopia, Ghana, Kenya, and Uganda on the willingness of smallholder farmers to pay for digital extension service delivery, none have been conducted in Malawi. There was a need, therefore, to test the commercial services model of digital extension, and see how farmers would respond to such a revolutionary change.

2.5 Conceptual framework

This is an illustration of the variables to be studied and the relationship that is expected between or among the variables in the research (Singh, 2023). In this research, it was expected that the smallholder farmers who were aware of the existence of digital extension services would be able to appreciate the benefits of such services for their agricultural activities. It was also expected that

such farmers would be willing to pay for the financial sustenance of the digital extension services if the farmers could do so.

2.5.1 The motivation model of theory of expectancy

This conceptual framework was motivated by Victor Vroom's expectancy theory, which states that "the intensity of a tendency to perform in a particular manner is dependent on the intensity of an expectation that the performance will be followed by a definite outcome, and on the appeal of the outcome to the individual." In this study, it was the benefits of digital media that were expected to motivate the smallholder farmers to start utilizing the fee-paying digital media for extension services for their agricultural needs.

This conceptual framework, therefore, can be illustrated as follows:

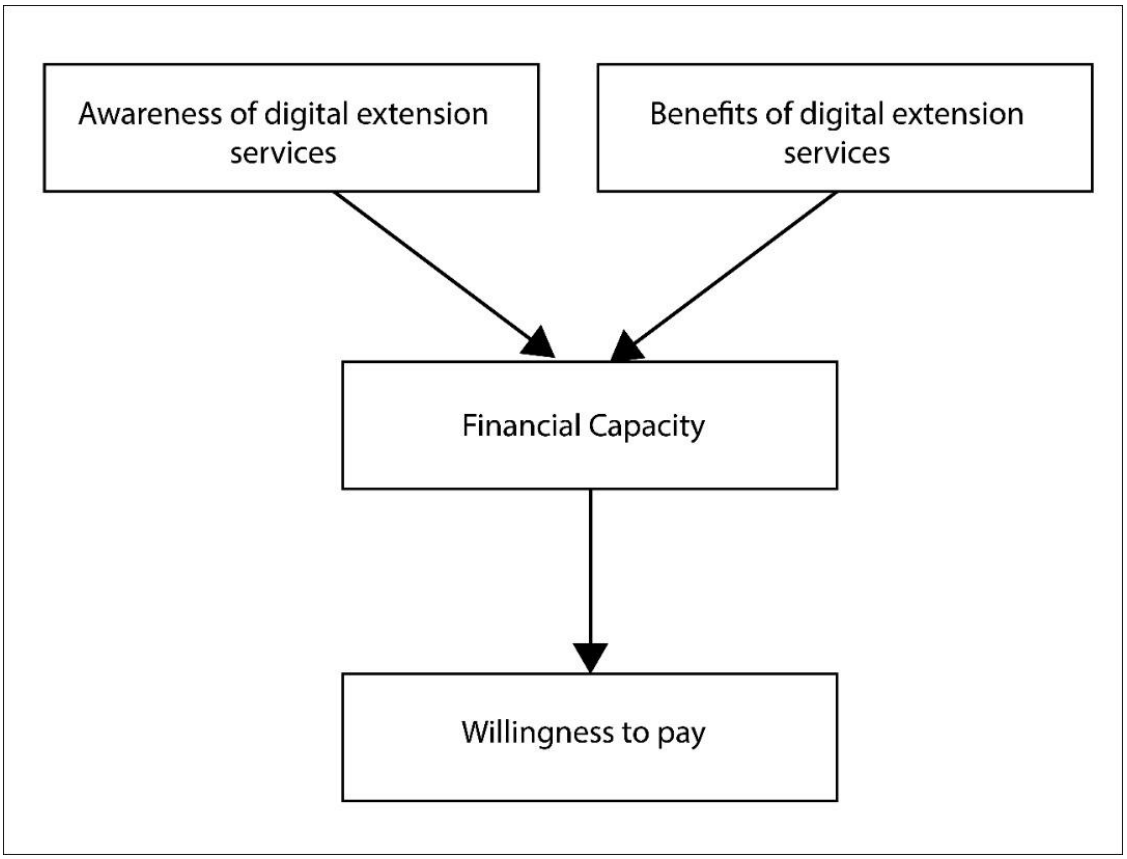

Figure 1: An illustration of the research conceptual framework

The four variables are explained as follows:

2.5.2 Awareness

Alordiah et al. (2023) defined awareness as "the capacity to be conscious of a new trend, such as a new technology or system." The scholars also defined knowledge as "the familiarity or comprehension of something or someone, such as ideas, information, descriptions, or abilities, gained by discovery or learning through experience or education." While knowledge "implies a thorough comprehension and acquaintance with a subject or technique, awareness does not" (Alordinah et al., 2023). In this study context, however, it was expected that the smallholder farmers who were exposed to digital extension services were both aware and knowledgeable about the services. It was further expected that the farmers would translate their broad understanding of digital extension services into a more thorough and specialised understanding of the usage of such services.

The research intended to determine if indeed the research participants were aware of the existence of the digital extension services in their locality and had used them. It was expected that the higher the awareness about digital extension services, the higher the likelihood that these farmers would be able to determine the benefits of such services and decide on whether they were ready to start utilising fee-paying digital extension services, and vice versa.

2.5.3 Benefits

The research intended to determine the level of importance the smallholder farmers attached to the benefits they got from accessing digital extension services. The expectation was that the farmers who found the services beneficial would be ready to start using fee-paying digital extension services to access agricultural information, and vice versa.

Fabregas et al. (2022) defined benefit as "something that produces good or helpful results or effects or that promotes well-being." About digital agriculture extension services, the scholars noted that such services "provide personalised advice tailored to specific regions, crops, and individual farmer needs, which in turn help the farmers to make decisions, leading to better crop yields, reduced input costs, and improved overall farm management." In other words, the digital extension platforms have the benefit of "bridging the knowledge gap, that had hitherto left millions of the continent's smallholder farming households struggling, to make meaning of their agricultural enterprises; allowing for low-cost, timely, and customised information delivery at scale; allowing for the delivery of dynamic information which requires continuous updates, such as weather information and market prices; delivery of information to farmers in remote areas with poor infrastructure,

conflict-affected areas beyond the reach of in-person extension services, and in contexts affected by natural disasters in which the delivery of time-sensitive information can be life-saving" (Fabregas et al., 2022).

2.5.4 Capacity

The research aimed to find out about the respondents' financial capacity about their readiness to start utilising the fee-paying digital extension services. It was expected that the farmers that had the financial capacity, and at the same time appreciated the benefits of the digital extension services, would be more willing to pay to access such services. On the other hand, the smallholder farmers who did not have the capacity would be less likely to pay to access the digital extension services.

Kansiime et al. (2022) defined financial capacity as "an individual's capability to manage their money-financial affairs and make relevant decisions while keeping in mind all possible financial-legal consequences of their acts." About digital extension, capacity by smallholder farmers was about ownership and control of digital devices, access to mobile phones and other ICTs, including other household items.

2.5.5 Readiness to utilise fee-paying digital media for extension services

It was expected that the smallholder farmers who were aware of the digital extension services, including their benefits, would be more likely to pay to access the agricultural-related information, especially if they had the financial capacity to do so. On the other hand, the smallholder farmers who did not have the capacity would be less likely to pay to access the digital extension services, even if they found such services very beneficial for their agricultural activities.

2.6 Theoretical framework

2.6.1 The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), as developed by Fred Davis and Richard Bagozzi in 1986, is an extension of the theory of reasoned action (TRA), which "assumes that when someone forms an intention to act, they will be free to act without limitation." Sennuga et al. (2021) have argued that "smallholder farmers get motivated to make certain decisions on the usage of technology based on several factors as highlighted in the TAM." The theory postulates that "the acceptance of technology is predicted by the users' behavioural intention" (Malatji et al., 2020), which is, in turn, "determined by the perception of technology's usefulness in performing the task

(the degree to which a person believes that using a particular system would result in enhanced job performance and output) and perceived ease of its use (the degree to which a person feels that the technology will need little or no effort)." The TAM assumes that "when users perceive that a type of technology is useful and easy to use, they will be willing to use it" (Malatji et al., 2021).

Smallholder farmers make decisions to use a technology "based on their individual cost-benefits thoughtfulness, such as value addition" (Sennuga et al., 2021; Rahimi et al., 2018). Since the TAM is based on the theory of reasoned action (Marikyan & Papagiannidis, 2023; James & James, 2023b), the decision by smallholder farmers to consider using fee-paying digital platforms for their agricultural activities will depend on the farmers' perceived usefulness and benefits for the same. The scholars' arguments are in line with the study's objective of determining the financial capacity of smallholder farmers to start accessing agricultural information using fee-paying digital platforms.

Over the years, the TAM has transformed into TAM2, with the incorporation of "new constructs and moderators such as subjective norm (a person's perception that most people who are important to him think he should or should not perform the behaviour in question), image (the degree to which use of an innovation is perceived to enhance one's status in one's social system), job relevance (an individual's perception regarding the degree to which the target system applies to their job), output quality (the perception of the quality of technology in performing the task), result demonstrability (tangibility of the results of using the innovation), experience and voluntariness" (Marikyan & Papagiannidis, 2023). These are some of the aspects the farmers take into consideration when using a technology, let alone adopting it. These arguments relate to the study's objective of determining the smallholder farmers' awareness of digital extension platforms.

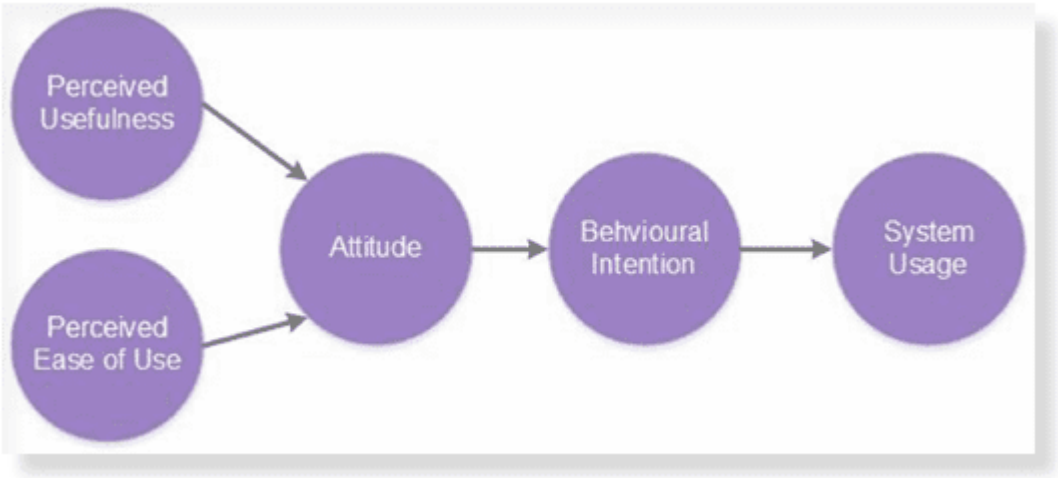

Figure 2: An illustration of the concepts of the TAM

The TAM has further been transformed into TAM3, and according to Marikyan and Papaginannidis (2023), the TAM3 has "three new moderation effects of experience on the relationships between computer anxiety and perceived ease of use, perceived ease of use and perceived usefulness, and perceived ease of use and intention to use." Once the technology is perceived as user-friendly, its adoption becomes very easy among the users. This study theorised that once the smallholder farmer became aware and knowledgeable about technology, including its usage and perceived benefits, then it would be easy for the farmer to decide to start using technology. The TAM3, therefore, is responding to the study's objective of determining the benefits of using a technology, including fee-paying digital platforms. Smallholder farmers were expected to start using technology once they saw the benefits of such technology, and this is what is key in the TAM.

Ease of use and usefulness are key in the TAM model since they form the prospective user's "subjective probability that using a specific application system will enhance their job or life performance, including the user's expectation that the technology will be free of effort" (Allen, 2023; Surendran, 2012). This argument is responding to the study's objective of determining whether the smallholder farmers are aware and knowledgeable about digital extension services, including the benefits for the same. Digital extension services such as the call centre can be described as easy to use since they can be accessed using any other type of mobile phone, and without any effort since the services are currently being offered to farmers for free. The call centre can be accessed by farmers who can barely read and write since they are free to speak in a language,

they are comfortable with and can describe the problems they are facing in their agricultural activities with ease.

Marikyan and Papaginannidis (2023) have argued that "an individual's decision to perform a behaviour is the result of the analysis of the benefit that they expect to receive from the behaviour, compared to the effort/costs they put in to perform the behaviour." Based on this argument, it was expected that the smallholder farmers would decide to start using technology, including the fee-paying digital platforms, regardless of the costs attached to them, as long as the benefits from such technology were satisfactory.

Perceived risk and perceived trust in technology are two other expansions of the TAM, as discussed by Worthington (2021), who has defined perceived risk as the "degree to which an individual believes that using the technology involves exposure to danger." The theory, therefore, further postulates that "as perceived risk increases, intentions to use the specific technology decrease" (Worthington, 2021). Perceived trust in technology, however, is "the degree to which an individual believes that the other party will act responsibly and will not attempt to exploit the user" (Worthington, 2021). The TAM, therefore, further stipulates that "as perceived trust increases, intentions to use the specific technology also increase." These expansions are responding to the study's objective of determining the benefits of technology for smallholder farmers, who might find it to be a risk if they don't get any benefits from using the digital extension services, such as the fee-paying call centre services, or being charged for an SMS they have received on their mobile device. On the other hand, the farmers may develop trust in the technology once they are convinced of the benefits they are getting from the usage of such technology, including payment for the same.

2.7 Chapter summary

The literature that has been reviewed in this study has shown that digital platforms have become essential tools for information dissemination in the agriculture sector. These tools are bridging the knowledge gap given the diminishing numbers of extension staff. The Information and Communication Technologies (ICTs) for agricultural extension, is a sure way of addressing the information needs of farmers, to ensure that agricultural extension becomes more diversified, knowledge-intensive, and demand-driven, thereby meeting the farmers' information needs. Literature has further shown that farmers would be ready to start utilising fee-paying digital extension services if they see economic value and benefits from them. Value addition is another factor that has a higher likelihood of attracting farmers to pay for information based on their needs.

Nonetheless, some gaps have been identified such as a lack of literature that proposes the viable financing options for the digital extension service delivery, including the feedback from farmers on what they would prefer to be affordable rates for the fee-paying digital extension services.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter discusses the quantitative method of data collection and analysis, including the probability sampling technique that was used to identify participants. The chapter also discusses why the study used the descriptive study design to analyse the data that was collected through the quantitative method. Other elements that are discussed in this chapter include the study population, sample size, data collection tools and analysis of the data, ethical considerations, research validity and reliability.

3.2 Research/study design

Research methodology is "the specific procedure or technique used to identify, select, process, and analyse information about a topic, including an explanation of how the data was collected, from where, and how it was analysed, to ensure reliable, valid results that address the aims and objectives of the study" (Blanchflower, 2018). This study used the quantitative method of data collection and analysis, with the pragmatism approach as its philosophy.

A research philosophy or paradigm refers to "a set of beliefs, assumptions, and principles about how data about a phenomenon should be gathered, analysed and used" (Jansen, 2023). This philosophy focuses on "the outcomes of action, meaning whichever theories are useful in a particular context, are thereby valid" (Blanchflower, 2018). This study took the pragmatism approach, using the quantitative method of data collection and analysis, to focus on the usefulness and applicability of the research findings, specifically to confirm whether the smallholder farmers are willing/ready to start using fee-paying digital extension platforms to access agricultural-related information.

Quantitative research was chosen for this study because the respondents, in this case, the smallholder farmers, were already exposed to digital extension services, hence the need to gauge their attitudes and behaviours towards the introduction of fee-paying services. The quantitative method also allowed the collection of a wide range of data from many respondents, and in turn, allowed the researcher to make determinations about the farmers' preferences as regards their readiness or willingness to start accessing the fee-paying digital extension services. The method "allows the measurement of different types of variables and describes frequencies, averages, and

correlations; the testing of hypotheses about relationships between variables; the testing of the effectiveness of a new treatment, program, or product" (McCombes, 2023).

According to Blanchflower (2018), the quantitative method "helps the researcher to explain causes and effects, correlations, or why things are the way they are." This study wanted to find out whether the farmers found digital extension beneficial to their farming, and whether such benefits could excite the farmers to start paying for such services. The quantitative method, therefore, was appropriate for this study because it gives the freedom to state pre-determined answers that are skewed towards the study's hypothesis, thereby building evidence either in favour or against the hypothesis.

3.3 Study design

This study adopted a survey design, where the respondents were asked standardised questions. Surveys allow researchers to collect "a breadth of either subjective or objective data from large samples and generalise to the larger population from which the sample was drawn" (Blanchflower, 2018) thereby ascertaining individuals' "attitudes, beliefs, opinions, or their reporting of their experiences and/or behaviours." The survey design was chosen for this study because of the need to show correlations between and among variables for the study, such as awareness, experience, benefits, and willingness.

The study used the cross-sectional design to get information from a sample at a particular point in time and to observe the variables without influencing them. The participants in this type of study are selected "based on variables of interest since the study is observational and descriptive" (MSEd, 2022; Wang & Cheng, 2020; Leavey, 2017). The cross-sectional design was chosen to collect large amounts of information from a large pool of participants with ease, and on different variables to see how they affected the smallholder farmers' willingness to start accessing information using fee-paying digital extension services, such as sex, age, educational status, and income. All these variables were assessed against willingness, which was the outcome variable in this study.

3.4 Study population and sampling

The population of this study was small holder farmers of Nkanakhothi EPA in Kasungu district in central Malawi, and Malosa EPA in Zomba district, in southern Malawi. These smallholder farmers were the target population because they are the ones who utilise digital extension services. They are organised into farmer groups, also known as Radio Listening Groups (RLGs). These

groups usually meet for various activities such as women groups, forestry groups, and Village Savings and Loans (VSL) groups, and later find time to listen to radio programmes with agricultural content, have access to the farmer call centre, and have an opportunity to make any agricultural inquiries, to improve their agricultural production and productivity, hence their exposure to the digital extension services since they also receive direct interventions from extension officers, including NGOs that provide extension services.

3.4.1 Sampling procedure and sample size estimation

Sample size is "the number of individuals, items, or data points selected from a larger population and included in a study or experiment, to represent a population" (Kibuacha, 2022). The number is often broken down into sub-groups by demographics such as "age, gender, and location so that the total sample represents the entire population." For a heterogenous population like the one for smallholder farmers, there was a need for a larger sample size to obtain some level of precision. To ascertain the levels of precision, confidence interval, and variability, Taro Yamane's formula was used to calculate the sample size: n = N/ 1+ N(e)2, where;

n is the required sample size from the population under study

N is the whole population that is under study

e is the precision or sampling error

The confidence interval shows "how confident the researcher can be that the results from a study reflect what the researcher would expect to find if it were possible to survey the entire population being studied" (Olonite, 2021); such as 54% or 66% if the confidence interval was 6 and 60% of the sample picked the same answer. The confidence level, however, refers to "the percentage of probability, or certainty that the confidence interval would contain the true population parameter when the survey is repeated" (Olonite, 2021).

As of June 2022, there were 20, 921 farming households in Malosa EPA in Zomba district. This was the total population for the study in Malosa EPA. Since the whole population could not take part in the study, Yamane's formula was used to calculate the sample size, and out of the total population, 392 were found as a figure for farmers that would take part in this study in that EPA alone. Nkanakhothi EPA on the other hand, had 15, 561 farming households, and after using

Yamane's formula to calculate the sample size, 390 was the figure that came out as the number of farmers that would take part in this study.

The smallholder farmers were identified through the district agriculture office (DAO), which has field-level structures such as the Extension Planning Areas (EPAs). It is at these EPAs where extension officers, known as Agriculture Extension Development Officers (AEDO), who work directly with the farmers, operate.

The sites for the study were chosen randomly among the districts and EPAs where digital extension interventions by private players in the agriculture sector were available and were being championed by Farm Radio Trust and the Agricultural Commodity Exchange. The assumption, therefore, was that these catchment areas were exposed to digital extension services, where the targeted beneficiaries, who were the smallholder farmers, could appreciate the importance of using digital extension platforms.

After adding the sample size for Malosa and Nkanakhothi EPAs, a total of 782 was found as the total sample size for the two EPAs, being the number of farmers that took part in the study.

This is how the sample size for participants in Malosa EPA was arrived at:

Sample size calculation for Malosa EPA in Zomba district.

The total number of farming households = **20, 921**

n = N/ 1+ N(e)2

$$= \frac{N}{1 + N(e)^2}$$

$$n = \frac{20\ 921}{1 + 20921(0.05)^2}$$

$$n = \frac{20\ 921}{53.3025}$$

n = 392

Therefore, the sample size for Malosa EPA was **392.**

Sample size calculation for Mkanakhoti EPA in Kasungu District was as follows:

Total number of farming households = **15, 561**

n = N/ 1+ N(e)2

$$= \frac{N}{1 + N(e)^2}$$

$$n = \frac{15\ 561}{1 + 15\ 561(0.05)^2}$$

$$n = \frac{15\ 561}{39.9025}$$

n = 390

Therefore, the sample size for Nkanakhothi EPA was **390.**

The two EPAs had two different sample sizes simply because the total population for one EPA was different from the other: 20,921 for Malosa EPA and 15,561 for Nkanakhothi EPA.

3.4.2 Sampling methods

This study used simple random sampling to give every smallholder farmer a chance of being selected to participate in the survey. It was possible to conduct the probability sampling because each of the two EPAs had a register of farmer groups, known as Radio Listening Groups, which were existent and active in the EPA, including the type of value chains the farmer groups were championing. The Radio Listening Groups are groups of farmers that "meet regularly over a given time to listen to audio programming and discuss issues and challenges they face to review awareness and content of programmes aimed to improve agricultural production and productivity, while at the same time addressing growing calls for better accountability to affected populations in the communities" (Parater, 2018). A list of all the members of the farmer groups was provided, and the participants for the survey were picked randomly from the list until the total sample size of 782 was reached.

3.5 Data collection

3.5.1 Data collection tools

This study used a questionnaire to collect the primary from the source or through direct interaction with the respondents and allowed the researcher to obtain firsthand information based on the research objectives. With this technique, the questionnaire, as a data collection instrument, was administered to the research participants through face-to-face interviews. The same questionnaire was also administered through a telephone interview when face-to-face interactions were not possible. The questions were crafted based on each variable for the study, such as general awareness and knowledge by the respondents about digital extension services; the benefits the smallholder farmers got from accessing the digital extension services; determining the financial capacity of the respondents; determining the readiness/willingness by the respondents to start accessing agricultural related information using fee-paying digital extension services. Each question had five (5) sub-questions, with five options of strongly disagree, somewhat disagree, neutral, somewhat agree and strongly agree. The options were rated on a scale of 1 – 5, where 1 was for strongly disagree, 2 was for somewhat disagree, 3 was for neutral, 4 was for somewhat agree, and 5 was for strongly agree.

Data collection for this research study was done using a questionnaire, which was administered through face to face and by telephone, especially for participants who were in hard-to-reach areas. The participants were gathered at one place, and one by one were interviewed over the telephone using the same questionnaire. The study used structured questionnaires, with closed-ended questions, and yes/no or either/or answers. These forced-choice or fixed-choice questions provided the respondents with a range of response options from which to select. This kind of question design allowed the study to collect data that was easy to quantify, with high generalisability. The forced-choice questions were in the form of multiple choice, checklists, and scales. The results of such questions can be extrapolated to make empirical statements that help in decision-making (Brace, 2018). The research used a cross-sectional design which “seeks information from a sample at one point in time” (Leavey, 2017). The survey questionnaire was loaded on an electronic data collection application known as Kobo Collect, and all the data was collected and stored electronically. In this way, there was no need to print the questionnaires since the responses were recorded electronically using the electronic gadget.

3.5.2 Data collection procedure

Ali (2023) and Mishra, (2021) defined data collection procedure/protocol as "documentation of details of the implementation of the research design and data collection, explaining how the data was obtained." The procedure/plan looks at the feasibility of undertaking the exercise, including identifying the unforeseen challenges.

An action plan/guiding tool for the data collection exercise for this study was drawn, detailing the tasks that were to be undertaken once the questionnaire was done. The tasks included translation of the questionnaire into the local language Chichewa; orientation of research assistants; loading the questionnaire onto the Kobo Collect application; pretesting the questionnaire with a sample of smallholder farmers; booking appointments with the farmer groups through the relevant government authorities such as the extension officers and traditional chiefs; completing the questionnaires; data entry and analysis; dissertation writing and submission.

The survey questionnaire was translated into the vernacular language to enable the respondents, most of whom had low literacy levels, to understand the questions, and to reduce ambiguity, while ensuring correct and consistent data collection exercise. After the translation was done, the enumerators/research assistants were oriented on the data collection exercise.

The survey questionnaire was pre-tested/piloted before the real data collection was done, to see if the planned procedure was practical and optimal. A group of 20 smallholder farmers were assembled for the pilot exercise. It was noted during the pilot exercise that information on the collection of mobile numbers as part of demographic information had to be taken out because some respondents were not comfortable giving their mobile numbers, and the wording of the question on capacity had to be reworked to ensure specificity on the actual amount spent on call charges per week.

3.6 Data analysis and management

3.6.1 Data analysis

Kelley (2023) and Calzon (2023) defined data analysis as "the process of cleaning raw data and extracting actionable, relevant information, including interpreting the data, which helps researchers make informed decisions, by providing useful insights and statistics, often presented in charts, images, tables, and graphs, to determine patterns, relationships, or trends." The process involves

coding the data, having all the relevant data available, and making sure that the data has the potential to answer the research questions, including supporting or refuting the hypothesis.

Under this study, the data was exported to Kobo Collect software and was entered into SPSS software, where it was coded to ensure that it was clean of errors. Values were also grouped and assigned to the survey responses to find trends, correlations, variations, and patterns in the research questions. The results were then interpreted to come up with a course (s) of action.

The study used the descriptive analysis method to interpret the results. Rawat (2021) defined descriptive analytics as "the process of using current and historical data to identify trends and relationships to spur decision-making." The method was therefore used to determine the number of men and women that participated in the survey, including the number of occurrences on each variable; determining the measures of central tendency, such as mean, median, and mode; determining the measures of dispersion (how spread out the individual scores were and how they differed from each other) such as the standard deviation.

Data analyses for the study were done using IBM® SPSS® statistics version 22. Before the actual data analysis, the collected data was screened for accuracy, by checking for errors in the data, such as any values that might have been outside the range of possible values for the variables. To ensure the instruments' internal consistency and reliability, analysis using Cronbach's alpha was calculated and reported. Pearson correlation was calculated to establish the association between variables assessed in the study. Descriptive statistics for all the tested variables was performed and Mean and Standard Deviation for all demographic sub-groups were calculated, because a higher standard deviation meant more significant variability, while a lower value would suggest that data points were closer to the mean. To test if there were any disparities in the study variables among population sub-groups, independent samples t-test, Chi-square and the Analysis of Variance (ANOVA) were used ($p < 0.05$).

3.6.2 Data management

Dey et al. (2018) and Zozus (2017) defined data management as "the process of creating organised, documented, accessible, and re-usable research data at all stages of a research project, from designing and planning the research to collecting and analysing the data, including publishing, archiving, and reusing the data after the research activity." Data management also helps in ensuring that research is shared in an accessible and reusable way. This entails a data management plan to

ensure that all aspects and requirements of data management are considered from the start of the research up to the end.

This study developed a data management plan, detailing the process for data collection; formats used for data collection; data collection methodology; data storage and backup; security for sensitive and personal data; management of intellectual property rights; and data sharing. In terms of data storage and sharing for this study, cloud sources and the repository at the Malawi University of Business and Applied Sciences (MUBAS) were the two options that were available for use. Cloud storage is affordable and highly reliable for backing up data since it enables real-time backup updates.

Kobo collect application, which was used during the data collection exercise for this study, is a cloud storage tool, and allows the exportation of the data for analysis, after completion of the data collection.

3.7 Ethical considerations

Fleming and Zegwaard (2018) and Catic (2017) defined ethical considerations in research as "a set of principles that guide the research designs and practices, which include voluntary participation, informed consent, anonymity, confidentiality, potential for harm, and results communication. For any research that involves human participants, it is important to seek human research ethics approval before the commencement of data gathering."

This study did not require the approval of an ethics committee for the research to be conducted, because it was of negligible, or low risk to the participants. According to Kıraç (2013), the term negligible risk in research refers to "research where there is no foreseeable risk of harm or discomfort; and any foreseeable risk involves no more than inconvenience." The scholar further described harm as "physical harms such as injury, illness, and pain; psychological harms such as feelings of worthlessness, distress, or fear; devaluation of personal worth such as being treated unjustly; social harms such as damage to social networks or relationships; economic harms such as the imposition of costs on participants; legal harms such as discovery and prosecution of criminal conduct."

None of the harms stated above were associated with this study. The research only required the participants to give up their time to participate in the survey, including giving consent for the same, to ensure that they were freely taking part in the interviews. Since the study was of low risk to the

participants, consent was sought from the Ministry of Agriculture, specifically from the Directors of Agriculture, Environment and Natural Resources (DAENRs) for Kasungu and Zomba districts, through written communication, before the commencement of data collection. Before the commencement of interviews with the research participants, the research assistants sought permission from the respective traditional chiefs where the farmer groups were located. This was done to ensure that the research was in line with and/or respected the local people's traditional beliefs and values.

Before the interviews, the research assistants sought consent from the respondents, by explaining to them the purpose of the study, and assuring them that the information that was being collected would be treated as private and confidential. The respondents were then given the option of either taking part in the study or excusing themselves from participating in the study if they didn't feel comfortable taking part in the study. The participants for the study were also advised not to give false information, as this would have jeopardised the study results.

3.8 Research validity and reliability

3.8.1 Achieving validity in quantitative research

According to Leavey (2017), and Heale and Twycross (2015), validity in quantitative research is "a measure of how accurately the study answers the questions and hypotheses it was commissioned to answer, to ensure its credibility and to avoid uncertainty on the integrity of the data." The scholars further highlighted the types of validity in quantitative research as "internal (where the results of a survey are internally valid if they measure what they are supposed to measure, providing credible results), external (the extent to which the results of your research can be applied to a broader context), construct (whether or not the instrument adequately covers all the content that it should, concerning the variable) and statistical validity (the extent to which the different instruments measure the same variable)." Datt and Chetty (2022) conceded validity "cannot be established with complete certainty, but the validity of the measuring instrument needs to be maintained."

To achieve validity, the study used the criterion/statistical validity method, specifically the convergent subset, where the results predicted a high correlation with the existing study instrument. The research findings indicated that the farmers' scores on their financial capacity negatively correlated with their readiness to start paying for digital extension services. This is evidence enough that these scores represented a valid measure. The cognitive interviewing technique was used,

during which the participants were asked on what they thought about the questions they responded to. The participants' thought process and cognitive understanding, helped the researcher to evaluate the quality of the survey questions and responses, thereby reducing the response error, since all possible difficulties or problems were identified.

3.8.2 Achieving reliability in quantitative research

Leavey (2017), and Heale and Twycross (2015) defined reliability as "the extent to which the results of a research study can be reproduced when the research is repeated over time, under the same conditions, and yields consistent results." Test re-test, inter-rater, internal consistency, Cronbach's alpha, and factor analysis are some of the types of reliability used in quantitative research.

To achieve reliability, internal consistency was used, which is the consistency of responses across the items on a multiple-item measure, to determine Cronbach's alpha coefficient. Cronbach's alpha is "the most used test to determine the internal consistency of an instrument, where the average of all correlations in every combination of split halves is determined" (Heale & Twycross, 2015), and is a number between 0 and 1. The study instrument had the following internal reliability tests: for awareness, the Cronbach alpha was 0.811; for benefits, it was 0.740; for capacity, it was 0.775 and for readiness, it was 0.727. This consistency in responses from the participants in the study was an indication that the measurements were very reliable.

3.9 Chapter summary

This chapter has defined research methodology as the specific procedure or technique used to identify, select, process, and analyse information about a topic, including an explanation of how the data was collected, from where, and how it was analysed, to ensure reliable, valid results that address the aims and objectives of the study. The study used the quantitative method of data collection, and survey research as its design, where the respondents were asked standardised questions. It also used the cross-sectional design to get information from a sample at a particular point in time and to observe the variables without influencing them. Smallholder farmers were the target population because they are the ones who utilise digital extension services. Nkanakhothi EPA in Kasungu district in central Malawi and Malosa EPA in Zomba district, in southern Malawi, were selected as the study sites for participation and were chosen randomly among the districts and EPAs where there were digital extension interventions by private players in the agriculture sector,

which were championing digital extension services, such as Farm Radio Trust and the Agricultural Commodity Exchange.

A sample size of 782 participants was calculated using Taro Yamane's formula: n = N/ 1+ N(e)2, and probability sampling, specifically simple random sampling, was used as a method of selecting the participants in the survey, to give every smallholder farmer a chance of being selected to participate in the survey. Data was collected using the primary data collection method, and a survey questionnaire with structured questions was used as a tool for data collection. The study used the descriptive analysis method to interpret the results and to identify trends and relationships to spur decision-making. This study did not require the approval of an ethics committee for the research to be conducted, because it was of negligible, or low risk to the participants. To achieve validity, the study used criterion/statistical validity, where the scores on a measure were correlated with other variables. A cognitive interview technique was used, and this helped in correcting all the possible errors in the survey questionnaire.

CHAPTER 4: FINDINGS AND DISCUSSION

4.1 **Introduction**

The findings of the study were presented using the descriptive analysis method, showing the relationships between and among variables. This study aimed to gauge the smallholder farmers' readiness towards fee-paying digital extension services in Malawi, to access agricultural-related information, such as the call centre and the SMS. The study results were based on the demographic characteristics of the respondents; the level of awareness and knowledge among the smallholder farmers about the existence of the digital extension service delivery in the agriculture sector; whether or not the smallholder farmers found the digital extension services beneficial for their agricultural activities; whether or not the smallholder farmers had the capacity to access fee-paying digital extension services; and the readiness of the smallholder farmers to start accessing agricultural related information using fee-paying digital extension platforms.

The following were the specific objectives for the study: to assess the level of awareness and knowledge among the smallholder farmers in Malawi about the digital extension service delivery in the agriculture sector; to assess whether the smallholder farmers in Malawi found the digital extension services beneficial for their agricultural activities; to assess the smallholder farmers' capacity to access fee-paying digital extension services.

4.1.1 Demographic characteristics

A total of 768 out of the intended 782 respondents participated in the study which was conducted with smallholder farmers who comprised men, women, and the youth. These farmers belonged to farmer clubs where they were already exposed to various agricultural technologies and they were easily reached out by the extension officers from both government and non-governmental organisations (NGOs), for direct agricultural interventions. The respondents were of different age ranges, education levels, years of experience as well as economic status.

Table 1: Demographic characteristics of study respondents (n = 768)

Participants' groups	Sub-groups	Frequency	Percentage
Gender	Male	278	36.19%
	Female	490	63.80%
Age range	18 – 30	18	2.34%
	31 – 40	393	51.17%
	41 and above	357	46.48%
Education levels	None	142	18.48%
	Primary	465	60.54%
	Secondary	152	19.79%
	Tertiary	9	1.17%
Economic status	High	464	60.41%
	Low	304	39.58%
Experience	Less than 1 year	135	17.57%
	More than 1 year	633	82.42%

The study found that 278 (36.19%) of the farmers that participated in the study were males while 490 (63.8%) were females.

The study also found that 2.34% (18) of the respondents were aged between 18 and 30 years, 51.1% (393) were between 31 and 40 years, and 46.48% (357) were 41 years of age and above.

In terms of the farmers' economic status, 60.41% (170 males and 294 females) were registered as of high economic status while 39.58% (108 males and 196 females) were registered as of low economic status.

The respondents were of different education levels as 18.48% (54 males and 88 females) of them did not attain any level of education; 60.54% (167 males and 298 females) attained Primary School level; 19.79% (54 males and 98 females) attained Secondary School level; and 1.17% (3 males and 6 females) went as far as tertiary level.

In terms of experience in using digital extension platforms, 17.57% (135) reported that they had less than 1 year of experience, while 82.24% (633) had more than 1 year of experience.

4.1.2 Descriptive statistics and correlation analysis for objective 1 of the study

The results of the study indicated that all the correlation coefficients for the variables were weak, ranging from 0.003 to 0.215. A positive correlation existed among the 3 variables of awareness, capacity, and readiness, with a significant positive correlation between capacity and readiness. This meant that an increase in one variable was associated with an increase in the other, and vice-versa.

A negative correlation existed between awareness and benefits. This meant that an increase in one variable resulted in a decrease in the other, and vice-versa.

Table 2: Descriptive statistics and Pearson correlations analysis among all study variables (n = 768)

Variable	Mean	SD	1	2	3	4
Awareness	4.58	0.251	1			
Benefits	4.54	0.301	-0.003	1		
Capacity	4.08	0.599	0.031	0.030	1	
Readiness	3.75	0.850	0.048	0.027	0.215**	1

** Correlation is significant at p <0 .001 level (2-tailed)

Table 3: Mean scores and SDs of study variables by gender, EPA and status (n = 768)

Variable	Gender				EPA				Economic Status			
	Male		**Female**		**Nkanakhoti**		**Malosa**		**High**		**Low**	
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
Awareness	4.58	0.244	4.59	0.256	4.60	0.222	4.57	0.277	4.59	0.256	4.57	0.244
Benefits	4.55	0.277	4.53	0.315	4.54	0.297	4.54	0.306	4.56	0.302	4.51	0.298
Capacity	4.06	0.577	4.09	0.612	4.07	0.565	4.09	0.632	4.06	0.590	4.11	0.613
Readiness	3.64	0.872	3.82	0.830	3.81	0.820	3.70	0.876	3.81	0.802	3.66	0.912

Table 4: Mean scores and SDs of study variables by experience and education (n = 768)

Variable	Experience				Education							
	<1yr		**>1yr**		**None**		**Primary**		**Secondary**		**Tertiary**	
	M	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***	***M***	***SD***
Awareness	4.60	0.221	4.58	0.258	4.60	0.276	4.59	0.245	4.56	0.249	4.62	0.253
Benefits	4.58	0.246	4.53	0.311	4.57	0.331	4.53	0.293	4.52	0.286	4.41	0.467
Capacity	4.00	0.604	4.10	0.597	4.15	0.557	4.06	0.622	4.05	0.572	4.33	0.387
Readiness	3.57	0.876	3.79	0.840	3.69	0.868	3.79	0.850	3.71	0.842	3.77	0.678

4.1.3 Levels of awareness, knowledge and readiness to access fee-paying digital media for extension service delivery

The study used a one-sample t-test to further determine whether the four variables of awareness, benefits, capacity, and readiness had any influence over the other. Each variable was measured on a test value of 3.0 (a median on a 5-point Likert scale). A score significantly lower than 3.0 meant

that the farmer perceived the variable to be low while a score significantly higher than 3.0 meant that the farmer perceived the variable to be high. The one sample t-test results are shown in Table 5. From these results, the farmers perceived all the variables as high (p >0.001).

Table 5: Awareness, benefits, capacity, readiness (n = 768; test value = 3)

Variable	**Mean**	**SD**	**t (767)**	**p-value**
Awareness	4.58	0.251	174.88	0.000
Benefits	4.54	0.301	141.70	0.000
Capacity	4.08	0.599	50.18	0.000
Readiness	3.75	0.850	24.69	0.000

4.1.4 The role of the demographic characteristics on the study variables

The study involved both male and female participants and aimed to check if gender had any significance on the four variables of awareness, benefits, capacity, and readiness.

To check if there were significant differences between male and female participants on the study variables, an Independent Samples t-test was used (see Table 6). On readiness, there were significant differences between male and female participants (p< 0.05), with female participants having a higher score than their male counterparts. Regarding awareness, there were no significant differences between male and female participants ($p > 0.05$). Concerning benefits, there were no significant differences between male and female participants (p > 0.05). Concerning capacity, there were no significant differences between male and female participants (p > 0.05).

Table 6: T-test results for gender differences

Variable	Male		Female		t(767)	df	p-value
	M	***SD***	***M***	***SD***			
Awareness	4.58	0.244	4.59	0.256	-0.172	766	0.864
Benefits	4.55	0.277	4.53	0.315	0.488	766	0.625
Capacity	4.06	0.577	4.09	0.612	-0.746	766	0.456
Readiness	3.64	0.872	3.82	0.830	-2.876	766	0.004**

** Correlation is significant at p <0 .005 level (2-tailed)

Regarding the differences in locations between participants residing in Nkanakhothi and those from Malosa, an Independent Samples t-test was used (see Table 7). There were no significant differences in all variables between the participants in Nkanakhothi EPA in Kasungu district, and those in Malosa EPA in Zomba district (p>0.005).

Table 7: T-test results for geographical locations

Variable	Nkanakhothi		Malosa		t(767)	df	p-value
	M	*SD*	*M*	*SD*			
Awareness	4.60	0.22	4.57	0.27	1.56	766	0.11
Benefits	4.54	0.20	4.54	0.30	0.18	766	0.85
Capacity	4.07	0.56	4.09	0.63	-0.29	766	0.76
Readiness	3.81	0.82	3.70	0.87	1.78	766	0.07

Concerning the differences in economic status of the participants, an Independent Samples t-test was used to discover the disparities between participants with high economic status and low economic status (see Table 8). There were no significant differences among the participants who were of either high or low economic status about the four variables of awareness, benefits, capacity, and readiness ($p>0.005$).

Table 8: Demographic characteristics: economic status

Variable	High		Low		t(767)	df	p-value
	M	*SD*	*M*	*SD*			
Awareness	4.59	0.25	4.57	0.24	1.08	766	0.27
Benefits	4.56	0.30	4.51	0.29	2.06	766*	0.04
Capacity	4.06	0.59	4.11	0.61	-0.93	766	0.35
Readiness	3.81	0.80	3.66	0.91	2.33	766*	0.02

*Significant at P <0.001

To find out if there were significant differences concerning the length of exposure to digital extension services on the study variables, an Independent Samples t-test was used (see Table 9). There was a significant difference in readiness about the length of exposure to digital extension services ($p<0.005$), with those who were exposed for more than one year being more willing to start accessing fee-paying digital extension services than those who had less than 1 year of exposure.

Table 9: Demographic characteristics: length of exposure to digital media for extension service delivery

Variable	Less than 1 year		More than 1 year		t(767)	df	p-value
	M	*SD*	*M*	*SD*			
Awareness	4.60	0.22	4.58	0.25	0.97	766	0.334
Benefits	4.58	0.24	4.53	0.31	1.85	766	0.064
Capacity	4.00	0.60	4.10	0.59	-1.74	766	0.081
Readiness	3.57	0.87	3.79	0.84	-2.80	766	0.005**

** significant at p <0 .01 level (2-tailed)

One-way analysis of variance (ANOVA) was conducted to compare the study variables, first, among the three sub-categories within the age range, and second among the four sub-categories within education status sub-groups. Regarding age range, significant results were observed on readiness only across the three age groups [F(2,765) = 4.484, p = 0.012]. Concerning the other variables, there were no significant differences across the three age groups (p > 0.05). Regarding education level differences, there were no significant differences across the four education levels (p > 0.05). See Table 10.

Table 10: ANOVA results showing demographic differences of study variables (n = 768)

Group	Variable	Characteristics	No	Mean	SD	F	p-value
Age-range	Awareness	18-30yrs	18	4.60	0.23	F(2,765) = 0.67	0.93
		31-40yrs	393	4.58	0.24		
		41 above	357	4.59	0.25		
	Benefits	18-30yrs	18	4.65	0.27	F(2,765) = 1.28	0.27
		31-40yrs	393	4.54	0.30		
		41 above	357	4.53	0.30		
	Capacity	18-30yrs	18	4.15	0.59	F(2,765) = 1.42	0.24
		31-40yrs	393	4.05	0.58		
		41 above	357	4.12	0.61		
	Readiness	18-30yrs	18	4.09	0.64	F(2,765) = 4.484*	0.01
		31-40yrs	393	3.67	0.88		
		41 above	357	3.82	0.80		
Education	Awareness	None	142	4.60	0.27	F(2,765) = 0.57	0.63
		Primary	465	4.59	0.24		
		Secondary	152	4.46	0.24		
		Tertiary	9	4.62	0.25		
	Benefits	None	142	4.57	0.33	F(2,765) = 1.26	0.28
		Primary	465	4.53	0.29		
		Secondary	152	4.52	0.28		
		Tertiary	9	4.41	0.46		
	Capacity	None	142	4.15	0.55	F(2,765) = 1.42	0.23
		Primary	465	4.06	0.62		
		Secondary	152	4.05	0.57		
		Tertiary	9	4.33	0.38		
	Readiness	None	142	3.69	0.86	F(2,765) = 0.69	0.55
		Primary	465	3.79	0.85		
		Secondary	152	3.71	0.84		
		Tertiary	9	3.77	0.67		

*Significant at p <0 .05 level (2-tailed)

The post hoc comparisons using the LSD test on readiness indicated that the mean score for the participants aged 31 – 40 was higher than those aged 18 – 30 (*MD* = 0.419, $p > 0.005$) and participants aged 31-40 had a significant lower score than those aged 41years and above *(MD* = -0.151, $p < 0.05$).

4.1.5 Predictors of readiness to access fee-paying digital extension services

The study further aimed to find out if awareness, benefits, and capacity of the participants as regards digital extension service influenced their readiness to access fee-paying digital extension services. Linear regression was used to test if these variables significantly predicted readiness to access fee-paying digital media for extension service delivery. Capacity was the only variable that was accepted in the prediction model, and it was statistically significant, [$F(3,764) = 12.917$, $p = 0.000$] and accounted for approximately 5% ($R^2 = 0.048$) of the variance of readiness. Participants' readiness to access fee-paying digital media for extension service delivery was therefore positively predicted by capacity [$\beta = 0.213$, $t = 6.023$, $p < 0.001$]. These results indicated that the higher the capacity of the participants in terms of their economic status, the more they were willing to pay for the digital extension services. Awareness and benefit did not predict readiness ($p > 0.05$).

4.2 **Discussion of findings**

This study aimed to assess the readiness of smallholder farmers in Malawi, to start utilizing fee-paying digital media for extension service delivery, such as the call centre and the SMS. The objectives of the study were to assess the level of awareness among the smallholder farmers in Malawi about the existence of digital extension service delivery in the agriculture sector; to assess whether the smallholder farmers in Malawi found the digital extension services beneficial for their agricultural activities; to assess the level of the smallholder farmers' capacity to access agricultural related information using fee-paying digital extension platforms in Malawi; and to assess the readiness by the smallholder farmers to start using fee-paying digital media for extension service delivery.

The analysis for the study showed that perception of all the variables of awareness, benefits, capacity, and readiness was high. Due to the exposure of the farmers to digital media for extension services, the farmers that took part in this study were all aware of the existence of digital extension services and knew the benefits of such services. The farmers also indicated that they were ready to start accessing fee-paying digital media for extension service delivery. Those who had enough capacity indicated more willingness, as compared to those who indicated they had less capacity.

A study conducted by Krell et al. (2020) on smallholder farmers' use of mobile phone services in central Kenya, specifically on a mobile phone technology known as m-service, found that "membership in farmer organisations/groups positively influenced m-service use, as farmers in such groups were more likely than non-members to use m-services." M-services in Kenya were used to "deliver electronic media content through mobile technologies and were an umbrella term that included m-agri, m-commerce, m-banking, or m-payments and came in varied forms, including Short Message Service (SMS), Unstructured Supplementary Service Data (USSD), mobile applications (apps) and helplines" (Krell et al., 2020).

This study which was conducted in Kenya justifies the results of this research, in terms of the relationship between exposure to digital media for extension services and the levels of awareness and knowledge about such services. Farmers who are organised in groups can access direct interventions from extension workers as well as private actors in the agriculture industry that are championing digital media for extension service delivery. Such exposure increases the farmers' awareness and knowledge about digital media for extension services.

Singh et al. (2023) emphasised that "farmer groups such as farmer field schools (FFSs), farmer business schools (FBSs), farmer clusters, and radio forums, help farmers to innovate, facilitating solutions to their concerns, and even changing farmer behaviours." These learning groups are also "a site for the fast spread of tacit knowledge, and they improve farmers' adoption of beneficial practices."

What farmers are exposed to in these organised groups also agrees with the Technology Acceptance Model (TAM), which argues that "acceptance of technology is predicted by the users' behavioural intention" (Malatji et al., 2020), which is, in turn, determined by the "perception of the technology's usefulness in performing the task, and perceived ease of its use." The TAM assumes that "when users perceive that a type of technology is useful and easy to use, they will be willing to use it." Farmers learn about the usefulness of technologies in farmer groups, and this explains the high levels of awareness, benefits, and knowledge in the farmers' responses in this study.

On demographic results, this research involved both male and female participants, and aimed to check if gender had any significance on the four variables of awareness, benefits, capacity, and readiness, specifically on issues to do with exposure to digital media for extension service delivery. The male participants that took part in the study comprised 36.19% of the sample, while 63.8%

were female. The dominance of women in agricultural activities has also been attested to by Asamu et al. (2020), whose research indicated that "women constitute 70% of agricultural workers, 80% of food producers, 100% are involved in the processing of essential foodstuffs, while 60 to 90% undertake marketing, and that out of every ten agricultural workers in the world, four are women." It was not surprising therefore, to find a lot of women in the farmer groups under this study, as compared to men. A UN Women report (2016), indicated that "in Malawi, just like in most African countries, women are essential to agricultural productivity, as they make up 70% of the agricultural labor force; produce 70% of household food and perform between 50 and 70% of all agricultural tasks." A report by Heifer International (2022) indicated that "in South Asia and sub-Saharan Africa, 60% of women work in agriculture, and as primary caregivers, women fell duty bound and accountable for a large portion of informal and unpaid work, responsible for most household duties."

Regarding awareness, there were no significant differences between male and female participants, and neither were there any significant differences between male and female participants regarding benefits. Based on the selection criteria for the research participants, the target population was smallholder farmers that were already exposed to digital extension services. Though it is widely recognised that "women throughout the world play significant roles in the production and management of crops, women farmers tend to have less access to agricultural information and training than men" (Ragetlie et al., 2022) as agricultural extension has "historically marginalised women." However, in this study, men and women that were picked for participation, had the same exposure and opportunities for accessing digital extension services, hence the lack of differences in knowledge about the existence and benefits of the services, despite the gender differences.

Gebre et al. (2019) acknowledged that "it is difficult to ascertain differences between gender on technology adoption, but in a study conducted on gender differences in the adoption of agricultural technology: The case of improved maize varieties in southern Ethiopia, the scholars found out that that females in male-headed households and males in female-headed households independently or jointly make decisions." This implied that either a male or female, not both, was the dominant decision maker in male- and female-headed households, respectively. Based on this scenario in Ethiopia, therefore, it can be argued that "agricultural technology adoption in relation to gender is context-specific and common conclusions are challenging to reach" (Gebre et al., 2019).

The example from Ethiopia is consistent with the results in this study, which indicated that there were no gender differences when it came to awareness and knowledge among male and female participants in the farmer groups because the men and women in the farmer groups were both in control of their situation, since they were all treated equally in the groups, regardless of their gender. Such treatment empowered both men and women to behave as if they oversaw either male-headed households if they were men, or female-headed households if they were women.

Mutenje et al. (2016) acknowledged that "gender inequalities constrain women more than men in competitiveness and entrepreneurship, and further recommended that improving access to requisite resources (such as land, seed, and fertilizer) for rural women to the same extent as men, would increase agricultural production by 20%." Such strategies are employed in group dynamics in farmer groups, where exposure to technology adoption is done without considering one's gender. It is therefore important to understand the "dynamic processes of technology change related to gender and agriculture innovation, to enhance faster and sustained agricultural growth, particularly in sub-Saharan Africa, where gender disparities tend to be greatest among the poor" (Mutenje et al., 2016).

As per the study's hypothesis, that smallholder farmers that had enough capacity would be willing to start utilizing fee-paying digital media for extension services, the participants in this study were able to express their opinion about their readiness to start accessing fee-paying digital media extension services. Those that indicated higher levels of capacity were more willing than those with less capacity. This was due to their exposure to these services, and their attitudes towards the same. Capacity in the hypothesis, however, was a condition for accessing the fee-paying digital media for extension services, but the results have shown that even smallholder farmers with less capacity were still ready to start accessing the fee-paying digital media for extension services.

Ullah et al. (2022), highlighted that "awareness and knowledge of a technology is very crucial, as it is an important aspect of the adoption decisions of farmers, because even if a farmer is a potential adopter, he/she may not adopt because of their low awareness of the technology and its benefits, since the farmer's awareness shapes a household's positive or negative perceptions towards technology."

Concerning capacity, there were no significant differences between male and female participants, even though the study findings indicated that 60.41% were registered as of high economic status

while 39.58% were registered as of low economic status. This was probably due to the participants' involvement in farmer groups, where they are involved in various income-generating activities. However, rural women in low and middle-income countries "are being left behind, as they are 7% less likely than men to own a mobile phone, and 16% less likely to use smartphones" (Ragasa et al., 2013), hence they are being "excluded from digital services, like online banking, placing orders online, e-learning or simply pursuing their interests online." Beaman et al. (2016) found out that "the adoption of agricultural technologies was easier and faster for farmers who were organised in groups, and even in households that had links to trained lead farmers, including the increase in knowledge."

This could be cemented by the Technology Acceptance Model (TAM), which argues that technology is accepted and adopted based on individual cost-benefit thoughtfulness, such as value addition" (Sennuga et al. 2021; Rahimi et al., 2018), "subjective norm, image, job relevance, output quality, result demonstrability" (Marikyan & Papagiannidis, 2023).

Regarding the differences in locations between participants residing in Nkanakhothi EPA in Kasungu district and those from Malosa EPA in Zomba district, it was noted that there were no significant differences. This was due to the farmers' exposure to the digital extension services that are available in their localities. Literature has also shown that ICT and development efforts are now centred on the use of mobile phones to help smallholder farmers improve their access to information, financial services, and markets. Research findings by Steinfield et al. (2015) have shown that "mobile phone owners are more likely to receive information on farming practices, pests and diseases, and livestock from their agricultural extension officers and radio than non-phone owners." The scholar also found out that "mobile phone owners use the radio more than non-phone owners for information on seeds as well as the weather." Aker & Mbiti (2010) have acknowledged the fact that "mobile phones have now become a necessity and a potent force for economic development in Africa." This is an indication that even smallholder farmers value the importance of accessing information using various digital platforms.

To find out if there were significant differences concerning the length of exposure to digital extension services on the study variables, it was noted that there was a significant difference in readiness, with those who were exposed for more than one year being higher than those who were exposed for less than one year. This meant that the longer the farmers were exposed to digital media for extension services, the more experienced they became in terms of usage of such services, as

17.57% of the respondents reported that they had less than 1 year of experience, while 82.24% had more than 1 year of experience.

Ullah et al. (2022) outlined some factors determining farmers' decision to adopt new technologies, which include “length of exposure to the technologies such as the number of contacts with extension services per year, and years of farming experience.” Farming experience, therefore, “increases the awareness of farmers and their ability to adopt improved agricultural practices, hence the expectation that farmers’ experiences will have a positive influence on their awareness and adoption of the extension-recommended agricultural practices” (Ullah et al., 2022).

Regarding age range, significant results were observed on readiness only across the three age groups of 18 – 30 years, 31 – 40 years, and 40 years and above. Concerning the other variables, there were no significant differences across the three age groups. Regarding education level differences, there were no significant differences across the four education levels of those who did not go to school, those who attended primary education level, those who attended secondary education level, and those who attended tertiary education level.

The findings have shown that the farmers aged between 18 and 30 years showed signs of readiness to access the fee-paying digital media for extension services than those aged between 31 and 40, and those above 40 years of age. It can be concluded, therefore, that the higher the age, the less the interest in digital technology, and therefore the less the interest to access fee-paying digital media for extension service delivery. This can be true of age, as Adil et al. (2013) found out that in Pakistan, there was an association between the level of age and daily time spent on a computer, as people who used computers for more than 5 hours belonged to the lower age group. So, the older the person, the less interested they become in digital technologies.

Even though technology adoption in the United States is high, a study conducted by Köttl et al. (2022) has shown that “25% of people aged 65 and older do not engage in internet activities due to various reasons, among them socioeconomic factors such as low educational levels or low income.” It can therefore be concluded that the older generation is less interested in technology adoption, let alone paying for it to access agricultural content.

In their study conducted in Bangladesh, Rwanda, and Zambia, Ogunmodede et al. (2022) found that “there was a significant negative relationship between age and the farmer's willingness to pay for agricultural content in the sense that younger farmers were more willing to pay to access plant

clinic services than older ones." Heinz (2018) noted that a digital divide exists between older and younger users of technology, arguing that "older adults are less likely to adopt and use technology, but was quick to admit that researchers had not yet studied the specific individual characteristics influencing technology adoption among older users."

This augurs well with the Technology Acceptance Model (TAM) as highlighted by Sennuga et al. (2021) that "smallholder farmers get motivated to make certain decisions on the usage of technology based on several factors such as the users' behavioural intention, which is, in turn, determined by the perception of technology usefulness in performing the task, and perceived ease of its use." The TAM assumes that "when users perceive that a type of technology is useful and easy to use, they will be willing to use it." Older persons, therefore, might not find technology very easy to use, hence their reluctance to adopt it.

The study further aimed to find out if awareness, benefits, and capacity of the participants as regards digital media for extension service influenced their readiness to access fee-paying digital extension services. The findings showed that the participant's readiness to access fee-paying digital media for extension services was positively predicted by capacity. The results, therefore, indicated that the higher the capacity of the participants in terms of their economic status, the higher their readiness to pay for the digital media for extension services. Awareness and benefits did not predict readiness.

As conceptualized in this study, it was expected that the smallholder farmers who were aware of the existence of digital media for extension services would be able to appreciate the benefits of such services for their agricultural activities. It was also expected that such farmers would be ready to start accessing agricultural content using fee-paying digital media for extension services if they had enough capacity to do so, as illustrated in the figure below:

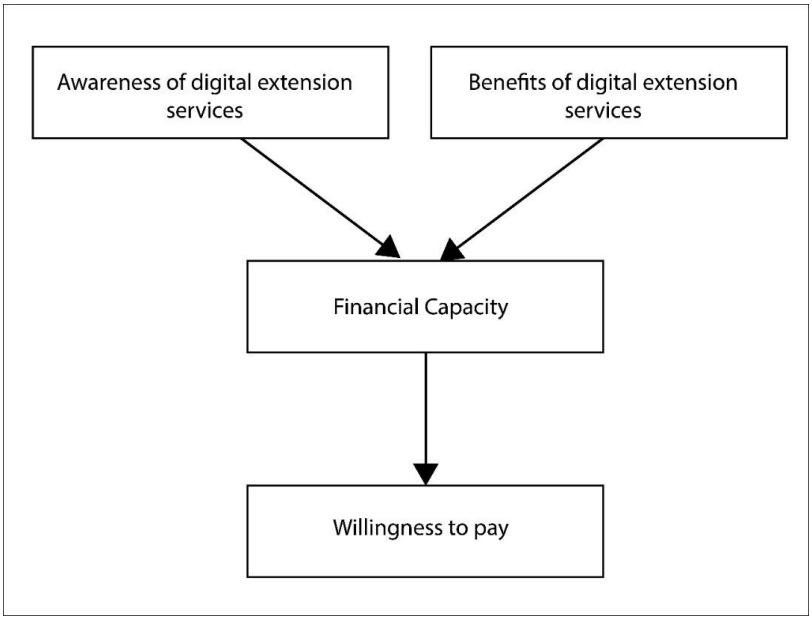

Figure 3: Aspects of the study's conceptual framework

A study conducted in Ethiopia and Nigeria (Gebreegziabher et al. 2020), showed that apart from the capacity of farmers, the commercialisation of digital extension was also affected by other issues such as socioeconomic factors, age, household income, and credit access. Farmers were also willing to pay for extension services under the condition of profit-guaranteed specific advice for their farms.

On readiness, however, there were significant differences between male and female participants, with female participants having a higher score than their male counterparts. Even though women have less access to mobile phones and are less empowered economically (Mpogele et al., 2008), there are more women in the farmer groups as compared to men, hence the higher scores on readiness to start accessing fee-paying digital extension services, due to their interest in agricultural activities at the household level, and the caregiving responsibilities the women have.

Hidrobo et al. (2020) noted that "the farmers' willingness to pay for agricultural information in Ghana was dependent on the prices that were being charged." In Kenya and Uganda for instance (Frontiers of Agricultural Science and Engineering, 2021), "smallholders faced various barriers to accessing digital extension services, among others, prohibitive calling rates and very high subscription fees for some services." It is clear, therefore, that farmers in Ghana were ready to start accessing agricultural information using fee-paying digital media for extension services, but such readiness is dependent on the prices being charged for the services.

In their literature review, Ogunmodede et al. (2022) found out that a study conducted by Onoh et al. (2014) on livestock farmers' willingness to pay for agricultural extension services in southeast Nigeria found that "the farmers were not willing to pay for most extension services due to their inability to handle the recommended technologies easily," while Ozor et al. (2013) found out that "95.1% of farmers in Nigeria were willing to pay for improved agricultural extension services if the services remained relevant to their needs." This is in line with the TAM used in this study, which centres on individual choices that are made by the users of technology, based on the benefits/value attached to the technology's usefulness or consequences.

The main findings of this study, therefore, indicated that smallholder farmers were ready and willing to start using the fee-paying digital media for extension services to access agricultural related information, based on their awareness and the benefits they saw in such services. However, those that indicated higher financial capacity, were more willing to access the services than those with less capacity.

4.3 **Chapter summary**

The analysis for the study has shown that due to the exposure of the farmers to digital media for extension services, the farmers that took part in this study were all aware of the existence and had knowledge about the benefits of such services. While the farmers indicated that they were ready to start accessing fee-paying digital media for extension services, those with higher financial capacity indicated more willingness to start accessing the services. This can be cemented by the Technology Acceptance Model (TAM), which argues that technology is accepted and adopted by smallholder farmers based on individual cost-benefit thoughtfulness.

The findings have also shown that the length of exposure to digital media for extension services had an impact on the responses, with scores of those who were exposed for more than one year being higher than those who were exposed for less than one year. This meant that the longer the farmers were exposed to digital extension services, the more experienced they became in terms of usage of such services, as 17.57% of the respondents reported that they had less than 1 year of experience, while 82.24% had more than 1 year of experience.

Regarding age range, the findings have shown that the farmers aged between 18 and 30 years showed signs of readiness to access the fee-paying digital extension platforms than those aged between 31 and 40, and those above 40 years of age, indicating that the higher the age, the less the

readiness to start accessing the fee-paying digital extension services. Using the TAM, which states that “when users perceive that a type of technology is useful and easy to use, they would be willing to use it,” the study has shown that older persons do not find technology very easy to use, hence their reluctance to adopt it.

The study findings have shown that the participant’s readiness to access fee-paying digital media for extension services was positively predicted by capacity, with those with enough capacity showing more willingness to pay than those with less capacity.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This chapter provides the study conclusion, recommendations, and areas for further study. The conclusion is based on the findings from the study. The chapter also makes recommendations and provides directions for future research on digital media for extension service delivery.

The study findings have revealed that smallholder farmers' exposure to digital extension services improves their awareness and knowledge about the services, including their benefits. This is an answer to the research question of whether the smallholder farmers were aware of the existence of the digital extension services offered by players in the agriculture sector. It is also an answer to the research question of whether the smallholder farmers found the digital extension services beneficial for the enhancement of agricultural productivity.

Much as awareness is not the same as knowledge, Johara et al. (2021) noted that "awareness can refer to common knowledge or understanding about a social, scientific, or political issue since it aims to improve the general knowledge of people about something." Awareness can also "translate to knowledge and understanding that something is happening or exists." Vedanta (2015), however, argued that "awareness arises when knowledge accompanies action since the mere acquisition of knowledge does not mean that such knowledge will translate into action."

The study findings, therefore, have shown that the smallholder farmers from the sites where the study was conducted, became aware of the digital media for extension services when they got exposed to such services in their farmer groups through extension officers and NGOs such as Farm Radio Trust and Agricultural Commodities Exchange. The period of exposure also matters as the study findings have shown that there were significant differences concerning the length of exposure to digital media for extension services on the study variables, about the farmers' readiness to start using fee-paying digital extension services, with scores of those that were exposed for more than one year being higher than those that were exposed for less than one year.

Once the farmers got exposed to the services in the study sites, they started using them. It was at this point that the farmers became knowledgeable about the benefits of digital media for extension services.

The study findings have further revealed that financial capacity was an enabler for more willingness among the smallholder farmers to utilize fee-paying digital media for extension service delivery,

if the current free/subsidised services became unsustainable or were no longer available. This was an answer to a research question on whether the smallholder farmers had the financial capacity to spend money on call charges to access agricultural-related information. The findings further revealed that more readiness to start accessing the fee-paying digital media for extension service delivery was registered among the respondents who had enough financial capacity.

The findings have shown that there were no significant differences between male and female participants when it came to being aware and becoming knowledgeable about digital extension services, even though 60.41% of the respondents were registered as of high economic status while 39.58% were registered as of low economic status. This was probably due to the participants' involvement in farmer groups, where they were involved in various income-generating activities. Fadeyi et al. (2022) found out that "technology adoption among smallholder farmers in Nigeria was dependent on factors such as the farmers' characteristics, farm characteristics, technology characteristics, institutional support and the associated costs of technology acquisition and operation, which are often high and beyond the financial capacity of smallholder maize farmers." Oyinbo et al. (2021) and Bontsa et al. (2023) noted that "smallholder farmers found digital technologies to be expensive compared to other agricultural technologies and that they were a cause of a digital divide, even though the farmers acknowledged that the digital technologies improved agricultural production."

In their responses on whether they were ready to start using fee-paying digital extension services to access agricultural-related information, 21.97% of the participants indicated that they were not sure, 70.96% of the participants said they were ready, and 7.03% of the responses indicated that they were not ready. When asked to state whether they would start using the fee-paying digital media for extension services if the charges were affordable, 76.17% of the respondents responded positively to the question, 0.78 responded negatively, and 23.05% were not sure.

The coming in of the Digital Economy Strategy 2021-2026, however, has brought some rays of hope among the players in digital extension, since it is specifically "focusing on agriculture beyond increasing use or access to smallholder farmers and stakeholders and includes the use of innovative technologies such as the Internet of Things (IoT), smart farming, open data and makes specific references to online platforms."

The main findings of this study, therefore, showed that the smallholder farmers were ready to start using fee-paying digital media for extension services to access agricultural content if the subsidised services were no longer available. Farmers with higher financial capacity indicated more willingness to start accessing the services than those with less capacity.

5.2 Recommendations

Based on the study's findings, the following are the recommendations to be considered:

a) Since there is more exposure to digital media for extension service delivery in farmer groups, a deliberate policy has to be put in place by government to ensure that fee-paying digital media for extension service delivery are affordable to the users across the country, specifically those in farmer groups.

b) The findings for the study have shown that the smallholder farmers with higher capacity or economic status, were more willing to utilize fee-paying digital media for extension service delivery, than those with less capacity or lower economic status. Government should therefore, consider introducing soft loans for digital media champions for extension service delivery, in order to boost adoption and usage of fee-paying digital media across the country.

c) The study findings have shown that there were no significant differences in terms of awareness of digital media for extension service delivery, and knowledge about the benefits for the same, among the respondents that were in different locations, and had different education levels. This means that digital media can be accessed and adopted by anyone, regardless of their location or education levels. What matters most is the sustainability to ensure steady provision of the services, hence the need for government to develop appropriate policies on sustainability of the subsidised digital media for extension service delivery, which have proven to be beneficial to the users.

5.3 Areas for further research

Several areas for further study were identified from the findings. For instance, it might be necessary to conduct audience research with the communities, specifically smallholder farmers who are not in farmer groups. The study only targeted smallholder farmers who were in farmer groups and were already exposed to digital media for extension service delivery. In this future study, it might be necessary to explore why some farmers do not participate in agricultural activities by joining Radio

Listening Groups, where they too can be exposed to such digital media, in order to boost usage of technology in extension service delivery.

The study found that the farmers' economic status or financial capacity was positively correlated with their readiness to start accessing agricultural content using fee-paying digital media for extension service delivery. The issue of affordability that was highlighted by the farmers in this study needs to be investigated. In future, the farmers need to state the actual charges they can afford. This information will help the institutions that are championing digital media for extension service delivery, to introduce the right packages for users in terms of costs.

5.4 Chapter summary

This chapter has discussed the study findings, which have revealed that smallholder farmers' exposure to digital media for extension services had improved their awareness and knowledge about the services, including their benefits, answering the research question on whether the smallholder farmers were aware of the existence of the digital extension services offered by players in the agriculture sector, including the question on whether the smallholder farmers found the digital media for extension services beneficial for the enhancement of agricultural production and productivity. The study findings have further revealed that financial capacity was the main enabler for smallholder farmers to show more willingness to utilize fee-paying digital media for extension service delivery, if the current subsidised services became unavailable, thereby answering the research question on whether the smallholder farmers had the financial capacity to spend money on call charges to access agricultural related information. The main findings for this study, therefore, have shown that the smallholder farmers are ready to start using fee-paying digital media for extension service delivery, and more willingness was registered among farmers who indicated that they had enough financial capacity.

The study has therefore recommended that government should come up with a deliberate policy to ensure that fee-paying digital media for extension service delivery are affordable to the users across the country, specifically those in farmer groups. The study has further recommended that government should, therefore, consider introducing soft loans for digital media champions for extension service delivery, in order to boost adoption and usage of fee-paying digital media across the country. Another recommendation is that government should consider developing appropriate policies on sustainability of the subsidised digital media for extension service delivery, which have proven to be beneficial to the users.

The study has concluded by suggesting areas for future research, such as conducting audience research with the communities, specifically smallholder farmers that are not in farmer groups, to understand their perceptions of digital media for extension service delivery. The study has also suggested that in future, research should be conducted to establish the actual costs the smallholder farmers in Malawi could afford, if they were to start accessing fee-paying digital media for extension service delivery.

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APPENDICES

APPENDIX 1: SURVEY QUESTIONNAIRE

A QUESTIONNAIRE TO ASSESS THE READINESS BY THE SMALLHOLDER FARMERS TO IN MALAWI TO START ACCESSING AGRICULTURAL CONTENT USING FEE PAYING DIGITAL EXTENSION PLATFORMS

Introduction

My name is Augustine Sinforiano Mulomole, I'm a student at the Malawi University of Business and Applied Sciences (MUBAS). I'm pursuing a Master of Arts in Media Studies (MMS) Programme. I'm currently conducting research on the topic: **Assessing the readiness of Smallholder Farmers in Malawi to start Accessing Agricultural Content Using fee paying Digital Extension Platforms.**

This questionnaire, therefore, has been designed to gauge your awareness as a smallholder farmer, about digital extension; the benefits you attach to digital extension services; your financial capacity as a smallholder farmer; and your willingness to pay in order to access agricultural related information using the digital extension platforms. All the answers given by you will be treated with confidentiality, therefore, answer the questions honestly. It will not take you more than 20 minutes to complete the questionnaire. You are also at liberty to decline your participation in this research.

Part A: Demographic Information

The following questions will require you to give demographic information, please respond by ticking in the appropriate boxes provided.

VILLAGE	GVH	T/A	EPA

Age range	☐ 18-30 ☐ 31-40 ☐ 41 above	
Education	None	☐
	Primary Education	☐
	Secondary education	☐
	Tertiary Education	☐
Gender	☐ Male	
	☐ Female	
Economic status	In possession of livestock	**Yes** ☐ **No** ☐
	Produces crops for food	**Yes** ☐ **No** ☐
	Produces crops for sale	**Yes** ☐ **No** ☐
	In possession of a motorbike	**Yes** ☐ **No** ☐
	In possession of a bicycle	**Yes** ☐ **No** ☐
	In possession of a cellphone	**Yes** ☐ **No** ☐
	In possession of a television set	**Yes** ☐ **No** ☐
	In possession of a radio set	**Yes** ☐ **No** ☐

For how long have you been accessing digital extension services?	Less than 1 year ☐	More than 1 year ☐

Part B: Level of awareness about the digital extension services; benefits of digital extension services; financial capacity of the farmer; willingness by the farmers to pay to access agricultural related information using the digital extension services

General awareness by the respondents about digital extension services

Please read each statement and circle the appropriate number 1, 2, 3, 4 or 5 according to your opinion

The rating scale is as follows:

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree

1	Digital extension services enable smallholder farmers to access agricultural related information in near to real-time	1	2	3	4	5
2	Digital extension services cannot be accessed by people that have never gone to school	1	2	3	4	5
3	Digital extension services complement the work of agricultural extension officers	1	2	3	4	5
4	Digital extension services cannot be accessed by people living in rural areas	1	2	3	4	5
5	Digital extension tools are things like radio, mobile phone, television set	1	2	3	4	5

Awareness by the respondents about the benefits of accessing the digital extension services

Please read each statement and circle the appropriate number 1, 2, 3, 4 or 5 according to your opinion

The rating scale is as follows:

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree

6	Digital extension services cannot enhance agricultural productivity	1	2	3	4	5
7	Agricultural productivity in my household will be affected once the digital extension services are no longer available	1	2	3	4	5
8	Digital extension services are very slow compared to face-to-face methods of accessing agricultural related information	1	2	3	4	5

9	I can access digital extension services even in my house without physically meeting agriculture extension officers	1	2	3	4	5
10	I have to travel to town in order to access digital extension services	1	2	3	4	5

Determining the financial capacity of the respondents

Please read each statement and circle the appropriate number 1, 2, 3, 4 or 5 according to your level of agreement

The rating scale is as follows:

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree

11	I can afford to spend money on airtime worth MWK500 or more in in a week in order to make telephone calls	1	2	3	4	5
12	We cannot afford to eat two meals every day in our family because we do not harvest enough produce	1	2	3	4	5
13	I do not have access to a mobile phone	1	2	3	4	5
14	My household is food secure all year round	1	2	3	4	5
15	I make money through sales of my agricultural produce such as crops and livestock	1	2	3	4	5

Readiness by the respondents to pay in order to access agricultural related information through the digital extension services once the free services are no longer available

Please read each statement and circle the appropriate number 1, 2, 3, 4 or 5 according to your level of agreement

The rating scale is as follows:

1	2	3	4	5
Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree

16	I'm ready to make a call at a fee in order to talk to an extension agent for agricultural advisories because they make agricultural activities less tasking	1	2	3	4	5

17	I'm not willing to start paying for the digital extension services because I don't find them beneficial	1	2	3	4	5
18	I will stop accessing the digital extension services once the free services are no longer available because I cannot afford to pay for such calls	1	2	3	4	5
19	I'm not willing to start paying for digital extension services because I find call charges very expensive since I will have to stay for long on the phone talking to extension agents	1	2	3	4	5
20	I'm ready to pay for agricultural related information as long as the call charges are affordable	1	2	3	4	5

APPENDIX 2: CORRELATIONS BETWEEN INDEPENDENT AND DEPENDENT VARIABLES

Correlations

		Awareness	Benefits	Capacity	Readiness
Awareness	Pearson Correlation	1	-.003	.031	.048
	Sig. (2-tailed)		.939	.396	.180
	N	768	768	768	768
Benefits	Pearson Correlation	-.003	1	.030	.027
	Sig. (2-tailed)	.939		.410	.456
	N	768	768	768	768
Capacity	Pearson Correlation	.031	.030	1	.215**
	Sig. (2-tailed)	.396	.410		.000
	N	768	768	768	768
Readiness	Pearson Correlation	.048	.027	.215**	1
	Sig. (2-tailed)	.180	.456	.000	
	N	768	768	768	768

**. Correlation is significant at the 0.01 level (2-tailed).

APPENDIX 3: LINEAR REGRESSION RESULTS FOR PREDICTING READINESS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.610	.732		2.199	.028
	Benefits	.058	.099	.021	.587	.558
	Awareness	.142	.119	.042	1.189	.235
	Capacity	.302	.050	.213	6.023	.000

a. Dependent Variable: Readiness