

BINDURA UNIVERSITY OF SCIENCE EDUCATION



Faculty of Agriculture and Environmental Science

Department of Agricultural Economics, Education and Extension

TITLE OF THE THESIS

Assessing the influence of information communication technology (ICT) on the marketing of tomatoes by smallholder farmers in Chiweshe communal area

Submitted by

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**A Dissertation Submitted in Partial Fulfillment of the Requirements of the
Bachelor of Science Honours Degree in Agricultural Economics and
Management**

31 MAY 2025

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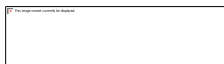
DEGREE TITLE: BACHELOR OF AGRICULTURAL SCIENCE HONOURS DEGREE IN
AGRICULTURAL ECONOMICS AND MANAGEMENT.

RESEARCH PROJECT TITLE: ASSESSING THE INFLUENCE OF INFORMATION
COMMUNICATION TECHNOLOGY ICT ON THE MARKETING OF TOMATOES BY
SMALLHOLDER FARMERS IN CHIWESHE COMMUNAL AREA

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Submitted in partial fulfillment of the Bachelor of Agricultural Science Honours Degree in Agricultural Economics and Management.

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DECLARATION

I, DEVE VIMBAI C, declare that this dissertation titled "ASSESSING THE INFLUENCE OF INFORMATION COMMUNICATION TECHNOLOGY ON THE MARKETING OF TOMATOEW BY SMALLHOLDER FARMERS IN CHIWESHE COMMUNAL AREA" is my original work and has not been submitted elsewhere for any degree or qualification. I acknowledge that I have received guidance and support from my supervisor, Dr. N. Mafuse, and other academic staff during this research, but the intellectual content and presentation of this dissertation are entirely my own. I have followed the guidelines and regulations of the Bindura University of Science Education regarding plagiarism and academic integrity, and I have properly cited and referenced all sources of information used in this dissertation.

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DEDICATION

This research study is dedicated to my parents and young sisters. They instilled in me a desire to learn and made sacrifices so I would have access to high education from an early age. I also dedicate this research to my friends who have been encouraging me through my time at Bindura University of Science Education.

ACKNOWLEDGEMENTS

This thesis would not be had been a success had it not been for the Lord Almighty who give me strength courage and good health to carry on. I would also want to acknowledge the support I got from Deve family, relatives and my friends Hardlife, Rumbidzai and Mirriam. When I needed and emotional and financial support, they were always ready to support me.

Credit goes to my supervisor Dr N. Mafuse for patiently guiding in the process of developing to the completion this thesis. BUSE and the department of agricultural Economics and Management are greatly appreciated for providing with helpful and necessary information. I sincerely thank everyone for your support and assistance, may the Almighty continue to bless you in the future

ABSTRACT

Tomatoes are produced and consumed around the world. In Zimbabwe, tomato production is a source of income for rural populations. However, this sector faces many challenges like post-harvest losses and inadequate market information. In spite of ICT use in agricultural marketing of among smallholder farmers in Zimbabwe, there is still limited information on the ICT usage in marketing of tomatoes among smallholder farmers in Chiweshe communal area. This study was done in Chiweshe communal Area. Data was collected from a sample size of 100 households which were selected using a random sampling technique. Primary data was collected using structured questionnaire. Descriptive statistics was used to analyze the ICT tools in the marketing of tomatoes, the available marketing channels and the challenges using ranking and scoring method. Gross margin analysis was used to indicate the profitability of the available marketing channels. The study found high mobile phone penetration among respondents. However traditional ICT tools like radio are still dominant. Agricultural applications and general internet usage showed minimal adoption. The research identified two marketing channels employed by farmers which are from farmer direct to consumer and from farmer to intermediary traders to consumers while online selling showed zero adoption. Poor network coverage emerged as the most critical barrier followed by high data costs. The government is recommended to prioritize expanding reliable network coverage, reducing data costs, and addressing digital literacy gaps to enhance ICT adoption and utilization for agricultural marketing in rural areas.

Keywords: Information Communication Technology (ICT), Smallholder farmers, Agricultural marketing, Market access

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LIST OF ACRONYMS AND ABBREVIATION

CSA	Climate Smart Agriculture
FAO	Food and Agriculture Organization
ICT	Information Communication Technology
GDP	Gross Domestic Product
GM	Gross Margin
IoT	Internet of Things
NGO	Non-Governmental Organization
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
SMS	Short Message Services
SPSS	Statistical Packages for Social Sciences
TAM	Technology Acceptance Model
TR	Total Revenue
TVC	Total Variable Costs
WFP	World Food Programme
ZIDA	Zimbabwe Investment and Development Agency

CHAPTER 1

INTRODUCTION

1.0. Background of the study

Tomatoes, are amongst most important horticultural crops around the world and they originated from South America from where they spread to Europe in the sixteenth century and later to East Africa (Mauti, 2021). In Africa, tomatoes are mainly grown in Egypt, Morocco and Algeria and they are ranked number two after potato as the most important vegetable in most of the regions in the world (Mauti, 2021). In sub-Saharan Africa, farmers produce tomatoes more than other vegetable crops because they result in multiple harvest which leads to higher profits per unit (Mauti et al., 2021). Agriculture is the backbone of Zimbabwe's economy as it plays a crucial role in rural population livelihoods (Saungweme & Matandare, 2014). The sector contributes to the livelihood of over 60% of the country's population, 23% of formal employment, 63% of raw materials required by the manufacturing sector, 30% of export earnings and 15% to Gross Domestic Product (GDP) (ZIDA, 2023). The sector has strong backward and forward linkages that enhance the production value chain.

Tomatoes are one of the most horticultural products that are mostly grown and consumed globally. For instance, in Zimbabwe, tomatoes are consumed in almost all the three daily meals and are eaten either raw or cooked during breakfasts, lunches and suppers. Despite these contributions, the product has the challenges of poor marketing arrangements. They are rich in vitamins and it is a cash crop for both smallholder and commercial farmers globally (Maliwichi et al., 2014). Therefore, the crop has a higher daily demand compared to nonhorticultural crops. (Muroyiwa et al., 2023) state that tomatoes are considered a 'super food' because they are nutrient dense but also are a naturally low-calorie food. 110 g of tomatoes give about one-third of the recommended daily allowance for vitamin C, and contains beta-carotene, potassium, folic acid, vitamin B2, iron, and fibre. The crop is a major source of the antioxidant lycopene whose benefits include reduced risk of heart diseases and cancer (Mwenda, 2022).

However, horticultural crops are highly perishable which might lead to challenges like postharvest losses to the products collected which indicate a loss of resources implemented, so

reliable markets are an essential if commercially produced (Mugao, 2023). Because of their perishable nature, farmers face marketing problems such as low tomato prices and market information being manipulated by few actors caused by disconnect between producers and consumers so ICT plays an important role by providing solutions to these challenge (Mauti et al., 2021).

Information and Communication Technologies (ICTs) are among the profound tools to help the poor and marginalized rural smallholder farmers make a difference in their lives (Ndimbo et al., 2023) Access to information and communication technology (ICT) has become a major factor enhancing the marketing capabilities of smallholder farmers and these tools include radios television and mobile phones. The use of ICT has increased the access to information and knowledge across the whole world even in some remote areas of developed countries. Though information communication technology use in marketing of tomatoes is increasing, there is lack of information on the ICT usage in the marketing of tomatoes by smallholder farmers. In many developing counties like Zimbabwe smallholder farmers there is limited accesses to more market information about available markets, so they end up selling their tomatoes at farm gates or nearby villages and they usually sell at lower prices and this will affect their profit margins (Mukarumbwa et al., 2018).

Also, information and communication technology (ICT) use could alleviate pest information asymmetry which result to increased yields leading to higher sales. Information and Communication Technology (ICT) tools such as radio, television and mobile phones are important to the producers as they support the agricultural sector during the changing process by proving farmers with updated information (Mauti, 2021). This technology gives smallholder farmers the ability to tap into a wider range of knowledge and information than they could not access previously. In Chiweshe smallholder farmers are facing many challenges in marketing their tomatoes, this study aims to assess the influence of ICT on the marketing of tomatoes and the findings from this study will be able to provide some information to policy makers and try to come up with solutions to these challenges.

1.1. Statement of the Problem

The marketing of tomatoes by smallholder farmers in Chiweshe is critical, given the important part tomato production plays in the livelihoods of rural communities in Zimbabwe. Despite that

smallholder farmers in Chiweshe often face numerous challenges that hinder their ability to effectively market their produce. One of the primary challenges faced by smallholder farmers is the lack of knowledge about information communication technology (ICT). Access to information and communication technology (ICT) has become a major factor enhancing the marketing capabilities of smallholder farmers and these tools include radios, computers, mobile phones, and mobile applications like Esoko, Emkambo, Eco farmer etc. This lack of knowledge can lead to poor marketing techniques and poor produce, which diminishes their competitiveness in the market thereby reducing their gross income.

Availability and reliability of infrastructure and connectivity is a great challenge towards the adoption and implementation of ICT in Chiweshe, which hinders farmers' ability to access and utilize ICT tools effectively. Inadequate electricity supply and infrastructure further complicates ICT adoption, as many ICT tools require consistent power supply (Aliyu et al., 2024). One of the reasons for the low level of ICT usage is that many households in rural areas have no electricity, in which case, farmers have difficulty charging their cell phones, and having them switched off almost all the time (Khabisi-Bokaako, 2023). Modern digital tools, such as apps, have seen lower adoption rates, likely due to the high cost of data, device affordability issues, and low levels of digital literacy among farmers (Hove et al., 2024). Addressing this problem will require investment in ICT infrastructure and programs that are custom-made to meet the needs of small-scale farmers.

1.2. Research Questions

1. What specific ICT tool that are currently utilized by smallholder farmers to market their tomatoes
2. What are the primary marketing channels available to smallholder farmers in Chiweshe
3. What are the challenges being faced by smallholder farmers to access ICT.

1.3. Research Objectives

1.3.1. Main Objective

To assess the contribution of ICT on the market access in marketing tomatoes among smallholder farmers in Chiweshe communal area.

1.3.2. Specific Objectives

1. To identify ICT tools that are used in the marketing of tomatoes by smallholder farmers in Chiweshe.
2. To identify marketing channels that are available for smallholder tomato farmers in Chiweshe.
3. To Analyse challenges faced by smallholder farmers in accessing ICT.

1.4. Significance of the Study / Justification

This research is essential because tomatoes production contribute smallholder farmers livelihoods. Tomato is a main cash crop that is grown in different region of the country including Chiweshe. Tomato production is an important source of income for smallholder farmers in Chiweshe and contribute to the food security and economic wellbeing. Some research states that smallholder farmer faces challenges like lack of information, lack of education, lack of infrastructure and many others. So, it is important to identify challenges that affect marketing of tomatoes in Chiweshe and come up with solution to overcome these challenges. By studying the part of ICT amongst small-scale farmers, we can identify ways to help them access markets, information and financial services, which can improve their income and reduce poverty also by studying the role of ICT amongst small-scale farmers, we can identify ways to bridge this digital divide and promote digital inclusion. By studying the influence of ICT amongst small-scale farmers in Zimbabwe is important for economic development, poverty reduction, sustainable agriculture, digital inclusion and policy implications.

1.5. Scope and limitations of the study

The study is restricted to communal households in Chiweshe communal area, it does not extend to other areas within Mazowe district and target only smallholder farmers. It only focuses on tomato production only excluding all other agricultural products. This study was affected by macroeconomic conditions like inflation which influences the marketing decisions beyond ICT. Also, this study relies from data collected from smallholder farmers in Chiweshe communal area which may result into bias due because some farmers might answer questions to fulfil their selfish desires.

1.6. Organisation of the thesis

This thesis is organized into 5 chapters

Chapter 1: it comprises of the background of the study, problem statement, project objectives, significance of the study, limitation of the study research questions and the reference list.

Chapter 2: literature review, it gives the literature which support the study. It comprises of ICT tools that are used in the marketing of tomatoes, marketing challenges related to ICT faced by smallholder farmers, the effect of ICT on the choice of marketing channels and the theoretical framework.

Chapter 3: methodology and design, it gives in depth information on the methodology adopted by the researcher. The chapter comprises of the study area, research design, sampling procedure, data collection and data analysis. The chapter also comprises of ethics that were considered.

Chapter 4: data presentation, analysis and discussion of results

Chapter 5: summary, conclusion, recommendations

CHAPTER 2

LITERATURE REVIEW

1.0. Introduction

This chapter gives a wholesome of the literature on the studies that have been carried out concerning factors related to ICT affecting marketing of by smallholder farmers. It comprises of ICT tools that are used in agricultural marketing, marketing challenges faced that faced by smallholder farmers in access ICT, the effect of ICT on the choice of marketing channel of tomatoes and the theoretical framework.

1.1.Review of key terms

1.1.1. Information Communication Technology (ICT)

ICT refers to all communication technologies including the internet, wireless networks, cell phones, computers, software, middleware, video-conferencing, social networking, and other media applications and services enabling users to access, retrieve, store, transmit, and manipulate information in a digital form (FAO, 2023). Information and Communication Technology (ICT) in tomato production has shown important benefits, particularly in enhancing productivity and sustainability (Aliyu et al., 2024). ICT has been a significant contributor to the growth and socio-economic development around the world. The effective integration of ICT in the agriculture sector in developed countries has led to improvement in agriculture value chain efficiency and productivity (Ayim et al., 2022).

The areas of the market, production, financial development, management and counseling, Smart Farming, and Internet of Things (IoT) have been approached, associated with the ICT (Oyelami et al., 2022). Most of the smallholder farmers fail to access due to lack of adequate training. Mobile devices, internet connectivity, updated ICT applications, and a farmers' database are the most important supports needed for tomato smallholder tomato farmers (Ahsan et al., 2022).

1.1.2. Smallholder farmers

Smallholders are small-scale farmers, pastoralists, forest keepers, fishers who manage areas varying from less than one hectare to 10 hectares (Lowder et al., 2016). Smallholders are characterized by family-focused motives such as favoring the stability of the farm household system, using mainly family labour for production and using part of the produce for family

consumption (Carelsen et al., 2021). The government and investors rely on smallholder farmers to produce food for their households and create jobs for rural communities

Smallholder farmers play an important role in ensuring world food security within the country. Also small-scale farming also provides numerous other direct and indirect environmental, social, cultural, and economic benefits by improving crop diversification, job security, and self-sufficiency (Dhillon & Moncur, 2023). Smallholder farmers fail to new developed climate smart agriculture like integrated soil fertility management, water harvesting, and agroforestry mainly due to shortage of cropland, land tenure issues, lack of adequate knowledge about CSA, slow return on investments, and insufficient policy and implementation schemes (Zerssa et al., 2021).

1.1.3. Marketing

Marketing refers to all the activities involved in moving tomatoes from the farm to the consumer, including harvesting, transportation, storage, processing, and selling (Hilmi, 2022). Marketing is mainly categorized as indirect marketing and direct marketing. Indirect marketing follows the principle of producers selling their farm produce to the consumers through brokers, retailers, and other supply chain components (Chanda et al., 2021). It is an important process as it ensures that farmers earn fair prices and consumers have access to fresh tomatoes. A market is where exchanges take place, it is where products are exchanged and it can be a physical land or online digital location, for example a village market (Reardon et al., 2019). So, it should be noted that there is difference between a market and marketing. Market plays crucial role in the economic life of farmers, and essential in the chain of commodity distribution (Kumari et al., 2022).

1.2. ICT tools in agricultural marketing

1.2.1. Introduction

Information and Communication Technologies (ICT) tools include a wide range of digital and electronic technologies that make it easier to collect, store, process, transmit, and distribute information. ICT tools include mobile phones, agricultural platforms, social media networks, radio, television, and internet-based applications. They allow farmers to get market information, weather data, agricultural advice, and connect with buyers and suppliers. These technologies have transformed the way agricultural information is exchanged and accessible, altering traditional farming practices and marketing strategies. The incorporation of ICT technologies into agricultural marketing has emerged as a game changer for smallholder farmers in developing countries, particularly in terms of accessing market information and improving their economic outcomes.

1.2.2. Mobile phones

Mobile phones have become an important ICT tool that can communicate and access agricultural related information, so understanding and adoption of this mobile technology is critical for farmers. Farmers use mobile phones to build a network of contacts and draw on this wider experience and expertise to obtain critical information more rapidly (Aker et al., 2016). Farmers need training in effectively using mobile phones or other modern ICTs to help them obtain useful agricultural and market information. A study by (Erlangga et al., 2023) highlighted that mobile phones reduce climate vulnerability and variability effect by providing useful climate information needed through radio, SMS, and mobile applications weather forecast. It was recommended that the government should have strong policies that promote the expansion of internet connectivity both in rural and urban areas in order to stimulate the acquisition and usage of mobile phones.

1.2.3. Agricultural platforms

1.2.3.1. Introduction

Agricultural information apps are digital platforms and mobile-based applications that give farmers quick access to essential agricultural data, market information, and farming support services via smartphones and other mobile devices. These applications are complete tools that include a variety of capabilities such as real-time market price updates, weather forecasts, agricultural advice, insurance services and direct communication channels for farmers and

agricultural service providers. In Zimbabwe, various agricultural platforms have evolved to meet the information demands of smallholder farmers. They include the Esoko platform, which connects over 170,000 farmers to market information across 17 fresh produce markets and 33 commodities through SMS alerts, and eMkambo, a government-initiated mobile and web-based facility aimed at sharing market pricing from key markets like Mbare Musika.

1.2.3.2. Esoko platform

Esoko is a digital platform used to connect smallholder farmers to market information and opportunities through mobile technology. By essentially providing real-time updates on agricultural prices, weather conditions and other crucial data via SMS alerts allowing farmers to make informed decisions about their produce and sales (Munthali et al., 2018). The Esoko mobile platform started its operations in Zimbabwe in 2012. They currently service 17 fresh produce markets scattered across Zimbabwe and they cover 33 commodities. They provide services to over 170,000 smallholder farmers. Esoko uses a number of NGOs and contractors to push out their services to farmers (Ifeoma & Mthitwa, 2015).

According to the research by (Gyaase & Owusu, 2022), the ability to create awareness and the timely delivery of climatic information would have a major impact on living standards among smallholder farmers. Although the Esoko platform facilitates effective delivery information for farmers, the commercial nature of the platform is shifting the attention from important information such as climatic information to market driven product prices. Agricultural extension services are going back to the nineteenth century with the aims of providing an avenue for research findings and new farming methods to be communicated to farmers

1.2.3.3. Eco farmers platform

The Eco Farmer platform, a farming insurance initiative being offered by Zimbabwe for most mobile network provider Econet Wireless started operations in 2013. It is a revolutionary way of farming using mobile technology (Ifeoma & Mthitwa, 2015). Eco Farmer enabled farmers to insure their crops against the risk of unpredictable rainfall patterns and excessive heat for as little as \$2.50 per year for \$25 worth of covering. A study that was carried out by (Kirchner & Musshoff, 2024) include that the insurance attributes enabled by eco farmer platform are attractive to farmers. Product bundles that include mobile-delivered weather information and agricultural advice in addition to the insurance policy or credit access increase the likelihood of farmers taking out insurance.

Farmers reported a higher appreciation for services such as Eco farmer and NGO projects, which offer localized advisory content tailored to specific value chains. This targeted approach was seen as more relevant than generalized advisories provided by local programs that may not address the crops or livestock of particular interest to farmers. For example, Eco farmer's messages allowed farmers to select specific value chains for targeted advisory services, which enhanced the perceived relevance of the content (Hove et al., 2024).

1.2.3.4.eMkamambo

The platform is a mobile and web-based facility integrating the use of mobile phones and the internet to share information and knowledge as well as conduct agro-focused transactions. It is designed to have farmers in a database and push SMS messages to them to inform them of market prices at produce markets like Mbare Musika in Harare, polling of farmers, customized tips for farmers and other such. eMkamambo itself is Ndebele for "market", which means eMarket.

Following a study by (Musungwini, 2018), it seems clear that many, if not all, of the smallholder farmers could benefit, at least to some extent, from using their mobile phones to engage with one or more of the existing mobile agricultural platforms serving Zimbabwe, e.g., the aforementioned eMkamambo. However, attempts by the Zimbabwean Government to implement such a platform, eMkamambo, have largely remained below expectations as many agricultural producers, particularly small-scale producers, have limited or no access to smartphones or cell phones and prices for internet bundles are relatively high (Burke & Valdivia, 2021).

1.2.3.5.Social media platforms

The use of social media in agricultural marketing is increasing across the country. Social media platforms like Facebook, WhatsApp, Instagram and others have played a critical role in agricultural marketing. One of the advantages of social media is that it makes it easier for people to get information, therefore people choose social media as the easiest tool to send and receive information quickly.

According to the research by (Konoplyannikova, 2024) data indicates a robust presence of agricultural enterprises on social media platforms, with Facebook being the primary choice for engaging with audiences. The high adoption rate of 80% on Facebook and an average engagement rate of 15% signify a strong connection with the audience. Twitter with a 60% adoption rate and a 10% engagement rate, excels in real-time communication, evidenced by its notably low average response time of 1.8 hours. Instagram, with a 45% adoption rate and an

8% engagement rate, demonstrates steady growth, and a reasonable average response time of 3.2 hours indicates active engagement.

The use of social media has significant impact on knowledge and practices of young farmers. Farmers also reported that their knowledge regarding insect pests and diseases increased (31.0%) and decreased excessive use of insecticides (16.5%). Farmers also reported balanced use of fertilizers (15.1%) due to increased knowledge through social media (Singh et al., 2021).

1.2.4. Radio

Radio is a valuable tool that can be used by smallholder farmers especially in rural areas in Mazowe district. It provides market information like prices and it also promotes use of best farming practices that can be used by smallholder farmers for them to produce quality tomatoes that are preferred by everyone. They can also receive information about where there are shortage tomatoes and try to utilize that opportunities. (Paul, 2024) indicated that farmer in Plateau state were introduced to Padma F1 hybrid tomato through radio programs as the programme is usually informative and educative. Also, this study recommends more establishment of rural community radio to increase radio listenership and promotion of new agricultural innovations in rural communities through agricultural broadcast programs.

Smallholder tomato farmers prefer the use of radio to get information on climate change information and to raise awareness about coping, adaptation and mitigation options because it is cheap no data costs are needed. Smallholder tomato growers mostly needed information on drought-tolerant and disease-tolerant tomato seeds, application of pesticides and various types of fertilizers. The information most used was on time for planting tomatoes and critical farming decisions in relation to land preparation. (Siyao & Sanga, 2023) Traditional, easily accessible communication channels such as SMS and radio continue to dominate agricultural decision-making in rural areas and these platforms are preferred due to their accessibility and cost-effectiveness. However, modern digital tools, such as apps and podcasts, have seen lower adoption rates, likely due to the high cost of data, device affordability issues, and low levels of digital literacy among farmers (Hove et al., 2024).

1.2.5. Television

Agricultural marketing information can also be shared using appropriate information communication technologies, such as television, which is a popular communication medium among farmers (Khabisi-Bokaako, 2023). Television has been used as a media platform to promote marketing of tomatoes. Television can showcase the versatility of tomatoes in various

dishes, highlighting their fresh taste and nutritional benefits which persuade customers to realize their importances and influence their willingness to buy.

1.3.Challenges faced by smallholder farmers in accessing ICT

Introduction

Despite the great potential of information and communication technologies to revolutionize agricultural practices and enhance the livelihoods of smallholder farmers, various constraints continue to prevent widespread adoption and effective use of these tools in rural communities. Smallholder farmers confront numerous hurdles in using ICT, mostly due to poor infrastructure and connectivity issues, as rural areas frequently lack reliable electricity, communications networks, and internet access. Farmers are finding it challenging to routinely access online information and services. Digital literacy remains a key barrier, since many farmers lack the technical abilities required to successfully access and use ICT products. Farmers face major financial constraints due to the high costs of ICT devices such as cellphones and PCs, as well as costly internet data bundles and subscription services

1.3.1. Infrastructure and Connectivity Issues

Rural areas, where many smallholder farmers reside, often lack basic ICT infrastructure, such as reliable electricity, telecommunication networks, and internet access. Even where internet access exists, it may be unreliable, slow, and expensive, making it difficult for farmers to access information and services online. ICT usage by smallholder farmers is still lagging behind because of factor like availability and reliability of infrastructure and connectivity is a great challenge towards the adoption and implementation of ICT, this challenge is has led to limited connectivity. According to the research by (Mauti, 2021), Rural areas often lack reliable internet connectivity, which hinders farmers' ability to access and utilize ICT tools effectively. inadequate electricity supply and inadequate infrastructure further complicates ICT adoption, as many ICT tools require consistent power supply.

1.3.2. Digital Literacy

Many smallholder farmers lack the necessary digital skills to effectively use ICT tools, including basic computer literacy, internet navigation, and using agricultural applications. There may be a lack of awareness among farmers about the potential benefits and applications of ICT in agriculture, leading to low adoption rates. Although use of mobile phones is increasing around the country smallholder farmers are still unable to adopt due to different

reasons like lack of technical expertise. Smallholder farmers can gain profits from using cell phones in their farming operations. The findings of this study indicate that elderly illiterate female smallholder farmers who do not own mobile phones are unable to acquire and use mobile phone technology in their everyday agricultural information seeking and sharing (Musungwini et al., 2024).

1.3.3. High costs

The cost of ICT devices (smartphones, computers, etc.) and internet access (data bundles, subscriptions) is often a great challenge for smallholder farmers with limited incomes. Access to credit or financing to purchase ICT equipment and services is often limited, hindering their ability to adopt and utilize these technologies. Costs associated with use and adoption ICT amongst tomato smallholder farmers are the major challenge that is facing smallholder farmers. Most of the small holder farmers do not earn enough income for them to use ICT gadgets.

Research conducted in Gokwe discovered that many smallholder farmers have mobile sim cards but no phones, indicating that they are unable to afford the cost of handsets. The results of this study suggest that smallholder farmers' aspirations to become more productive are affected by the high cost of mobile phone technology and related services like mobile agricultural applications, cost of calling, data, level of education attained, their age and gender, and the complexity of mobile phone technology applications. (Musungwini et al., 2024). The study discovered that some of Gokwe South's smallholder farmers usually lack cell phones and reliable internet connectivity. These limit their exposure to digital technologies and making them less confident when utilizing mobile agricultural apps. As a result, they have low digital literacy. Farmers are unable to take full advantage of these resources due to the complexity of these programs and the perceived difficulty in using them. This offers a significant barrier to the adoption and use of mobile agriculture apps such as Esoko, Emkambo, Eco Farmer, and Mubatsiri, among others.

(Burke & Valdivia, 2021) emphasized that such mobile platforms might protect rural producers' incomes by giving market access and competitive rates, as well as providing consumers with access to a varied range of commodities. However, the Zimbabwean government's attempts to implement such a platform, emkambo, have largely fallen short of expectations because many agricultural producers, particularly small-scale producers, have limited or no access to smartphones or cell phones, and internet bundle prices are relatively

expensive. Furthermore, capacity constraints linked to the operationalization of the platform and the marketing of the produce arose.

Content and Language Barriers

The availability of relevant agricultural information and applications in local languages is often limited hindering the usefulness of ICT for smallholder farmers. Also, some ICT applications are not user-friendly or tailored to the specific needs of smallholder farmers, leading to low adoption rates. (Trendov et al., 2019) highlighted that general agricultural advice offered via digital platforms frequently fails to address the specific issues encountered by smallholder farmers in various geographic regions. Agricultural information is frequently presented in scientific terms that may not be easily translated to local contexts or farmer understanding (Aker, 2011). This leads to a gap between the intended users and the technology as farmers struggle to interpret and implement information that is not tailored to their specific agricultural techniques and environmental conditions.

1.4. Marketing channels

1.4.1. Introduction

Marketing channels refer to the methods and pathways used to get farm produce from the producer to the consumer encompassing various stages of marketing and distribution. Agricultural marketing channels are the lifelines that connect farmers with consumers. These channels can be direct or indirect, formal or informal and involve a range of actors and structure (Milford et al., 2021). Marketing channels for tomatoes include direct sales farm gate, village markets, wholesale networks including local traders, wholesalers, and commission agents and online platforms. Specialized channels like cooperatives, Community Supported Agriculture (CSA) and food hubs can be utilized.

1.4.2. Direct marketing

Direct marketing in tomato marketing involves selling tomatoes directly from the producer to the consumer bypassing traditional middlemen like wholesalers and retailers. A study by (Gliceria et al., 2025) shows that direct marketing channel was established to take advantage of the benefits of eliminating intermediaries reducing costs and increasing income for these associations. There different types of direct marketing channel which include on farm sales local market and online sales.

Farm-gate sales are the most basic kind of direct marketing in which customers visit the farm and buy fresh goods directly from the supplier. This method avoids transportation expenses and enables farmers to sell their crops at higher rates due to perceived freshness and quality (Mmbando et al., 2017). Farmers' markets are another important direct marketing tool, allowing smallholders to promote their products while increasing brand recognition and customer loyalty within local communities.

The rise of digital platforms has transformed direct marketing prospects for smallholder farmers. Farmers can access a larger consumer base beyond their immediate geographic area by using online marketplaces and social media platforms (Krone et al., 2016). Community supported agriculture (CSA) programs are an innovative direct marketing technique in which consumers buy shares of anticipated harvests, providing farmers with upfront money and assured sales while supplying consumers with consistent supplies of fresh fruit (Woods et al., 2017). Roadside stands and pick-your-own businesses expand direct marketing opportunities allowing farmers to add value through agritourism experiences.

1.4.3. Indirect marketing

Indirect marketing is the employment of intermediaries including wholesalers, retailers, processors and exporters to get agricultural products from farmers to consumers. This traditional marketing method continues to be prominent in many developing nations due to the established infrastructure and market connections provided by intermediaries (Barrett, 2010). Wholesalers play an important role in the marketing chain by combining small quantities of food from multiple farmers providing storage facilities and distributing products to retail outlets across larger geographical areas.

While intermediaries are frequently criticised for retaining large profit margins they provide critical services such as market intelligence, shipping, storage, packaging and risk management (Fafchamps & Hill, 2005). Retailers such as supermarkets and grocery stores, provide smallholder farmers with access to urban consumer markets that they would otherwise struggle to reach on their own. However, these channels frequently impose rigorous quality criteria, constant supply requirements and lengthy payment terms which limit smallholder farmers' ability to participate successfully (Reardon et al., 2009).

1.5.Effect of ICT usage on the choice of marketing channels

ICT usage has significant impact on the choice of tomato marketing channels, by facilitating access to information and enhancing communication. Based on the research by (Mauti, 2021) Tomato farmers access market information through mobile phone, radio and television respectively. (Muto & Yamano, 2009) found that mobile phone usage had a considerable influence on farmers' marketing channel choices with ICT farmers are more likely to bypass traditional intermediaries and engage directly with end markets. Access to mobile phones boosted farmers' likelihood of selling to more profitable marketing channels by. The capacity to contact directly with customers, obtain real-time market data, and coordinate logistics via ICT platforms has fundamentally transformed farmers' cost-benefit analyses when choosing marketing channels (Nakasone et al., 2014).

ICT adoption substantially impacts the information landscape from which marketing channel decisions are formed. (Tadesse & Bahiigwa, 2015) discovered that farmers who had access to mobile phone-based market intelligence services were more likely to choose marketing channels with higher prices, even if these channels involved more transportation or coordination efforts. The capacity to compare prices across numerous channels in real time has altered the power balance between farmers and traditional marketing middlemen. Majority of tomato farmers use mobile phones to access marketing formation, followed by farmers who use radios while other use television. Television is the least ICT tool being used as compared to mobile phone and radio. This indicates that mobile phone is the most preferred ICT tool in tomato marketing among the farmers tomato smallholder farmers.

Mobile phone increases the way in which farmers get and exchange agricultural information. The study revealed that age, income, level of education, farmers' experience, and farm size, tomato production, willingness to pay for ICT tools, tomato prices and knowledge on ICT are predictors of choice of ICT use. ICT should be given in such a way that all farmers can get information as per their need. (Mauti et al., 2021).

1.6.Role of ICT in marketing of tomatoes

The use of ICT provides farmers with access to real-time market data, including pricing, demand trends, and consumer preferences (Emeana et al., 2020). ICT application in tomato production and marketing have to bring change, by allowing free flow of information to the smallholder farmers about new production techniques, commodity prices and many more (Masuka et al., 2016a). ICT has the potential to address many of the challenges faced by

smallholder farmers, especially in improving their access to market information. Mobile phones, the internet, and digital platforms can provide farmers with real-time market prices, weather forecasts, agricultural advice, and connection to buyers. A study by Ochieng et al. (2018) found that the use of mobile phones among farmers significantly improved their access to market prices, which helped them make informed decisions regarding when and where to sell their produce.

In addition, ICT enables farmers to overcome the spatial and temporal limitations inherent in traditional face-to-face marketing practices. The use of digital platforms can facilitate online transactions, reducing the need for intermediaries and increasing transparency in pricing. According to a study by (Uyeh et al., 2023), ICT tools also allow for better coordination among farmers, transporters, and buyers, resulting in a more efficient supply chain. ICT usage has contributed to poverty alleviation. Primary research findings depicted that information and communication technology, economic growth, foreign direct investment and private domestic credit were key tools for reducing poverty in Nigeria.(Mateko, 2024)

Mobile applications specifically designed for farmers, have proven useful in connecting smallholder farmers to the market. For example the use of apps like "M-Farm" in Kenya has enabled farmers to access market prices, track demand trends and receive tailored farming advice (Mutuma et al., 2023). These tools can empower farmers by improving their market literacy, reducing information asymmetry, and fostering competition in local markets.

1.7. Theoretical framework

Adoption of new technology is essential for economic development, but in remote areas like Chiweshe the rate of technology adoption is very low. While acceptance of technology in tomato production is important for smallholder farmers to access more market. This study aims assess the role of ICT on the income and profitability of tomato smallholder farmers using Technology Acceptance Model (TAM) as a theoretical framework.

The Technology Acceptance Model (TAM) was introduced by Davis in 1986, is one of the most widely used models to explain user acceptance behavior (Lai, 2017). TAM is a widely used model to investigate whether users will accept or refuse a new technology The model consists of two key variables; perceived usefulness (PU) and perceived ease of use (PEOU) which unswervingly influence the user's assertiveness and intention towards using the technology. Additionally, the model suggests that an external variable such as the social and

cultural environment in which the technology is used can have a significant impact on the user's attitude and intention.

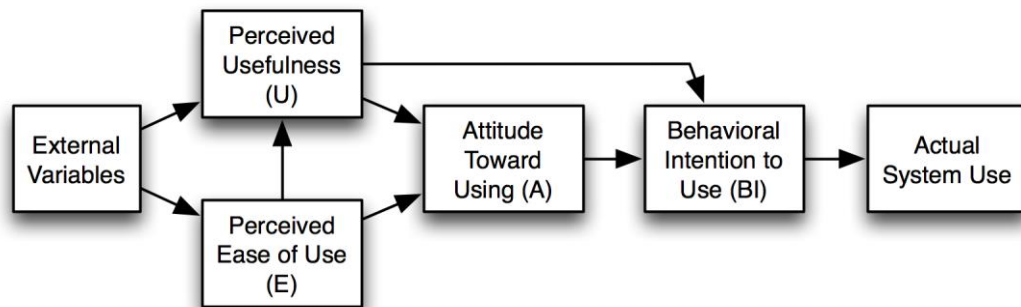


Figure 1: showing the components of TAM

1.7.1. Applying tam to the adoption of ICT amongst tomato smallholder farmers in Chiweshe

1.7.2. Perceived Usefulness (PU)

Smallholder farmers especially in Chiweshe will only adopt and utilize ICT if they perceive it to be useful and advantageous in their farming activities. In Zimbabwe, ICT can assist small scale farmers in accessing agricultural information, weather forecasting, markets their produce as well as prevailing prices on the market, also demand and supply of tomatoes on the market. This will help smallholder farmers to make informed decisions. So, it is import to evaluate, the extent to which these technologies can improve the productivity and profitability of smallholder farmer in Chiweshe.

1.7.3. Perceived Ease of Use (PEOU)

The second variable to be considered is the perceived ease of use of ICT by smallholder farmers. The ease of use will determine if a farmer can easily employ the technology into their farming activities. For instance, some ICT tools may require skills that are not common amongst smallholder farmers. This variable will be critical to determining which ICT applications are adopted and utilized by smallholder farmers.

1.7.4. External variables (Social and cultural environment)

The social and cultural environment of smallholder farmers in Chiweshe can significantly influence their attitude and intention towards the adoption of ICT. Social and cultural norms, beliefs, and values can determine the level of acceptability of ICT among smallholder farmers.

Therefore, it is crucial to explore the social and cultural dimensions of the setting in which these technologies are introduced amongst rural farmers.

1.7.5. Conclusion

In conclusion, the TAM framework is an appropriate theoretical lens through which to explore the embracing and usage of ICT amongst tomato smallholder farmers in Zimbabwe. The framework highlights the importance of perceived worth, perceived ease of usage, and the social and cultural environment of the user in determining their attitude and intention towards the adoption of these technologies. A better understanding of these variables can facilitate the development of effective strategies for promoting the adoption and use of ICT amongst smallholder farmers in Chiweshe.

1.8. Research gap

Despite the widespread acknowledgment of the importance of information and communication technologies (ICTs) in enhancing food security, there is an absence of research that assess the contribution of ICT in improving income of smallholder farmers in Chiweshe. This study was done in other areas but not in Chiweshe communal area. There is a crucial need for research in this field to identify specific ICT tools, strategies and their ability to increase income for smallholder farmers.

1.9. Conclusion

This chapter looked at the ICT tools used in Agricultural Marketing, the effect of ICT on the choice of marketing channels produces, the role of ICT in agricultural marketing as well as the theoretical framework to be used in this research. The Researcher also looked at Challenges being faced by small scale farmers in accessing ICT.

CHAPTER 3

RESEARCH METHODOLOGY

3.0. Introduction

This chapter presents the methodology that was followed to answer the study research questions. This section describes the study area, research design used, data sources used in analysis, the sampling methods used in data collection, discussion of data that was collected and collection methods and the type of analysis done to produce the results that have provided answers to the study research questions.

3.1. Description of the study area

The study was done in Chiweshe which falls under Mazowe District which is in Mashonaland central. Chiweshe communal area is approximately 80 kilometers from the capital city Harare. the communal area has a total land size of 86 200hactares with a population 92 326 (WFP, 2022). It consists of approximately 500 tomato smallholder farmers. Mazowe falls in natural region 2 which has an average annual rainfall of 800 – 1000mm that falls from November to March. The average temperature of Chiweshe ranges from 15 to 35 degrees Celsius. It is made up of 35 wards. The most common soils include sandy loams, clays loamy, and the main economic activities include livestock rearing and crop farming. The region has fertile soils and is considered a good area for commercial agriculture.

The region is suited for quite a number of crops that include maize, tobacco, wheat, soyabean, sorghum, groundnuts and horticultural crops like tomatoes and vegetables. Tomatoes are grown throughout the year since farmers depends on rainy and irrigation water from different dams which in include Mwenje, Ruya and Limbick dam. Smallholder farmers mainly grow tomato varieties like floradade and rodade plus. Chiweshe communal area is characterized by unpaved roads that connect farms to local markets. Access to major highway is limited due to poor road networks. Also, there many shops located in different area in Chiweshe that sells ICT gadgets which include mobile phones and laptops. The network providers available in Chiweshe communal area include Econet with 2 boosters on located in Howard and the other at Nyota Mountain, Netone with one booster located at Nyota Mountain and Telecel with one booster also located at Nyota Mountain. So, the most dominant network available is Econet.

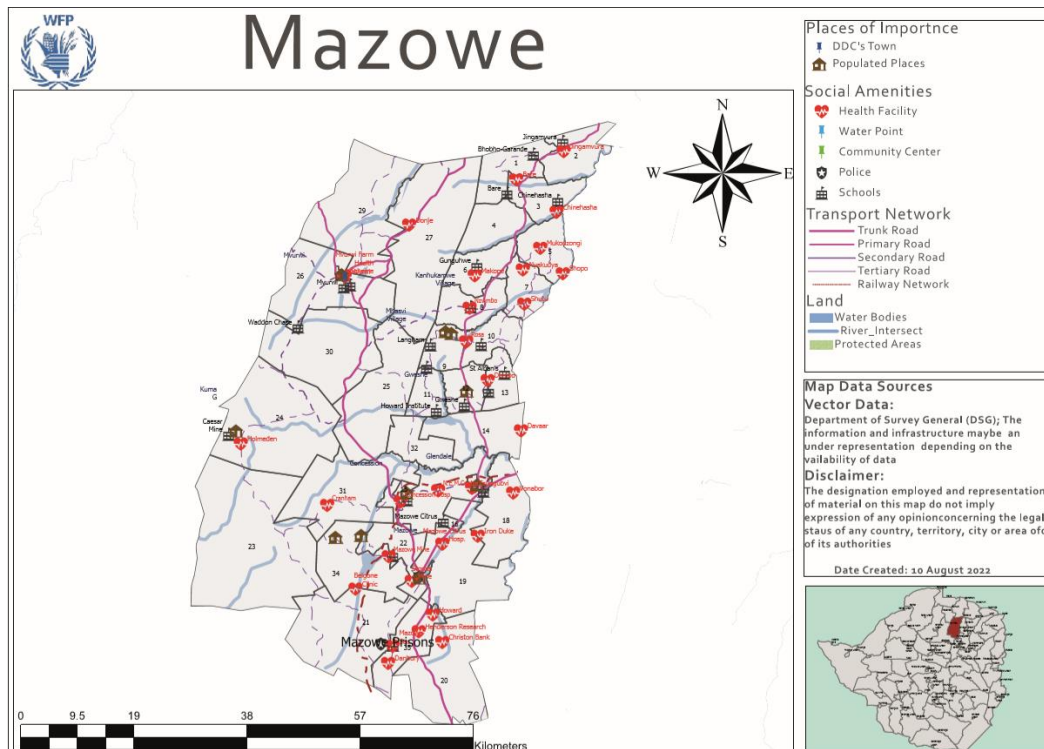


Figure 2: showing map of Mazowe District

3.2. Research design

This study employed the quantitative research methods, since the research involved the gathering and analysis of numerical data because of the nature of research objectives. This study is descriptive in nature and the analysis was done in numerical values. The descriptive design allowed for a comprehensive examination of the existing marketing channels, ICT tools in use, and challenges faced by these farmers without manipulating variables, thus providing an accurate representation of the current situation. Survey was done to collect quantitative data on the ICT tools that are used by smallholder tomato farmers, ICT challenges that are faced by tomato smallholder holder and the effect of ICT on the choice of marketing channels. The surveys targeted smallholder tomato farmers in Chiweshe communal area, gathering specific information on the use of ICT.

3.3. Sampling procedure

In this study Chiweshe was selected as the study area using purposive sampling technique. This is because it is one of the areas in Mazowe district with smallholder tomato farmers. A random technique was used to select despondence. Chiweshe communal area is divided into 13 wards. Three wards were selected randomly from Chiweshe communal area which are ward 8, 9 and

11. Finally eligible participants were selected on different factors like access to ICT and other factors related to tomato production. A total of 100 households were randomly selected out of the 500 tomato farmers. One of the advantages of simple random is that all the elements of the population had an equal chance of being selected. The sample size was determined using the Yamane (1967) formula below

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

were,

n = sample size

N= population size (500 tomato farmers)

e = sampling error (set at 0.09 or 9% for this study)

workings:

$$n = \frac{500}{1+500(0.09^2)}$$

$$n = \frac{500}{1+500(0.0081)}$$

$$n = \frac{500}{1+4.05}$$

$$n = \frac{500}{5.05}$$

$$n = 99.01 = 100 \text{ respondents}$$

Therefore, the number of respondents was calculated to be 100. These respondents were distributed across the three selected wards using stratified random sampling, with 30 selected from each ward (totaling 90), and the other 10 were included to represent those who might not be available for data collection, thus accounting for potential non-response. This additional 10% buffer helps to maintain the statistical power of the sample even if some selected farmers are unavailable or unwilling to participate.

3.4.Data collection methods

3.4.1. Primary data

Primary data refers to the data that is collected directly from the original source by the researcher for a specific purpose. The research was done with quantitative methods as the study was executed in the form of a survey. It is an effective tool for getting opinions from various farmers in a form that is easy to compare and analyse.

3.4.2. Questionnaire

A structured questionnaire was designed and used for the data collection in Chiweshe Communal area from farmers who are currently into tomato production. Quantitative data was captured by the questionnaire. Questionnaires were handed to farmers by the researcher and each farmer was interviewed separately in order to factual information from farmers. Items in the data collection tool were developed based on the objectives of the study. The first part of the questionnaire was used to collect basic information on the socio-demographic characteristics of the population for example the respondent's age, education, gender and household size, land size and also information on ICT tools, marketing channels and challenges faced by smallholder farmers.

Table 1: Data collection methods

Specific research objective	Data concepts and variables/ indicators	Data collection method/ tool	Respondents/ subjects
To identify ICT tools that are used in the marketing of tomatoes by smallholder farmers in Chiweshe.	Mobile phone social media platforms (WhatsApp and Facebook) Agricultural apps (eco farmer, emkambo, esoko)	Questionnaire	Household
+To identify marketing channels that are available for smallholder tomato farmers in Chiweshe	Direct sales to consumers (local markets, farm gate) Wholesalers and retailers	Questionnaire	Household
To Analyse challenges faced by smallholder farmers in accessing ICT	Lack of technical knowledge or skills to use ICT tools. Availability of internet connectivity in rural areas. Costs associated with purchasing ICT devices	Questionnaire	Household

	(phones, computers) and cost of data.		
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3.5.Data analysis procedure

Data analysis was done using statistical package for Social Sciences (SPSS) because of its ability to extensively analyze quantitative data. It also a storage facility and involves the vital analytical gears that are fast and easy to use (Luković et al., 2020). Data cleaning was done using SPSS.

3.5.1. Objective 1: To identify ICT, tools that are used in the marketing of tomatoes by smallholder farmers in Chiweshe.

To establish the ICT tools used in marketing of tomatoes and the extent of use of these tools, descriptive statistics was used to analyse data which include means, frequencies and percentages to quantify ICT usage and the data was presented in tables, pie charts and graphs. Descriptive statistics allow for the ease of data visualization and it also allows for data to be presented in a meaningful and understandable way which in turn allows for a simplified interpretation of the data set in question

3.5.2. Objective 2: To identify marketing channels that are available for smallholder tomato farmers in Chiweshe.

Marketing channels are routes through which farm products move from producers to consumers. The channel length however varies depending on the quantity of products to be moved, the form of consumer demand and degree of specialization in production. In this case the tomato farmers are price-takers and they are also channel-takers. Tomato farmers may have an opinion about which market gives the highest price and which actor provides the best technical assistance. But in the end, it will be the buyer who decides whether he/she wants to buy produce from a particular farmer. At the end Tomato farmers will use the market channel map to visualize market systems in an intuitive way and organize and analyze of information on the market system.

Data analysis was basically describing the behavior of farmers in terms of mean, percentages and frequency and others to show the different market channels that are used by tomato smallholder farmers in Chiweshe communal area.

Secondly, gross margin analysis was done to indicate the profitability of farmers from different marketing channels. The gross margin analysis is central to evaluating the profitability across different marketing channels. It is computed as $GM = TR - TVC$, where TR is the total revenue generated from tomato sales and TVC represents the total variable costs associated with each channel. The study employs this method to assess whether channels that offer higher nominal selling prices automatically translate into greater profitability for farmers or whether additional intermediary costs reduce farmers' net returns. It allows the researcher to identify correlations between the type of marketing channel such as direct sales versus multi-intermediary routes and the economic benefits retained by the farmers. The higher the gross margin the more capital a farmer retains.

Gross margin = total revenue – total variable costs

$$\text{Gross margin\%} = \frac{\text{gross profit}}{\text{revenue}} \times 100$$

channel	Total revenue	Total variable costs	Gross margin	Gross margin %
Channel 1				
Channel 2				
Channel 3				

3.5.3. Objective 3: To Analyse challenges faced by smallholder farmers in accessing ICT.

The first step in determining the ICT challenges faced by small-scale farmers in tomato marketing in Chiweshe communal area is to map tomato value chain actors. The assessment will analyze systematically or mapping the actors participating in the production, distribution, processing, marketing and consumption of tomatoes. This mapping assesses the characteristics of actors, profit and cost structures and flows of goods throughout the chain; employment characteristics and the destination and volumes of sales made among the actors.

3.5.3.1. Ranking and scoring method

Ranking and scoring method was used to assess the relative importance of marketing challenges that tomato farmers are facing in Chiweshe communal area by ranking and scoring. Following the identification of challenges the ranking and scoring method is employed to assess the perceived importance of each challenge. It will be used to identify best and most

important challenges from the list. Farmers were asked to allocate counters up to the maximum of 5 counters per challenge to indicate their views on the importance of the challenge. The allocated number will provide will provide a score on a scale of 0-5 with a score of zero as the least important.

3.5.3.2. Statistical analysis

Mean score and mean ranks were calculated for each barrier. to determine the relative importance or severity of those challenges. Mean ranks provide a way to compare the order of challenges based on their overall ranking across all participants or datasets while mean scores offer a numerical representation of the average importance or severity of each challenge.

Standard deviation was calculated to provides insight into the variance in responses among farmers. This signifying how much agreement or disagreement exists about a challenge's importance and frequency table was created. Group comparisons were made. For example, responses were compared the based-on demographics such as age which could reveal nuanced perceptions of ICT accessibility challenges that are specific to certain groups of farmers. Data was presented in tables and bar charts. This visual representation is crucial as it simplifies complex data into formats that can be readily interpreted. Effective data visualization tools enhance clarity for stakeholders and facilitate discussions on policy or intervention measures aimed at improving ICT access for smallholder farmers (Okeyo et al., 2022).

Table 2 : showing data collection tools

Specific Objective	Hypothesis/theory/ concepts	Variables/ indictors	Data analysis tools
To identify ICT tools that are used in the marketing of tomatoes by smallholder farmers in Chiweshe.	Smallholder in Chiweshe utilize mobile phones and social media platforms for marketing their tomatoes	Mobile phone Social media Agricultural app Television Radio Farmers perceptions towards ICT tools effectiveness	Descriptive statistics (mean, percentages, frequencies)

To identify marketing channels that are available for smallholder tomato farmers in Chiweshe.	Smallholder tomato farmers in Chiweshe primarily rely on local markets and directly to consumers as their main marketing channels.	Local markets Farm gate Wholesaler Online marketing. Prices receive through each channel	mean, percentages, frequencies Gross margin budget
To Analyse challenges faced by smallholder farmers in accessing ICT		Access to internet and mobile network Digital literacy levels of farmers Cost of ICT tools and services Lack of trust in digital platforms	Ranking and scoring

3.6.Ethical considerations

Ethics are systems of moral values that are concerned with the degree to which research procedures adhere to professional, legal and social obligations. Ethical considerations in this study are important to ensure the wellbeing and the rights of all participants involved. Participants were informed about the nature and importance of the study. Verbal consent was pursued from each participant with the right to quit the interview at any stage because of uneasiness or any other reasons. All study participants were treated with respect, fairness and dignity. Anonymity and confidentiality were guaranteed to reduce any fear that information acquired will not be availed to anyone else not involved in the study. It also involved that the researcher does not place contributors in a position where they might be in risk of harm as a result of their participation in the study. The participants of this research will not be promised anything or paid to participate. They will be told that there will be no benefit in participating as the research will be purely an academic endeavor. All protocol were observed with relevance authorities such as the ward councilor and the village heard.

CHAPTER 4

RESULTS AND DISCUSSION

1.10. Introduction

This chapter comprises of empirical findings obtained from the field and the interpretation of the results. Tables were used to aid the interpretation and clarification of the outcomes. The presentations and discussions include the findings on the type of ICT tools used by small holder farmers in Chiweshe, the marketing channels available and the challenges faced by smallholder farmers in Chiweshe communal area.

1.11. Respondents' demographic characteristics

In terms of age, the majority of respondents (25%) were between the ages of 50 and 60, followed by those aged 20 and 30, with 22% representing a mix of experienced and younger farmers. The majority of responders (45%) had O-level qualifications, followed by 24% who had A-levels. Only 15% had primary education, whereas 16% had tertiary education. In terms of farming experience, the majority of respondents were relatively new to the industry with 39% having 5-10 years and 38% having less than 5 years. Only 23% have at least 10 years of experience. This points to a recent increase in agricultural engagement in the studied area. Household part revealed relatively large family units with 38% having 6 members, 33% with 5 members and 29% with 7 members potentially providing family labor for farming activities.

Table 3 : demographic characteristics of respondents

Variable	Category	percentage
Age	20 to 30 years	22
	30 to 40 years	17
	40 to 50 years	18
	50 to 60 years	25
	60 and above	18
Education	None	10
	Primary	5
	O level	45
	A level	24

	Tertiary	16
Experience	Less than 5 years	38
	5 to 10 years	39
	10 to 20 years	15
	More than 20 years	8
Household size	5	33
	6	38
	7	29

1.12. Mobile phones owned by smallholder farmers

The data presented in table 4.2 show that respondents have a high mobile phone penetration rate with 93.9% owning at least one mobile device and only 6.16 claiming no mobile phone ownership. This use of mobile technology demonstrates how significant these gadgets are in the life of the studied population. Table 4.3 shows a more in-depth review of the different types of mobile phones owned. It demonstrates that smartphones account for 60.2% of the total implying that the majority of respondents have access to advanced features such as internet connectivity, applications and multimedia capabilities.

Basic phones accounted for 33.7% of the devices with 33 persons indicating that a part of the population continues to rely on devices with limited capability and mostly focused on calls and text messaging. The majority of smallholder farmers (60.1%) own smartphones. Tablet ownership remained relatively low at 5.1% with 5 people, despite their larger screen size and capability. Tablets have not been widely adopted as primary mobile devices among the assessed population due to their high cost and difficulty to use. This distribution reveals a digital gap among the sample and the majority having access to advanced digital tools but a sizable minority remaining limited to basic communication capabilities.

Table 4 : showing ownership of mobile phones

Response	frequency	Percentage
Yes	93	93.9
No	6	6.1

Table 5: types of mobile phone owned

Type	frequency	percentage
Basic phone	33	33.7
Smart phone	60	60.2
Tablet	5	5.1

1.13. ICT tools used

From table 4.4, radio was the most commonly used ICT tool by nearly three-quarters (73.4%) accounting for 40% of total replies. It was followed by WhatsApp which indicated significant penetration as a digital platform with 46.8% of respondents claiming usage accounting for 25.5% of total responses. Television was the third most popular instrument reaching over one-third (32.9%) of respondents and accounting for 17.9% of total replies. Facebook showed moderate adoption with 22.8% of cases and 12.4% of responses. General internet usage and specialist agricultural information applications had low adoption rates accounting for only 3.8% of instances and 2.1% of replies respectively. These findings illustrate the persistent reliance on traditional broadcast media as well as the increased popularity of mobile messaging platforms whereas specialist digital agriculture tools are underutilized.

Table 6 : ICT tools

Tool	Number of responses	Percentage%	Case percentages%
Television	26	17.9	32.9
Radio	50	40.0	73.4
WhatsApp	37	25.5	46.8
Facebook	18	12.4	22.8
Internet	3	2.1	3.8
Agricultural information apps	3	2.1	3.8

1.14. Marketing channels used

According to the results in table 4.5 all farmers sell their tomatoes at the farm gate which is represented by 100% of respondents. Intermediary dealers were used by 66.0% of respondents accounting for 28.5% of the responses. Roadside selling was practiced by 39.8% of respondents (12.2%) whilst local markets were used by only 8.7% of respondents (3.8%). 17.5% of respondents accessed urban marketplaces accounting for 7.5% of responses. However, online selling demonstrated zero uptake showing a complete lack of digital marketplace participation. As a result, farmers used both direct marketing channels (farm gate, roadside selling, local markets and metropolitan marketplaces) and middleman traders. While the absence of online selling highlights a critical digital divide in market access despite the previously noted ICT adoption for information purposes.

Table 7 : Marketing channels

Channel	Number of responses	Percentage%	Case Percentage%
Local markets	9	3.8	8.7
Intermediary traders	68	28.5	66.0
Road side selling	41	12.2	39.8
Urban markets	18	7.5	17.5
Farm gate	103	43.1	100
Online selling	0	0	0

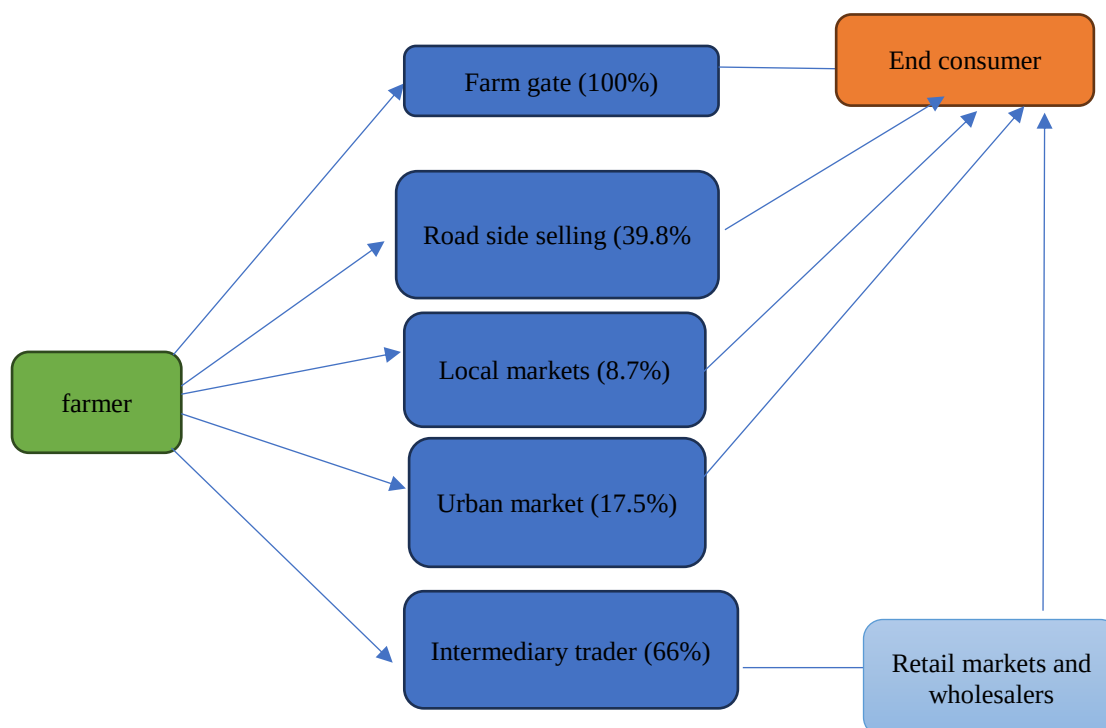


Figure 3 Tomato marketing channel map

1.15. Gross margin analysis

Gross margin analysis was done to indicate the profitability of farmers from different marketing channels. The gross margin analysis is central to evaluating the profitability across different marketing channels. It is computed as $GM = TR - TVC$ where TR is the total revenue generated from tomato sales and TVC represents the total variable costs associated with each channel. The study employs this method to assess whether channels that offer higher nominal selling prices automatically translate into greater profitability for farmers or whether additional intermediary costs reduce farmers' net returns. Table 4.5. shows total variable costs range from \$200 to \$9 000, with an average of \$2 439. Production volumes range from 1 000 kg to 50 000 kg, with farmers producing an average of 12 520.88 kg per season. When selling through intermediary traders, farmers receive between \$0.10 and \$0.20 per kg with an average of \$0.40 per kg while. Direct to consumer sales yield higher prices ranging from \$0.40 and \$0.50 per kg with a more consistent average of \$0.47 per kg.

Table 8 : Descriptive statistics

Variable	Minimum	Maximum	Mean	Std. deviation
Total variable costs in USD	200	9000	2439	2577.76

Production in kgs	1000	50000	12520.88	14255.52
Intermediary traders selling price per kg	0.10	0.20	0.40	1.978
Direct to consumers selling price per kg	0.40	0.50	0.47	0.435

These findings showed that when selling directly to consumers farmers had an average gross margin of 58.56% producing \$3 445.81 in gross profit from an average total revenue of \$5 884.14 after accounting for variable costs of \$2 439. The intermediary trader channel had a lower gross margin of 51.81% generating \$2 568.35 in gross profit from \$5,008.35 in average total revenue. This results in a 6.75 percentage point increase in gross margin for the direct-to-consumer channel. These data demonstrate that, despite similar variable costs across both channels, greater selling prices gained through direct marketing as compared to intermediaries translate directly into increased profitability for farmers. The \$875.79 difference in average total income from the direct channel is nearly fully reflected in the bottom line. This demonstrating that eliminating intermediaries allows farmers to capture more value from their production.

Table 9 : The gross margin analysis

channel	Average Total revenue	Average Total variable costs	Gross Profit	Gross margin %
Intermediary traders	5008.35	2439	2568.35	51.81
Direct to consumers	5884.14	2439	3445.81	58.56

1.16. Challenges faced by smallholder farmers in accessing ICT

Ranking and scoring method was used to assess the relative importance of marketing challenges that tomato farmers are facing in Chiweshe communal area by ranking and scoring. Following the identification of challenges the ranking and scoring method is employed to assess the perceived importance of each challenge. It was used to identify best and most important challenges from the list. Farmers were asked to allocate counters up to the maximum

of 5 counters per challenge to indicate their views on the importance of the challenge. The allocated number provided a score on a scale of 0-5 with a score of zero as the least important. The counters were as follows:

0-not important

1-slightly important

2-moderately important

3-important

4-very important

5-critical

Table 10 : mean scores

Challenges	Mean score	Median	Mode	Std deviation
Poor network coverages	4.35	4.35	5	0.914
High data costs	4.06	4.00	5	0.952
Lack of digital skills	4.04	4.00	5	1.014
Lack of appropriate devices	3.17	3.33	3	1.443
Lack of trust in digital platforms	1.68	2.00	2	1.109
Lack of finance	3.53	4.00	3	1.121

Based on the data presented in in table 4.7 Smallholder tomato farmers in Chiweshe communal area face multiple ICT challenges. Poor network coverage stands as the most critical barrier with the highest mean score of 4.35 and top mean rank of 1.43 with standard deviation of 0.640. High data costs represent the second most important challenge with a mean score of 4.06 mean and rank of 1.89. It was followed by lack of digital skills with a mean score of 4.04 and mean rank of 2.73 both exhibiting relatively consistent agreement among respondents. Lack of appropriate devices ranks fourth with a mean score of 3.17. Lack of finance with a mean score of 3.53 ranks fifth with considerable variation in farmers' perceptions standard deviation of 1.203. Lack of trust in digital platforms is perceived as the least important challenge with a mean score of 1.68 and a standard deviation of 1.436 suggests significant disagreement among farmers regarding this factor. The results clearly indicate that infrastructure and cost-related challenges outweigh skill-based and psychological barriers. This suggesting that interventions

should prioritize improving network infrastructure and reducing data costs to enhance ICT adoption among smallholder tomato farmers in this region.

Table 11 : ranking table

Challenge	Mean score	Mean rank	Std deviation	Overall ranking
Poor network coverages	4.35	1.43	0.640	1
High data costs	4.06	1.89	0.695	2
Lack of digital skills	4.04	2.73	0.737	3
Lack of appropriate devices	3.17	3.68	0.695	4
Lack of finance	3.53	4.31	1.203	5
Lack of trust in digital platforms	1.68	5.20	1.436	6

1.17. Discussion of results

1.17.1. ICT tools used by smallholder farmers

The data from table 4.2 indicate that 93.9% of respondents own at least one mobile device showing the critical role that mobile technology plays in the lives of individuals in the surveyed population. This high penetration rate suggests that mobile phones are not just communication tools but also essential instruments for accessing information, services, and markets. The results align with the research by (Aker et al., 2016) which reviewed that access to and use of mobile phones in sub-Saharan Africa has increased dramatically over the past decades and they have greatly reduced communication costs thereby allowing individuals and firms to send and to obtain information quickly and cheaply.

Table 4.4 shows that radio is the most commonly utilized ICT tool, with 73.4% of respondents and 40% of total responses. This means that traditional media continues to be used in agriculture marketing. Because of its accessibility and capacity to reach rural communities, radio is a useful medium for delivering agricultural information and market updates as it avoids network issues and data expenses. The use of television by (32.9%) of respondents indicates that visual media has a role in agriculture marketing. Television is not as widely used as radio

due to a lack of infrastructure particularly electricity. Many tomato smallholder growers in Chiweshe lack access to power. Television can provide farmers with visual demonstrations of best practices and market trends which can be particularly beneficial for those who may not have access to other forms of information. A study by (Das et al., 2021) reviews that radio and television had an effective role in improving awareness and increasing the modern technological knowledge of farmers through the television and radio programs also helped farmers' access.

46.8% of respondents uses WhatsApp which indicates a shift towards mobile messaging platforms. WhatsApp's popularity can be attributed to its user-friendly interface and the ability to facilitate real-time communication among farmers, buyers and suppliers. This finding is consistent with research that emphasizes the growing importance of mobile technologies in agricultural marketing (Aker et al., 2016). Facebook has been adopted by 22.8% which indicates that while social media is gaining traction it is not yet a primary tool for marketing among smallholder farmers. This is due to various factors like limited internet access or digital literacy among some farmers. Previous studies have noted similar trends where social media is recognized for its potential but remains underutilized in rural agricultural contexts. According to (Inegbedion et al., 2021) the use of social media (WhatsApp and Facebook) in the marketing of agricultural products was found to enhance efficiency and turnover of farmers through a significant reduction in the cost of marketing agricultural products as well as increased demand for agricultural products.

The low adoption rates for general internet usage and specialized agricultural information applications (both at 3.8%) highlight a gap in the utilization of digital resources specifically designed for agriculture (Karanasios & Slavova, 2019). This suggests that while there is a growing interest in digital tools, farmers may not be aware of or have access to these specialized applications.

1.17.2. Marketing channels used by smallholder farmers

Farm gate selling emerges as the choice used by every farmer with 100% indicating its fundamental role in the farmers' marketing strategy. This channel is most preferred by smallholder farmers because it cuts transport costs. This use of farm gate selling aligns with (Maspaitella et al., 2018) who found it is often dominate in smallholder farming systems due to transportation constraints and immediate cash needs. Intermediary traders represent the second most significant channel 66% of respondents suggesting a strong reliance on

middlemen to bridge market access gaps. This dependence on intermediaries is also align with findings by (Mgale & Yunxian, 2020) who noted that smallholder farmers often utilize traders to overcome logistical and market access limitations despite potential margin reductions.

limited utilization of local markets 8.7% demonstrate varied engagement with different direct marketing approaches this because that local markets are limited within the area so this why some farmers are using road side selling to reduce competition on the limited markets. This study contradict with other researches for example a research by (Musara et al., 2018) found that local marketing channel dominates due to its convenience and relatively lower transaction costs. Urban market participation 17.5% indicates that some farmers are attempting to access more lucrative markets despite distance challenges because they want to avoid post-harvest losses. This is because tomatoes are produced in large quantity and because of their perishable nature they need to be sold as quickly as possible. So, smallholder farmers end up sacrificing the transport cost

However, these farmers are suffering because of transport costs because of poor road networks which is increasing their cost of production. The complete absence of online selling highlights a critical digital divide in marketing despite potential ICT adoption for information purposes. This technological gap aligns with research by (Kante et al., 2019) who identified persistent barriers to digital marketplace participation among rural farmer including limited digital infrastructure, inadequate technological skills and low awareness of online marketing opportunities.

1.17.3. Gross margin analysis

The gross margin analysis reveals the profitability differences between direct and indirect marketing channels utilized by tomato farmers. When selling directly to consumers farmers achieved a higher gross margin of 58.56% compared to 51.81% when using intermediary traders representing a 6.75 percentage point advantage. This translates to an additional average gross profit of \$877.46 per farmer \$3 445.81 less \$2 568.35 despite identical variable costs of \$2 439 across both channels. These findings align with (Mmbando et al., 2017) who found that smallholder farmers who bypass intermediaries typically capture 15-20% more value from their production. According to (Wambua et al., 2018) such price differentials often reflect intermediaries' exploitation of information asymmetries and farmers' limited market access. However, as (Olwande et al., 2015) noted the persistent use of intermediaries despite lower

returns suggests that farmers face significant barriers to direct market participation including transportation constraints, time limitations and market access challenges.

1.17.4. Challenges faced by smallholder farmers

The ranking analysis identifies major hurdles to ICT adoption among smallholder tomato growers in the Chiweshe communal region. Poor network coverage was identified as the most essential challenge, with the highest mean score (4.35) and lowest mean rank (1.43) showing widespread agreement among respondents. This is due to inadequate telecommunications infrastructure in the area. A study by (Baumüller, 2018) supports these findings and emphasized that rural connectivity issues continue to undermine agricultural transformation efforts across sub-Saharan Africa with many farming communities operating in connectivity dead zones that prevent effective utilization of digital agricultural solutions.

High data costs ranked as the second most significant barrier with a mean score of 4.06. in order for smallholder farmers to access digital information they need data which is not easy in Zimbabwe. Smallholder farmers earn limited income which reduce their capabilities to account for data costs particularly in remote areas where income levels are already constrained. This economic barrier effectively prevents farmers from utilizing market information systems and digital extension services even when network infrastructure is available.

Lack of digital skills emerged as the third most important challenge with a mean score of 4.04, reflecting the digital literacy gap documented by (Masuka et al., 2016) who found that over 60% of smallholder farmers in Zimbabwe have insufficient ICT skills to effectively utilize available digital agricultural solutions. In rural Zimbabwe majority of smallholder farmers have not received any structured digital skills training largely because educational institutions in these areas lack adequate ICT infrastructure and qualified instructors to provide such training. A study by (Mathivha, 2022) highlighted that the lack of knowledge and skills in using ICT prohibits smallholder farmer from accessing information.

Lack of appropriate devices with mean score of 3.17 and lack of finance with mean score of 3.53 represent moderate but significant challenges considerable variation in responses with standard deviation of 1.203. A study by (Mwantimwa, 2019) on agricultural information access found that device affordability and financial constraints create a digital divide even within farming communities. This is because certain demographic groups remain excluded from digital agricultural ecosystems. As found in this study that even there is penetration of

smartphones many smallholder farmers possess basic devices unsuitable for accessing comprehensive agricultural applications.

The low importance assigned to lack of trust in digital platforms with mean score of 1.68. However, the high standard deviation (1.436) suggests significant disagreement among respondents. where concerns about reliability and security become prominent only after more fundamental infrastructure and skills barriers are addressed. Trust issues become more relevance as farmers gain experience with digital platforms, suggesting this challenge may become more significant as other barriers are reduced. These findings collectively indicate that infrastructure and cost-related challenges take precedence over psychological barriers to ICT adoption in Chiweshe communal area. Policy interventions should therefore prioritize expanding reliable network coverage and reducing data costs while also addressing digital literacy gaps.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.0. Conclusion

The primary goal of this study was to analyze the impact of ICT on market access for tomatoes among smallholder farmers in the Chiweshe communal region. These findings revealed that smallholder tomato growers in Chiweshe have high levels of mobile phone ownership, which indicates a huge possibility for digital agricultural interventions. However, the persistent dominance of traditional ICT means such as radio and television, combined with the low adoption of specialized agricultural applications, reveals a clear digital gap in agricultural information access. WhatsApp use illustrates the growing importance of mobile messaging platforms in agricultural communication, which could serve as a bridge between traditional and more modern digital technologies. The preference for WhatsApp can be attributed to its user-friendly interface, minimal data requirements, and versatility in facilitating both individual and group communication making it particularly suitable for farmers with limited digital literacy.

The reliance on farm gate sales along with the widespread usage of intermediary traders indicates major limits in market access for Chiweshe's smallholder farmers. The lack of online selling emphasizes the mismatch between current ICT usage and its use in digital marketplace participation. The gross margin analysis indisputably shows that direct marketing channels provide significantly higher income for farmers than intermediary-based channels. This discovery is especially relevant because it quantifies the economic gain of disintermediation and emphasizes the potential financial benefits of linking farmers more directly with customers via enhanced market access mechanisms such as digital platforms.

Challenges reveal that infrastructure and economic barriers predominate over skill-based and psychological factors in limiting ICT adoption among smallholder tomato farmers in Chiweshe. Poor network coverage and high data costs emerged as the most critical barriers pointing to fundamental infrastructure and economic constraints that must be addressed before other interventions can be effective. The significant challenge of digital skills deficiency indicates that even with improved infrastructure many farmers would still face barriers to effective ICT utilization.

5.1.Recommendations

The government and telecommunications providers should prioritize expanding dependable mobile network coverage in the Chiweshe communal region. This could include judicious placement of new network boosters, possibly through public-private partnerships with telecommunications companies such as Econet, NetOne, and Telecel.

Also implement practical digital literacy programs tailored to the needs of smallholder tomato farmers. These programs should focus on practical applications such as using WhatsApp for marketing, accessing market information online and utilizing mobile money services. Training should be conducted in local languages and incorporate hands-on learning approaches. Integrate digital skills training into existing agricultural extension services ensuring that ICT adoption is positioned as an integral component of modern farming practices rather than a separate technological domain. Also, there should be increased agricultural extension services as most of the farmers were complaining about not receiving any.

Support the development of simplified low data mobile applications specifically designed for smallholder farmers to connect directly with buyers. These platforms should accommodate various literacy levels through voice-based interfaces and visual elements operate effectively in low-network areas, and integrate with popular messaging platforms like WhatsApp.

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Appendix 1

Household Survey Questionnaire

My name is Vimbai Deve, a fourth-year student at Bindura University of Science Education, pursuing a degree in Agricultural Economics and Management. I am conducting research in Chiweshe Communal area, on the topic "Assessing the influence of Information Communication Technology (ICT) on the marketing of tomatoes by smallholder farmers." As part of this research, I have randomly selected your household to participate in a brief interview. Your participation will provide valuable insights into the understanding and application of ICT on the marketing and its effect on gross income. "Please be assured that all responses will be kept confidential and anonymous. Your consent to participate in this interview is greatly appreciated. Thank you for your time and cooperation.

SECTION A: Demographic information

1. Age

2. Gender:	Male	Female
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3. Level of education	None	Primary	Secondary school	High school	Tertiary
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4. Farming experience	Less than 5 years	5 to 10 years	10 to 20 years	More than 20 years
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5. What is your farm size in hectares?

6. What is your household size?

7. Are you a member of any organization?	Yes	No
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8. What is the distance to the nearest source of inputs in km.....

Section B: To identify ICT tools that are used in the marketing of tomatoes by smallholder farmers in Chiweshe

9. Do you have a mobile phone?	Yes	No
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10. If yes, what type of mobile phone do you own	Basic phone	Smart phone	tablet
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11. What type of ICT tools do you use?	Social media platforms		Internet	Television	radio	Mobile apps
12. How often do you use ICT tools?	Daily		Weekly	Monthly		Never
13. Why do you use ICT tools?	Price information	Market location	Tomato advertising	Payments		None
SECTION C: To identify marketing channels that are available for smallholder tomato farmers in Chiweshe						
14. Where do you sell your tomatoes?	Local markets	Urban market	Intermediary traders	Cooperatives	Online	Farm gate
15. What is selling price per kg? in USD						
16. What is your cost of production in USD						
16. What is your average tomato production in U						
Less than 1000	1000 to 10000	100000 to 20000	20000 to 50000	More than 50000		
17. What is your average income from tomato sales in USD?						
SECTION D: To Analyse challenges faced by smallholder farmers in accessing ICT						
What challenges are you facing in accessing ICT?						
Lack of finance	Poor network coverages			Limited digital skills		
High data costs	Lack of appropriate devices			Lack of trust		
18. Do you have any digital skills?						
No digital skills		Basic skills (can make calls, send messages)				
Intermediate skills (use social media, basic apps)		Advanced skills (use multiple platforms effectively)				
19. What Training do you need for ICT Usage (Select all that apply):						
Smartphone operations			Agricultural information apps			
Online marketing platforms			None			
SECTION E: OPEN-ENDED QUESTIONS						
20. What are the main difficulties you experience when using ICT for tomato marketing?						
21. How do you think ICT could improve your tomato marketing processes?						

22. Additional comments or suggestions:

