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Tomato (*Solanum lycopersicum*) as a cash crop in addressing food insecurity among smallholder farmers in communal areas. A case of Murehwa District, Mashonaland East, Zimbabwe.

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DECLARATION

I hereby declare that the research project entitled "**Tomato (*Solanum lycopersicum*) as a cash crop in addressing food insecurity among smallholder farmers in communal areas. A case of Murehwa District, Mashonaland East, Zimbabwe**" submitted to Bindura University of Science Education, Department of Agricultural Economics, Education and Extension is a record of an original work done by me under the guidance and supervision of Dr. E. Zivenge and this work is submitted in partial fulfilment of the requirements for the award of a Master of Science Degree in Food Security and Sustainable Agriculture. The results embodied in this thesis have not been submitted to any University or Institute for the award of any degree of diploma.

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DEDICATION

I dedicate this project to my children, Darren, Lorna and Faith as well as my grandchildren Jayden and Atipaishe for their love, support and inspiration during my studies. To my mom thank you. Glory be to the almighty God for his faithfulness

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I want to express my deep gratitude to Almighty God for being by my side from the beginning. I am genuinely thankful to my supervisor, Dr. Zivenge, for his insightful critiques, guidance, and support throughout this study. I also owe a special debt of gratitude to my family for their financial and emotional backing that made this journey possible. Additionally, I appreciate my colleague, Tracey Murambi for motivating me to pursue this program when I had lost my hope. May the Lord bless you all.

ABSTRACT

Tomato (Solanum lycopersicum) is a horticultural crop that has the potential to improve food security and resilience of smallholder farming households in communal areas of Southern Africa with high exposure to climatic shocks as well as volatility in markets. This abstract outlines potential pathways through which tomato production can improve food availability, access and utilization of households through provision of appropriate agronomic practices, market linkages and input provision. These include dietary nutrition (vitamin and mineral intake, dietary antioxidants), cash income generation for food and other needs of the farmer, and the convenience of short-term cash crops with multiple yearly harvests that can ensure active farming. The constraints on the tomato value chain include lack of quality seedlings, irrigation, fertilizers, pest management, post-harvest processing and marketing, and price information. This paper explores the consequences of these constraints for maintaining productivity and profitability and concludes that investments in building farmer capacity, reducing input costs and providing credit, improving extension services and strengthening value-chain interventions (aggregation, storage and market-led production) can increase the viability of tomato production as a means of addressing food insecurity. In conclusion, this study suggests that tomato can be an alternative cash crop and a food security option for smallholder farmers in communal areas, but only if such interventions are inclusive of poorer farmers and are context-specific.

Keywords: horticultural crop, climatic shocks, nutritional contribution, food insecurity

LIST OF ACRONYMS AND ABBREVIATIONS

SDGs	Sustainable Development Goals
CAADP	Comprehensive Africa Agriculture Development Programme
HFIAS	Household Food Insecurity Access Scale
FCS	Food Consumption Score
NCP	Non Centrality Parameter
RMSEA	Root Mean Square Error of Approximation
UNWFP	United Nations World Food Program

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CHAPTER I

INTRODUCTION

1.0 Introduction

The main objective of the study was to investigate the role of tomato production as an alternative cash crop to supplement food supply in Mashonaland East. The chapter gives background to the study objectives, importance and research terminology. This chapter focused on the background, problem statement, research questions, the justification of the study, limitations, delimitations, and the organization of the study, and provided the background for food security and the foundation for the research.

1.1 Background of the Study

Tomato (Solanum lycopersicum) is one of the most widely cultivated vegetable crops in the world, with an annual harvest of over 189 million tonnes, ranking second in total vegetable production after potatoes (FAO., 2022). It provides income to millions of smallholder farmers and contributes to food security in low-income countries. Only onions are more important than tomatoes among the horticultural crops grown in Sub-Saharan Africa (Motsi, 2021; Tanyanyiwa, 2019). They are popular in urban areas and the agro-processing sector (Agricultural Marketing Authority, 2020). Many tomato producers in the province of Mashonaland East are centered around Murehwa District, and provide tomatoes to the most densely populated urban centers like Harare (Mbare musika) (Makuvaro et al., 2023).

Due to the demand for tomatoes in local and urban markets, smallholder farmers have shifted their tomato production from subsistence to commercial production (Tanyanyiwa, 2019). Tomatoes are becoming an ever-increasing cash crop for rural communal farmers as it provides an avenue for meaningful cash income for smallholder farmers while helping increase their purchasing power and dietary diversity (Chipere et al., 2025). Climate change has worsened the situation of food security in Zimbabwe in communal areas. Tomato production has occupied the deficit left behind by seasonal rain fed cereal production as tomatoes are produced throughout the year (Kulkarni et al., 2022). Tomato production has increased from 19.3 kilo tonnes in 2020 to 26.4 kilo tonnes in 2024 as new communal

farmers are embracing tomato production in Zimbabwe (Chipere et al., 2025; Friis-Hansen, 2025). Smallholder tomato production is also considered as an important food security strategy in rural areas such as Murehwa District.

1.2 Problem statement

Agriculture is often unsustainable in rural Zimbabwe, contributing to food insecurity. In Murehwa District, most households rely on rain-fed maize, which is highly sensitive to climate-related and soil quality threats. National maize production is low with average yields of less than 1.3 tonnes per hectare (0.9 short ton/acre), though potentially more than 5 tonnes per hectare (3.5 short ton/acre) is possible with improved agronomic practices. Between 2000 and 2020, yields varied widely during drought years as low as Questions4l800,000 tonnes compared to a minimum national requirement of 2 million tonnes. While household income and dietary diversity have decreased, making them chronically food insecure, smallholder upland farmers have since shifted production to horticultural crops, such as tomatoes, and have begun purchasing cereals.

Owing to a strong market demand for tomato, districts like Murehwa have seen a rise in production, which has increased from about 190 000 tonnes in 2010, to over 260 000 tonnes in 2020. Tomatoes should be considered for cash crop production. Despite the above advantages, tomatoes and other horticultural crops' contribution towards household food security has not been well documented in the existing literature. The role of horticultural crop production systems in buffering households against the climate-induced of food insecurity has also not received the attention it deserves compared to staple crop production systems (Mutambara et al., 2013). Key limiting factors like post-harvest losses, weak market access and lack of production knowledge hamper the potential of tomato production (HLPE, 2020). Addressing existing knowledge gaps in production systems is therefore essential to formulate strategies that can maximize the contribution of horticulture to rural development and food security. Thus, it is imperative to understand the tomato production potential of the district and its contribution towards achieving food security.

1.3 Main Objective

To assess tomato as a cash crop in addressing Food Inecurity in communal areas in Murehwa District.

1.3.1 Specific Objectives

1. To assess challenges faced by smallholder tomato farmers in Murehwa District.
2. To assess the food security level of smallholder farmers engaged in tomato production in Murehwa District.
3. To assess the effect of tomato production on food security in Murehwa District

1.4 Research Questions

1. What are the challenges faced by smallholder tomato farmers in Murehwa District?
2. What is the food security level of smallholder farmers engaged in tomato production in Murehwa District?
3. What are the effects of tomato production on food security in Murehwa District?

1.5 Significance of the Study

The impacts of tomato production as an income crop and means of attaining food security on smallholder farmers in Murehwa District will be of interest to local and national stakeholders.

The study's findings can direct smallholder farmers and rural populations in overcoming post-harvest losses, lack of irrigation, and weak market links, and increasing sustainable profitability and productivity, which contribute to household food security and diet diversification, and improve resilience to climate shocks (FAO, 2022).

The study assists academics and researchers by adding to the growing body of knowledge exploring the production of high-value horticultural crops versus staple food production for supporting the development of rural agrarian economies and livelihoods. Although maize production is well documented in Zimbabwe, there is limited literature on horticultural crops in the communal areas that contribute to food security and income diversification (Mango et al., 2021). It thus fills a knowledge gap and strengthens the basis for larger-scale studies on smallholder commercialization and food system resilience.

The findings of the study would provide lending institutions evidence of the economic viability of tomato production as a business. Such evidence would further warrant the design of suitable lending facilities like seasonal credit, input financing and value-chain investment schemes. The Agricultural Finance Policy (2018) document and the Zimbabwe Agriculture Investment Plan (2013-2017) both stress equal access to financing for smallholder farming. Banks and microfinance institutions are reluctant to finance horticulture, as the sector is considered to be high-risk. The findings from this study can inform risk assessment and innovative financing.

For donors and development partners this study is well aligned to global commitments such as the Sustainable Development Goals (SDGs 1, 2 and 8) and the Comprehensive Africa Agriculture Development Programme (CAADP), which aim to increase food security, reduce poverty, and transform food and agricultural production systems. Lessons learned from Murehwa could be used to design interventions that support climate-smart horticultural production, value addition and market development in the most aid-effective manner.

The Government and other policymakers will benefit through the provision of recommendations for developing policy and interventions aimed at closing the gap between the national-level policy environment (such as the National Agriculture Policy Framework 2018-2030 and the Horticulture Recovery and Growth Plan 2020-2025) and the realities affecting farmers. Documenting the challenges and opportunities faced by tomato-producing farmers can provide a basis for recommendations on policy, resource allocation and rural infrastructure investment. Targeting the tomato value chain would enable the government to reduce rural food insecurity and increase horticultural exports and the contribution of the sector to GDP.

The study contributes to academia and practice by exploring the commercialization potential of tomatoes as a cash crop within the context of food security in communal areas. It provides evidence-informed insights for the academic debate, financial engineering, donor programing and policy development in the agriculture sector in Zimbabwe.

1.6 Limitations of the Study

Recall bias might be present in data obtained from farmers. Findings could depend on the season, as food security and tomato production vary by the time of the year. Tomatoes may skew results of their addition to income because of price fluctuation. Post-harvest losses for tomatoes are also difficult to estimate due to lack of documentation. Moreover, the Murehwa findings are not necessarily applicable to all other communal areas of Zimbabwe.

1.7 Delimitations of the Study

This study did not cover the agricultural sector in general or the entire Mashonaland East Province as a whole, but was limited to smallholder communal farmers in the Murehwa District growing tomatoes. The study focused on household food security indicators and limit the analysis to a single agricultural season, which for this paper, is the 2024/2025 agricultural season.

1.8 Outline of thesis

The project is divided into seven chapters. Chapter 1 is the introduction chapter that includes the background, problem statement, objectives, research questions, justification, limitations and delimitations and outline of the thesis. Chapter 2 reviews post-harvest loss management practices used in agriculture, the effect of post-harvest losses on maize profitability, theoretical and conceptual frameworks and the research gap. Chapter 3 describes the research methodology used in this study. It discusses the research design, the study area, the target population, the sampling procedure, the research instruments, the data collection procedures (Surveys, Interviews and Focus groups), the data analysis of qualitative and quantitative data, and the reliability and validity of the instruments Chapter Four presents and analyzes the research findings. The report also contains the summary of the findings on the challenges faced by smallholder tomato farmers. Chapter 5 presents the data analysis, discussion on smallholder farmers' food security level in tomato production, results and recommendations. Chapter 6 relates tomato production to food security. Chapter 7 discusses and interprets the results of the analysis, compares them with those of other studies, and provides conclusions and recommendations.

References

African Union Commission (AUC). (2014). *Comprehensive Africa Agriculture Development Programme (CAADP) Results Framework 2015–2025*. Addis Ababa**.**

Chihambakwe, M., Mafongoya, P., & Jiri, O. (2021). Urban and peri-urban agriculture: an analysis of the perceptions and use of food sovereignty among low-income dwellers in Harare, Zimbabwe [Cogent OA]. In *core.ac.uk* (Vol. 7, Issue 1). https://doi.org/10.1080/23311886.2021.1944486

Descheemaeker, K., Oosting, S. J., Homann-Kee Tui, S., Masikati, P., Falconnier, G. N., & Giller, K. E. (2016). Climate change adaptation and mitigation in smallholder crop–livestock systems in sub-Saharan Africa: a call for integrated impact assessments. *Regional Environmental Change*, *16*(8), 2331–2343. https://doi.org/10.1007/S10113-016-0957-8

FAO. (2021). *State of Food Security and Nutrition in the World 2021*. Rome: Food and Agriculture Organization of the United Nations.

FAO. (2022). *FAOSTAT Statistical Database*. Food and Agriculture Organization of the United Nations.

Government of Zimbabwe. (2018). *National Agriculture Policy Framework (2018–2030)*. Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement.

Government of Zimbabwe. (2020). *Horticulture Recovery and Growth Plan (2020–2025)*. Cabinet Office, Harare.

Makuvaro, V., Maparara, T., & Mukarati, J. (2023). Effects of COVID-19 on urban and peri-urban farmers in central Zimbabwe. *African Journal of Food, Agriculture, Nutrition and Development* , *23*(6), 23786–23799.

Mango, N., Makate, C., Tamene, L., Mponela, P., & Ndengu, G. (2021). Adoption of climate-smart agriculture and its implications for resilience to climate change in smallholder farming systems in Southern Africa. *Scientific African, 12*, e00757

Motsi, E. (2021). Food processing, handling and marketing in Zimbabwe. In *Environmental Resilience: Food and the City - Zimbabwe* (pp. 47–67). Springer Singapore. https://doi.org/10.1007/978-981-16-0305-1_4

Munyati, V., Mugabe, D., Chipunza, N., Vincent, M., Douglas, M., Nyasha, C., Never, M.,

Godfrey, C., & Joseph, M. (2013). An econometric approach to ascertain sorghum supply response in Zimbabwe. *African Journal of Agricultural Research, 8*(47), 6034–6038. https://doi.org/10.5897/AJAR12.7941

Mutambara, J., Jiri, O., & Mupangwa, W. (2013). *Smallholder farming and food security in Zimbabwe: The role of crop diversification strategies.* Journal of Development and Agricultural Economics, 5(3), 122–129.

Musara, J. P., Musemwa, L., Mutenje, M., Mushunje, A., & Pfukwa, C. (2018). Market participation and marketing channel preferences by small scale sorghum farmers in semi-arid Zimbabwe. *Agrekon, 57*(1), 64–77. https://doi.org/10.1080/03031853.2018.1454334

Mwatawala, H., Mponji, R., & Sesela, M. (2019). Role of tomato production in household income poverty reduction in Mvomero District, Tanzania. *International Journal of Progressive Sciences and Technologies, 14*, 107–113. https://www.academia.edu/download/102464519/441.pdf

Nomura, H., Fikadu, A. A., Gebre, G. G., & Shah, P. (2024). *Analysis of the Smallholder Horticulture Empowerment and Promotion ("SHEP") Intervention on Income and Food Security in Ethiopia*. https://core.ac.uk/download/pdf/649350413.pdf

Ongeri, B. (2014). *Small Scale Horticultural farming along the Kenyan Highways and Local economic development: Exploring the effect of factor prices*. https://erepository.uonbi.ac.ke/handle/11295/80107

Syafrial, S., Toiba, H., Retnoningsih, D., Purwanti, T. S., Rahman, M. S., Toiba, --Hery, Retnoningsih ---, ---Dwi, Sri, T., & Rahman, P.---M. S. (2022). Water use productivity and food security among smallholder homestead food gardening and irrigation crop farmers in North West province, South Africa. *Journal of Agriculture and Environment for International Development (JAEID), 12*(4), 250–259. https://doi.org/10.55493/5005.v12i4.4642

Tanyanyiwa, V. I. (2019). The Impact of Climate Change and Variability on Small-Scale Peri-Urban Horticultural Farmers in Domboshawa, Zimbabwe. In *Research Anthology on Environmental and Societal Impacts of Climate Change* (pp. 1535–1553). IGI Global.

Tselaesele, N., Bob, K., Torimiro, D., & Adebo, O. (2019). Small scale horticultural business: Challenges and (de) motivating factors of young farmers in Glen Valley horticultural farms of Botswana. *Smallholder Farmers and Farming Practices: Challenges and Prospects*, 203–224.

World Bank. (2013). *What is Food Security? There are Four Dimensions*. World Bank Group. https://www.worldbank.org/en/topic/agriculture/brief/food-security-update/what-is-food-security

Zvomuya, C. (2022). *Determinants of Smallholder Tomato Farmers' Participation in High-Value Markets in Shurugwi, Zimbabwe*. http://41.174.125.165:4024/jspui/handle/123456789/3787

CHAPTER II

LITERATURE REVIEW

2.0 Introduction

These experiences give a global and local perspective on how tomato production could be a food security strategy for smallholder farmers. These success stories undertaken by smallholder farmers in communal farming areas of Zimbabwe such as Murehwa District and the concepts of sustainable intensification, value chain development, and access to inputs and markets could be used to support tomato production as a cash crop for food security in Zimbabwe and Africa.

Definition of Key terms

Food security can be defined as "when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate water and sanitation, health services and care, allowing for healthy and active life as defined by World Bank, (2013)". Food security can also be defined as a state in which everyone has sufficient safe and nutritious food for normal growth and development, and an active and healthy life (UNWFP., 2013). Food security can be described as a situation where all people, at all times, have physical, social and economic access to sufficient, safe food that meets their dietary, nutritional and preference needs for an active and healthy life.

According to Mintesnot., (2016), tomato production is the process of growing tomatoes (Solanum lycopersicum) from seedlings to maturity in a greenhouse or field, or in any type of weather. Mwatawala et al., (2019) defined tomato production as the cultivation of tomatoes (Solanum lycopersicum) for the purpose of human consumption. These involve greenhouse and field production, growth, harvest, transport, processing and marketing of the fruit.

Commercialisation is the process of making an agricultural product or service available for sale to the public (Musara et al., 2018). In this instance commercialisation is the process of making tomatoes available for sale to the public.

2.1 Theoretical Framework

As a cash crop, tomatoes (Solanum lycopersicum) are important for the food security of smallholder farmers in the communal agriculture areas of Zimbabwe, where subsistence farming is popular but resources are limited (Massawe, 2014). This model assumes complexity in the interactions and interrelationships of smallholder farmers' socio-economic characteristics as they relate to tomato production, commercialization paths in generating income, and food security in their local rural area (Davies & Bowman, 2014; Syafrial et al., 2022). The limited availability of land for production, access to irrigation schemes, good quality inputs and extension services restricts the adoption of modern tomato production technologies which can improve yield and quality (Tselaesele et al., 2019). Certified seeds, adequate use of fertilizer, pest and disease management, and post-harvest handling practices can influence agricultural productivity (Muroyiwa et al., 2023; Mwatawala et al., 2019). However, the high cost of inputs, limited market access, and post-harvest loss continue to restrict production and market opportunities for this crop (Muroyiwa et al., 2023; Mwatawala et al., 2019).

The causal chain includes the pathway from increased production to market access of the surplus that is then sold within the local and regional markets, which turns subsistence farming into income generation (Mushiri & Tende, 2020). This increases household's purchasing power and, thus, smallholder farmers' access to many foods and non-food items, increasing their food security (Ahmed et al., 2024; Mwatawala et al., 2019; Zvomuya, 2022). Also, tomato sales offer a source of income to farmers, which can be used to purchase agricultural inputs and promote diversification, contributing to increased resilience to climate- and market-induced shocks (Ahmed et al., 2024; Mwatawala et al., 2019; Zvomuya, 2022). Outside the system, factors such as climate variability, infrastructure development and socio-political support systems including extension services and farmer organizations could also affect the performance of the system.

Thus, the theoretical supporting of the study is that tomato fits within the cash cropping model in which the interaction between agricultural productivity and value chain

development improves livelihood and nutrition outcomes in communal lands in Zimbabwe (Muroyiwa et al., 2022; Mushiri & Tende, 2020; Zvomuya, 2022). The theory also provides a justification for integrated interventions to improve tomato production technologies, market access and institutional support for smallholder farmers (Muroyiwa et al., 2022; Zvomuya, 2022). Such systems thinking approaches are important for leveraging tomato production to achieve food security, building resilience and improved livelihood for rural households whose incomes depend on agriculture in Zimbabwe (Muroyiwa et al., 2022; Zvomuya, 2022).

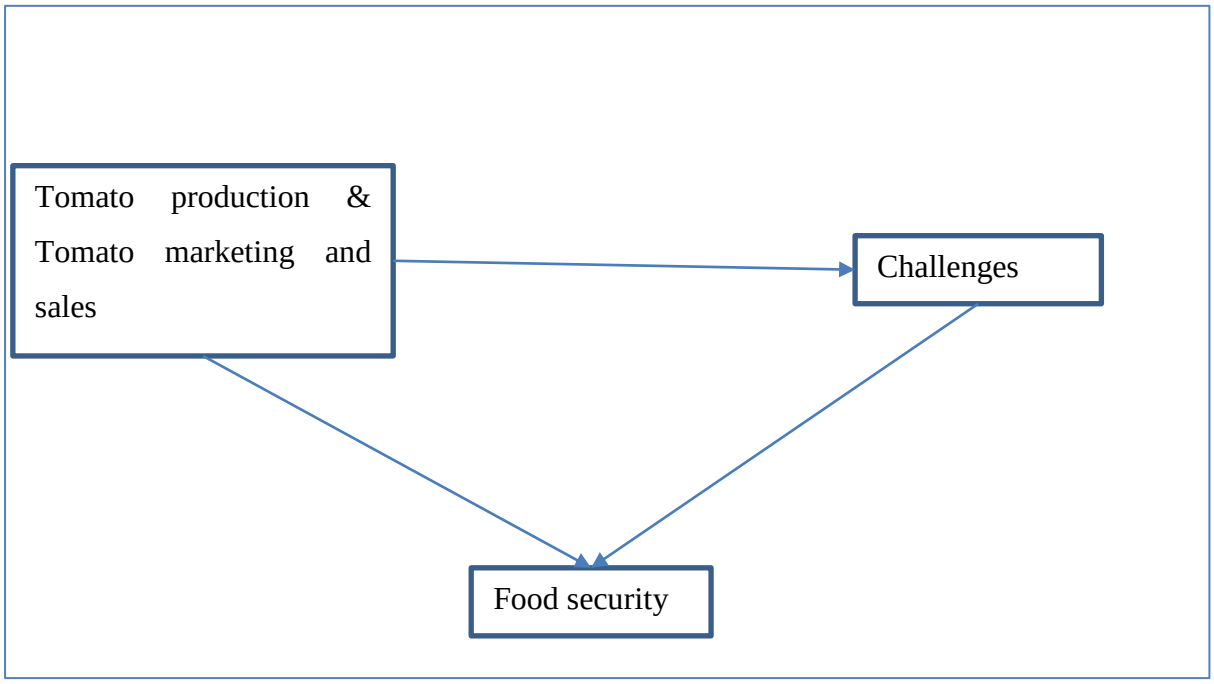


Figure 2.1 Theoretical framework (Eigenbrod & Gruda, 2015)

2.2 Challenges faced by small holder famers in Tomato Production

Smallholder tomato producers face diverse constraints that limit tomato yield and profitability and which include pest and disease pressure, which remains a chronic issue affecting tomato production globally (Mintesnot, 2016). Pests of tomato plants, such as whiteflies, aphids, and fruit borers, and diseases such as bacterial spot, late blight, and fusarium wilt lower yields and quality (Massawe, 2014). Pest control methods focus on chemical pesticides, but smallholders often lack the funds to purchase enough. Consequently, these pesticides are often used in too low concentrations and for too infrequent applications, which can further lead to the development of pest resistance and damage the environment (Massawe, 2014; Muroyiwa et al., 2022). The high cost and limited access to

quality seed and the unreliability of supply chains for improved, high-yielding and disease-resistant varieties are challenges to farmers (Mwatawala et al., 2019). The high costs and lack of availability of fertilizers and other agronomic inputs have contributed to the low uptake of fertilizers and subsequent nutrient deficiencies leading to low production (Mushiri & Tende, 2020). In addition to this, water scarcity, which is present in arid and semi-arid climates where precipitation is not reliably distributed, affects many smallholders who lack irrigation systems and consequently may see their yields decline in the face of drought as a climate impact (Nomura et al., 2024).

Postharvest losses are high in the tomato value chain, reducing producer profitability. Tomato postharvest losses of 30-50% have been attributed to poor handling practices, insufficient storage facilities, and a lack of cold chains (Mushiri & Tende, 2020). Tomatoes need to be processed or transported quickly, or much of the crop may be lost (Mushiri & Tende, 2020). These losses reduce households' income and food security in areas with limited resources (Irungu, 2009; Mintesnot, 2016). Geographic distance, poor roads and long distances to market increase the cost of transport and risk of postharvest losses (Irungu, 2009; Mintesnot, 2016). For smallholder farmers, the lack of low-cost mechanization and transport options limits market access, which can lead to lower prices due to poor access to markets, or higher postharvest losses if delivery to the market is not timely (Mushiri & Tende, 2020). Women farmers, who are also heavily involved in growing tomatoes, are at an even greater disadvantage since they typically have even less access to inputs and financing.

This is compounded by regional issues in southern Africa, where climate change is causing an increase in variations in seasonal weather patterns such as frequent droughts and dry spells. This severely reduces tomato yields (Mhembwe et al., 2019; Tselaesele et al., 2019), while the stresses also exert pressure on pests and diseases (Kapari et al., 2023; Muroyiwa et al., 2022), creating a vicious cycle of vulnerability. However, the limited adoption of irrigation and water harvesting techniques constrains farmers' capacity to adapt to these climatic shocks (Muroyiwa et al., 2023) and there are structural weaknesses in tomato value chains across many countries in southern Africa. For example, tomato products processing capacity is limited in South Africa and restricts its value addition potential and diversification opportunities, while the local market is competitive and tomato prices decline when local commodity production exceeds local demand (Broeck & Maertens, 2016; Minakov &

Goncharova, 2022). Local products compete with less expensive tomato products imported from neighboring countries, resulting in market volatility and affecting smallholders (Eigenbrod & Gruda, 2015). Access to credit is also a limitation. Financially, the risk of tomato production is perceived as high because of variable yields and returns, lending institutions typically see smallholder farmers as risky clients.

Smallholders rarely have access to support institutions for integrated pest management, sustainable production, and postharvest management. Extension services are weak or absent in remote areas (Mhembwe et al., 2019). Farmers have limited bargaining power for purchasing inputs or marketing produce due to a lack of organized producers' cooperatives. Underdeveloped market information systems prevent farmers from accessing market price and trend information, causing them to receive low prices for their produce. The absence of capacity-building programs and policies addressing smallholder production constraints impede the adoption of innovations and relevant subsidies that could increase agricultural production (Eigenbrod & Gruda, 2015; Msangi, 2014; Tselaesele et al., 2019).

One of the major challenges to smallholder tomato farmers in southern Africa is competition with industrial-sized commercial tomato producers who benefit from economies of scale, better-quality input access, technologies and supply chains that enable them to produce tomatoes at much higher yields per hectare and lower cost per unit (Kapari et al., 2023; Tselaesele et al., 2019). The dominance of these large-scale mega-farms gives them the power to flood the local market, forcing out smallholder producers and driving down prices (Kapari et al., 2023). In terms of price, quality and consistency of output, smallholders are often ejected from the formal market and forced to sell crops within the informal market closer to home, where remuneration is often less. Large scale farmers are often locked into longer term contracts with processors and supermarkets, which guarantees a market for their produce and a more secure income than is possible for a smallholder (Syafrial et al., 2022). The smallholder disadvantage is reinforced in market channels dominated by large-scale farmers since smallholders have little bargaining power and are more vulnerable to price manipulation by intermediary buyers (Msangi, 2014). Addressing this disadvantage in policy terms entails linking smallholders to the value chain to support their inclusion through cooperatives, market information access, and strengthening the bargaining position of smallholders in value chain negotiations and niche market development (Msangi, 2014).

Understanding the complex interrelationships among key biological, climatic, infrastructural, market and institutional constraints to smallholder tomato growers globally and in southern Africa is key to devising interventions to enable smallholder growers to sustainably increase tomato production, reduce tomato losses and enable smallholder tomato growers to earn stable livelihoods while supporting food security objectives, since tomato is an important cash crop and a good source of nutrition in rural areas.

2.3 Smallholder farmers' level of food security

Food security among smallholder communal farmers in Zimbabwe is marked with challenges, alongside mechanisms for adaptation and institutional support (Azadi et al., 2023; Minakov & Goncharova, 2022; Nomura et al., 2024; Syafrial et al., 2022). About 70% of Zimbabweans, most of whom live in communal smallholder farming areas, depend on subsistence rain-fed farming for food and livelihoods. Despite its importance, climate-related shocks such as droughts, erratic rainfall patterns and pests regularly upend agricultural production cycles here and reduce food availability (Muroyiwa et al., 2023). Farmer typology studies from districts such as Murehwa show that smallholder households vary greatly in terms of asset endowment. Food insecurity is greatest among severely resource-constrained households with limited land, labor, and off-farm income. However, moderately endowed farmers with diversified non-farm income are better able to access food and have a higher level of food security (FNC & WFP, 2022).

In the communal areas, food insecurity is generally driven by lack of access to agricultural inputs, inadequate irrigation technology and weak market integration (FNC & WFP, 2022; Friis-Hansen, 2025). Small-scale irrigation systems have been found to support year-round production for some crops, improving food availability and income; however, these systems are not widely adopted and do not fully buffer climatic variability (Chihambakwe et al., 2021; Tanyanyiwa, 2019). Food utilization and security are also a concern as staple crops such as maize are mostly the crop of choice for some households due to lower costs and food preferences (Chihambakwe et al., 2021). Food and Nutrition Council indicated that supplementary income-generating activities such as rearing small livestock and beekeeping are being promoted for income diversification and better access to food in the event of crop failures (FNC & WFP, 2022).

Despite improved harvests and relatively stable food commodity prices in 2025, an estimated 15% of rural households (around 1.5 million people) in Zimbabwe remained cereal insecure

in the peak hunger months (Friis-Hansen, 2025). Urban food insecurity was also high and remains a prominent issue, suggesting structural issues in addition to rural agricultural production must be considered (Chihambakwe et al., 2021; Gwetsayi et al., 2016). Ongoing humanitarian food assistance programs by the government and development partners focus on the most food insecure households to avert acute food crisis (FNC & WFP, 2022). Future efforts should improve access to climate-smart agriculture technologies, quality inputs, and finance. Investments in climate-resilient infrastructure are needed to ensure long-term food security (Chihambakwe et al., 2021). Knowledge sharing platforms and extension services are critical in building smallholder resilience in the face of active environmental and economic shocks.

Policy suggestions identify that food insecurity among Zimbabwean communal smallholders can be attributed to the compounded effects of externally induced shocks alongside structural limitations such as weak rural infrastructure, low access to credit and inputs, adverse climatic conditions and poor market linkages (Mangwanya & Manyeruke, 2019). Institutional frameworks that support smallholder capacity building and access to resources are critical. Diversified cropping systems that include improved value-added production of non-cereal staple crops could also ease better nutrition and income security (Fenton et al., 2022; Mangwanya & Manyeruke, 2019). Integrated, multi-pronged approaches built upon improved agricultural productivity and the economic and climate resilience of rural households are required for sustainable food security in Zimbabwe's communal areas. Food security among smallholder communal farmers in Zimbabwe is precarious, with important variability based on their access to resources and other situations. Despite focused actions and humanitarian food aid, sustainable food security relies on thorough programs that improve agriculture, infrastructure, market access, and community empowerment tailored to the unique needs of communal farmers in different regions of the country.

2.4 Global Tomato Production and Food Security

Tomato (Solanum lycopersicum) cultivation is a world-wide and a cash crop that is considered important for food security and for the livelihoods of smallholder farmers in communal lands. Tomatoes are grown on 5 million hectares of land and produce 189.1 million tons annually, making tomatoes one of the most important horticultural crops (Minakov & Goncharova, 2022). Italy, China, India and the US are the largest production countries. India has the second largest production worldwide, due to climatic conditions for

production all year round (Broeck & Maertens, 2016). This also means that the tomato is an important part of the food systems and diets around the world, both fresh and processed, contributing to food systems and nutrition globally (Broeck & Maertens, 2016). However, it also has heavy environmental impacts, such as greenhouse gas (GHG) and biodiversity loss due to modern industrialized tomato production methods. These methods also raise the question of sustainable tomato production systems (Makuvaro et al., 2023) that can be applied in smallholder farm contexts in Zimbabwe.

Elsewhere in Africa and in Zimbabwe, tomatoes are an important source of household income and food. Tomatoes are Zimbabwe's most commercially important vegetable crop. The tomato is grown widely by commercial and subsistence farmers (Muroyiwa et al., 2022; Zvomuya, 2022) and is an important cash crop for smallholder farmers on communal lands, who appreciate its relatively short cropping cycle, relative stability of market availability in the country, and the possibility of multiple cropping during the year (Zvomuya, 2022). Tomatoes are grown by smallholders on 0.25 ha of land per household and offer a good income to the producers, which contribute to poverty reduction and provide a financial buffer for rural households (Muroyiwa et al., 2022). Post-harvest losses, poor access to improved seeds and inputs, inadequate storage, cooling and processing infrastructure, and inadequate pest and disease management are constraints, causing wastage and price fluctuations and affecting price stability and food security (Nomura et al., 2024).

Tomatoes can be important for food security since they provide a nutritious vegetable, cash income for other food purchases, and a diversified income source to reduce vulnerability to food insecurity. Tomato production has been shown to increase household food security and general well-being in rural communities since cash inputs help to diversify income sources and spread risk. This is consistent with findings from other studies (e.g. Chipere et al. 2025 and Davies & Bowman 2014). Investments in focused actions along the tomato value chains involving improved irrigation, resistant varieties, education of farmers, improved market channels, and improved post-harvest technologies could be helpful (Ongeri 2014). Tomato production in Nigeria and Cameroon shows the importance of solving both supply chain bottlenecks and post-harvest losses, and easing access to low-cost credit, to ensure that tomato can remain a cash crop and also a staple food (FAO, 2004; Irungu, 2009; Kapari et al., 2023; Mintesnot, 2016).

Tomato production systems by rural communal farmers can contribute to improved rural household livelihoods and food security if obstacles to production are systematically addressed. These include market price fluctuation, high input costs, and incidences of pests. Solution-driven sustainable and climate-smart approaches can promote the long-term viability of tomato production systems in rural communal zones. Tomatoes represent a high potential opportunity for food security and income generation among smallholder farmers in communal farming systems accompanied by encouraging policies and strong market infrastructure.

2.5 Income from Tomato production

Tomato production has become important to smallholder farmers in various regions over the past decade. The crop is recognized in several studies as a potentially key contributor to rural livelihood, given that it is a high-value cash crop that farmers could grow for the domestic market or for local and export markets (Chihambakwe et al., 2021; Tanyanyiwa, 2019). Tomato production forms 32% to 63% of total annual household income for some smallholder tomato producers in the Mvomero District, Tanzania; therefore, it contributes to poverty alleviation and increased household spending on food, clothing, and healthcare (Mwatawala et al., 2019). The gross margins per acre per year showed positive returns on investment and indicated that tomato production is a profitable agricultural enterprise even for smallholder farmers with small landholdings (Mwatawala et al., 2019).

Similar evidence on the high value of tomato as an income-generating vegetable crop is found in Southern Africa. In South Africa, tomatoes contributed to about 17% of the total market vegetable income of smallholders, highlighting their importance and income potential in the market (Msangi, 2014; Syafrial et al., 2022). To maintain the sustainability and thereby improve the yields and quality of tomato products, practices such as crop rotation and organic farming are being applied (Msangi, 2014; Syafrial et al., 2022). However, smallholder tomato farmers still encounter difficulties in producing high-value tomatoes such as high production cost, pest and disease pressure, and post-harvest loss, reducing the optimal profit margin. Studies have proposed integrated practices such as pre harvest bagging to improve quality and reduce production cost so as to increase tomato farm viability and income (Hanif et al., 2024). Similar results have been reported in West Africa and other developing regions (Broeck & Maertens, 2016; Kapari et al., 2023). The presence of agricultural cooperatives has been linked to higher tomato yields and income. However, in

many regions, problems exist that are attributed to long-standing structural flaws in the marketing system, making it difficult for farmers to obtain a fair price. Smallholder tomato farmers in Kenya operate in customary markets, where, due to high transaction costs and low levels of value addition, they are subject to exploitation and low profitability (Eigenbrod & Gruda, 2015; Irungu, 2009). Interventions to improve profitability and generate regular income opportunities for tomato farmers through improved market linkages have been cited as potential approaches.

Systematic case studies of Asia confirm these outcomes. For instance, smallholder tomato farmers in Xinjiang province in China face high price instability and low farm-gate prices due to poor dissemination of information, ineffective tomato production skills and outdated post-harvest management practices, even as tomato production forms a key income source for farmers (Khan et al., 2020). Recommendations include: greater standardization of growing practices, stronger marketing networks, and farmer associations both to stabilize prices and to ensure farmers' incomes.

2.6 Summary

Tomato (Solanum lycopersicum) production is vital in some areas of Murehwa District, Mashonaland East Province in Zimbabwe where it improves food security and provides cash income streams to smallholder farmers. Tomato is a high-value cash crop that enables farmers to buy a variety of food and agricultural inputs that improve household dietary diversity and food security outcomes (Rubhara et al., 2020; Mukarumbwa et al., 2017). Field studies in Zimbabwe and similar environments have shown that the cash cropping of tomatoes and similar vegetables contributed to the improved food security of smallholder households by providing income, improving the access to a wider range of foods, and increasing household dietary diversity scores (Rubhara et al., 2020; Madududu et al., 2021; Mukarumbwa et al., 2017). Market access, postharvest grading and handling, ownership of productive assets, education, access to credits, and agricultural extension services determine the impacts of cash cropping on smallholder farmers (Mukarumbwa et al., 2017). Better postharvest handling, packaging and marketing information in Mashonaland East would help farmers minimize losses and increase returns, thereby contributing to food security and more diverse diets (Mukarumbwa et al. 2017). Cash cropping, such as tomato production, also has positive impacts on food security. However, this is not always the case. Such interventions are most successful when cash cropping is integrated with food crop production and off-farm

work, as well as with interventions that target resource investments and access to market opportunities (Rubhara et al. 2020; Manyanga et al. 2025). Consequently, tomato production and marketing, when combined with investment in postharvest management and market access, have the potential to improve food security for smallholder households in rural communal areas such as Murehwa District when they become one component of a broader-based and more diversified rural livelihood strategy (Rubhara et al., 2020; Mukarumbwa et al., 2017; Manyanga et al., 2025).

References

African Union Commission (AUC). (2014). *Comprehensive Africa Agriculture Development Programme (CAADP) Results Framework 2015–2025*. Addis Ababa**.**

Ahmed, M., Babayola, M., & Bake, I. (2024). Role of Horticultural Crops in Food and Nutritional Security: A Review. *Journal of Nutrition and Food Processing*, *7*(8), 1–6.

Azadi, H., Ghazali, S., Ghorbani, M., Tan, R., & Witlox, F. (2023). Contribution of small-scale farmers to global food security: a meta-analysis. *Journal of the Science of Food and Agriculture*, *103*(6), 2715–2726. https://doi.org/10.1002/JSFA.12207

Broeck, G. Van den, & Maertens, M. (2016). Horticultural exports and food security in developing countries. *Global Food Security*, *10*, 11–20. https://www.sciencedirect.com/science/article/pii/S2211912416300207

Chenje, M., Sola, L., & Paleczny, D. (1998). *The state of Zimbabwe's environment 1998*. http://agris.fao.org/agris-search/search.do?recordID=XF2015020262

Chihambakwe, M., Mafongoya, P., & Jiri, O. (2021). Urban and peri-urban agriculture: an analysis of the perceptions and use of food sovereignty among low-income dwellers in Harare, Zimbabwe [Cogent OA]. In *core.ac.uk* (Vol. 7, Issue 1). https://doi.org/10.1080/23311886.2021.1944486

Chipere, K., Mujaju, C., Matyora, T., Mateta, C., & Msamala, D. (2025). *An assessment of pesticide residues in tomatoes sold in selected markets in Zimbabwe*.

Davies, F., & Bowman, J. (2014). Horticulture, food security, and the challenge of feeding the world. In *XXIV International Horticultural Congress on Horticulture: Sustaining Lives, Livelihoods and Landscapes (IHC2014)* (Vol. 1128, pp. 1–6). https://www.actahort.org/books/1128/1128_1.htm

Eigenbrod, C., & Gruda, N. (2015). Urban vegetable for food security in cities. A review. *Agronomy for Sustainable Development*, *35*(2), 483–498. https://doi.org/10.1007/S13593-014-0273-Y

FAO. (2004). FAO - Twenty-Eighth Fao Regional Conference For Latin America And The Caribbean. *Food Security as Rural Development Strategy*. https://www.fao.org/4/J1562e/J1562e00.htm

Fenton, A., Gallagher, D., Wright, H., Huq, S., & Nyandiga, C. (2022). Addressing the

adaptation finance gap: scaling up investment in climate change adaptation using blended finance solutions. *Climate and Development*, *6*(4), 388–397. https://doi.org/10.1080/17565529.2014.953902

FNC, & WFP. (2022). MUREHWA District Food and Nutrition Security Profile. *Food and Nutrition Council*, *2022*(December).

Friis-Hansen, E. (2025). Farmer Market School Evaluation In Zimbabwe. *Adra.Dk*. https://adra.dk/wp-content/uploads/2025/08/FARMER-MARKET-SCHOOL-EVALUATION-IN-ZIMBABWE.pdf

Gwetsayi, R., Dube, L., & Mashapa, C. (2016). Urban horticulture for food security and livelihood restoration in Mutare City, Eastern Zimbabwe. *Greener Journal of Social Sciences*, *6*(3), 056–064. https://www.academia.edu/download/53402244/Gwetsayi_et_al.pdf

Hanif, T., Murad, R., Amam, R. S., & Ishrat Fatima, M. (2024). Role of horticulture in addressing food security and global nutrition challenges. *Cornous Biology*, *2*(1), 45–51. https://doi.org/10.37446/corbio/ra/2.1.2024.45-51

Irungu, J. (2009). Contribution of horticulture to food security in Kenya. In *I All Africa Horticultural Congress* (pp. 27–32). https://www.actahort.org/books/911/911_1.htm

Kapari, M., Hlophe-Ginindza, S., Nhamo, L., & Mpandeli, S. (2023). Contribution of smallholder farmers to food security and opportunities for resilient farming systems. *Frontiers in Sustainable Food Systems*, *7*, 1149854. https://doi.org/10.3389/FSUFS.2023.1149854/FULL

Khan, M., Akram, M., Janke, R., Qadri, R., Al-Sadi, A., & Farooque, A. (2020). Urban horticulture for food secure cities through and beyond COVID-19. *Sustainability*, *12*(22), 9592. https://www.mdpi.com/2071-1050/12/22/9592

Kulkarni, S., Hof, A., Ambrósio, G., Edelenbosch, O., Köberle, A. C., van Rijn, J., & van Vuuren, D. (2022). Investment needs to achieve SDGs: An overview. *PLOS Sustainability and Transformation*, *1*(7). https://doi.org/10.1371/JOURNAL.PSTR.0000020

Makuvaro, V., Maparara, T., & Mukarati, J. (2023). Effects of COVID-19 on urban and peri-urban farmers in central Zimbabwe. *African Journal of Food, Agriculture, Nutrition and*

Development , *23*(6), 23786–23799. https://www.ajol.info/index.php/ajfand/article/view/255083

Mangwanya, F., & Manyeruke, C. (2019). The political dynamics of food security and land reforms in Zimbabwe: 2000 and beyond. *Journal of Social Sciences*, *59*(1–3), 17–27. https://doi.org/10.31901/24566756.2019/59.1-3.2245

Massawe, C. R. S. (2014). *Impact of Nematode pest management strategies on Nematode communities in tomato production systems in Zimbabwe*. http://www.alumni.uz.ac.zw/bitstream/handle/10646/1232/Massawe_Impact_of_Nematode_pest_management_strategies.pdf?sequence=1&isAllowed=y

Mhembwe, S., Chiunya, N., & Dube, E. (2019). The contribution of small-scale rural irrigation schemes towards food security of smallholder farmers in Zimbabwe. *Jàmbá: Journal of Disaster Risk Studies*, *11*(1), 1–11. https://www.scielo.org.za/scielo.php?pid=S1996-14212019000100050&script=sci_arttext

Minakov, I., & Goncharova, N. (2022). State And Trends In Small-Scale Horticulture. *European Proceedings of Social and Behavioural Sciences*, 278–284. https://doi.org/10.15405/EPSBS.2022.02.34

Mintesnot, H. (2016). Review on contribution of fruits and vegetables on food security in Ethiopia. *Journal of Biology, Agriculture and Healthcare*, *6*(11), 49–58. https://core.ac.uk/download/pdf/234662024.pdf

Motsi, E. (2021). Food processing, handling and marketing in Zimbabwe. In *Environmental Resilience: Food and the City - Zimbabwe* (pp. 47–67). Springer Singapore. https://doi.org/10.1007/978-981-16-0305-1_4

Msangi, J. (2014). Food security among small-scale agricultural producers in Southern Africa. *Switzerland: Springer International Publishing*, *15442*. https://link.springer.com/content/pdf/10.1007/978-3-319-09495-3.pdf

Muroyiwa, G., Mashonjowa, E., Mhizha, T., & Muchuweti, M. (2023). The effects of deficit irrigation on water use efficiency, yield and quality of drip-irrigated tomatoes grown under field conditions in Zimbabwe. *Water SA*, *49*(4), 363–373. https://doi.org/10.17159/wsa/2023.v49.i4.3935

Muroyiwa, G., Mhizha, T., & Mashonjowa, E. (2022). Evaluation of FAO AquaCrop model for ability to simulate attainable yields and water use for field tomatoes grown under deficit irrigation in Harare, Zimbabwe. *African Crop Science Journal*, *30*(2), 245–269. https://doi.org/10.4314/acsj.v30i2.10

Musara, J. P., Musemwa, L., Mutenje, M., Mushunje, A., & Pfukwa, C. (2018). Market participation and marketing channel preferences by small scale sorghum farmers in semi-arid Zimbabwe. *Agrekon*, *57*(1), 64–77. https://doi.org/10.1080/03031853.2018.1454334

Mushiri, T., & Tende, T. (2020). Automated grading of tomatoes using artificial intelligence: The case of Zimbabwe. In *AI and Big Data's Potential for Disruptive Innovation* (pp. 216–239). IGI Global. https://www.igi-global.com/chapter/automated-grading-of-tomatoes-using-artificial-intelligence/236340

Mwatawala, H., Mponji, R., & Sesela, M. (2019). Role of tomato production in household income poverty reduction in Mvomero District, Tanzania. *International Journal of Progressive Sciences and Technologies*, *14*, 107–113. https://www.academia.edu/download/102464519/441.pdf

Nomura, H., Fikadu, A. A., Gebre, G. G., & Shah, P. (2024). *Analysis of the Smallholder Horticulture Empowerment and Promotion ("SHEP") Intervention on Income and Food Security in Ethiopia*. https://core.ac.uk/download/pdf/649350413.pdf

Ongeri, B. (2014). *Small Scale Horticultural farming along the Kenyan Highways and Local economic development: Exploring the effect of factor prices*. https://erepository.uonbi.ac.ke/handle/11295/80107

Syafrial, S., Toiba, H., Retnoningsih, D., Purwanti, T. S., Rahman, M. S., Toiba, --Hery, Retnoningsih ---, ---Dwi, Sri, T., & Rahman, P.---M. S. (2022). Water use productivity and food security among smallholder homestead food gardening and irrigation crop farmers in North West province, South Africa. *Journal of Agriculture and Environment for International Development (JAEID)*, *12*(4), 250–259. https://doi.org/10.55493/5005.v12i4.4642

Tanyanyiwa, V. I. (2019). The Impact of Climate Change and Variability on Small-Scale Peri-Urban Horticultural Farmers in Domboshawa, Zimbabwe. In *Research Anthology on Environmental and Societal Impacts of Climate Change* (pp. 1535–1553). IGI

Global.

Tselaesele, N., Bob, K., Torimiro, D., & Adebo, O. (2019). Small scale horticultural business: Challenges and (de) motivating factors of young farmers in Glen Valley horticultural farms of Botswana. *Smallholder Farmers and Farming Practices: Challenges and Prospects*, 203–224.

World Bank. (2013). *What is Food Security? There are Four Dimensions*. World Bank Group. https://www.worldbank.org/en/topic/agriculture/brief/food-security-update/what-is-food-security

Zvomuya, C. (2022). *Determinants of Smallholder Tomato Farmers' Participation in High-Value Markets in Shurugwi, Zimbabwe*. http://41.174.125.165:4024/jspui/handle/123456789/3787

CHAPTER III

METHODOLODY

3.0 Introduction

The methods section of this study presents the research design which seeks to investigate the use of tomato (Solanum lycopersicum) as a cash crop to improve food security among smallholder farmers in the communal areas of Murehwa District, Mashonaland East Province, Zimbabwe. This study adopted a mixed-methods research design that includes quantitative and qualitative data collection to provide a thorough understanding of the research problem. In this chapter, information is provided about the research site, data collection methods, data analysis and ethical considerations of the study.

3.1 Study Area

Murehwa District is located in the Mashonaland East Province of Zimbabwe (Figure 3.1) (Damir and Kinyanjui, 2005). It is located east of Harare and has three agri-ecological regions (natural region IIa, IIb and III) (FAO, 2021), with a total land area of 355,615 hectares (ha) (FAO, 2021). Of this total land area some 171,996 hectares are classified as potentially arable land. Most of the rural households live on this land, and there are estimated to be some 46,679 rural farming households on the potentially arable land, of which most are subsistence smallholders. These crops are an important component in livelihoods and food security in the region (Makuvaro et al., 2023), and the district's altitude of between 900 and 1,200 meters above sea level lends it a favorable climate for horticultural production (Chenje et al., 1998). Almost all the rivers and streams in the district are seasonal, owing to the seasonality of the area's rainfall. Annual precipitation averaged 900 to 1000mm and was concentrated within a six-month period, and the district's terrain slope is moderate to steep. However, the district also has several dams

and few perennial rivers, which are used for irrigation and other purposes (Nhachi, 2025).

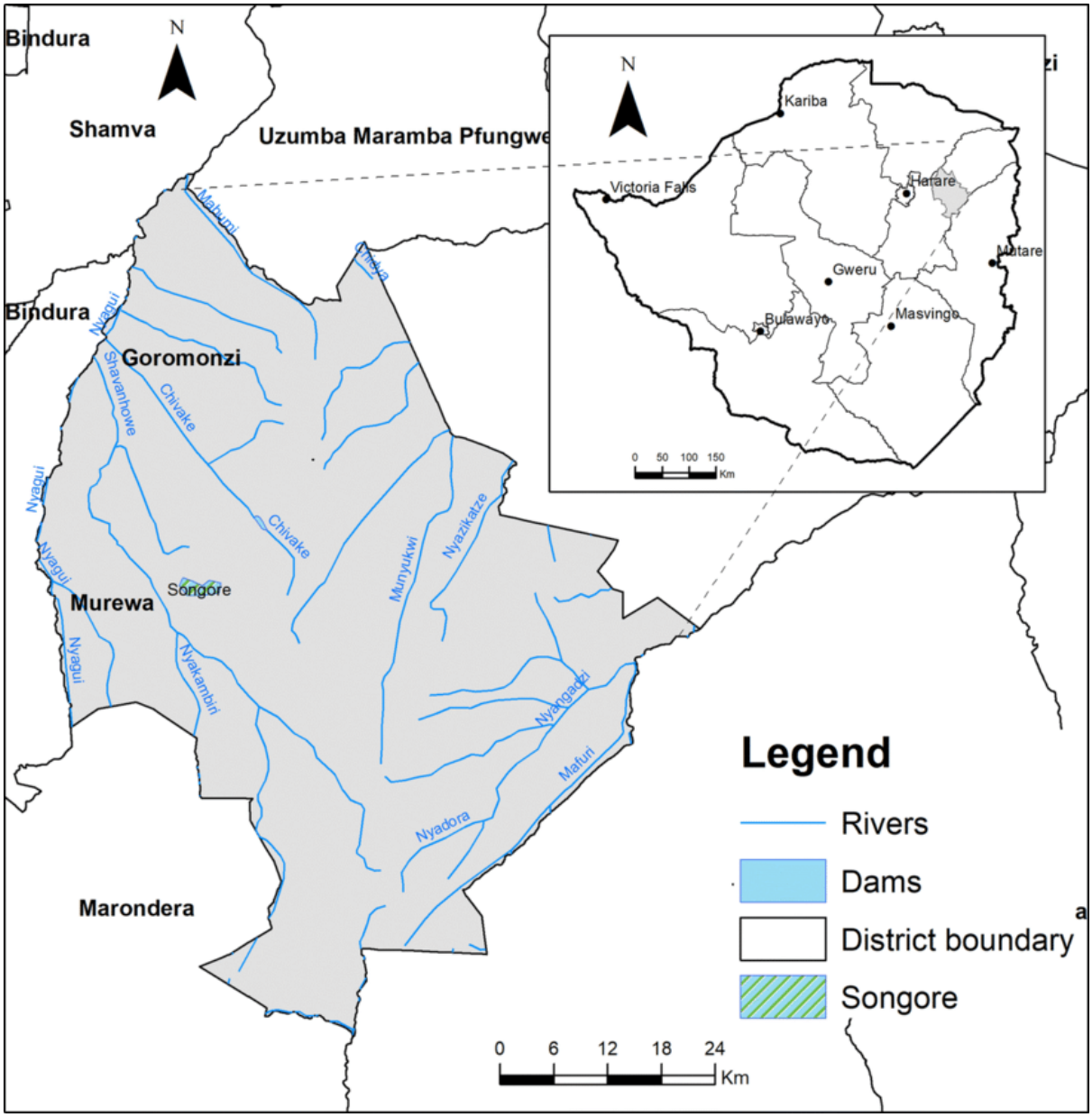
The majority of Kuwirirana's inhabitants are Shona and practice customary African subsistence farming (Ahmed et al., 2024). The local economy is mainly based on subsistence agriculture, though the southern quarter of the district is more commercialized. There are also remnants of commercial farms dating back to the colonial era (Azadi et al., 2023). There are aquaculture projects in the district, with about 900 fish ponds registered with the Department of Agricultural Technical and Extension Services (Mango et al., 2021). The varied climate and topography of the district provide potential for the production of a variety of crops. The moderate subtropical climate is favorable for horticultural crops such as tomatoes, which are fast becoming the cash crop of choice for food security and income generation for some of the smallholder farmers in the communal areas (Motsi, 2021). The district borders Uzumba Maramba Pfungwe to the north, Mutoko to the east, Makoni to the southeast, Marondera to the south and south west and Goromonzi to the west. Despite being in close proximity to Harare, the district's producers still encounter difficulties in distribution and infrastructure (Motsi, 2021).

The dominant soil types in the Murehwa District are granitic sandy soils (Lixisols) and clay soils from dolerite (Luvisols). The Lixisols cover the greatest area of land in the district. They have poorer structure, lower fertility, lower organic carbon content and lower nutrient retention. In particular, dolerite-derived clay soils are generally more productive because they are less prone to erosion, and need a greater application of organic manure such as cattle manure to become productive. (Rusinamhodzi et al., 2013; Dunjana et al., 2012; Zingore et al., 2011) These soils have greater fertility due to the higher clay, nutrient, and organic carbon content and respond well to the application of manure and fertilizer, which further improve the potential of these soils (Rusinamhodzi et al., 2013; Dunjana et al., 2012).

Land-use contributed to the differential fertility of the soils in the district, with homefields toward the home area being more fertile than outfields, with less fertile sandy soils in outfield locations. In these, sand content is >80% and clay content less than 15%, but for clay soils it varies from 39% to 44% (Dunjana et al., 2012). Although both soil types contribute to smallholder agriculture, sandy soils require higher amounts of

nutrients for maximum crop production than the other soils (Rusinamhodzi et al., 2013; Dunjana et al., 2012; Zingore et al., 2011).

Figure 3.1 Murehwa District



3.2 Research Design

The study adopted an explanatory sequential mixed methods research design to determine the contribution of tomato production to food security, assess the constraints inhibiting smallholder tomato producers and determine the food security status of tomato producing

households in Murehwa District after triangulating quantitative and qualitative data. The study's design collected quantitative data on food security and production status as well as qualitative data on the socio-economic and institutional constraints affecting tomato producers. The use of a mixed method approach allows convergence and triangulation of all data sources. It therefore aligns itself with the underlying principles of participatory rural appraisal espoused in communally based farming systems like that of the Murehwa District. The mixed method approach is an appropriate choice as it complements the quantitative production and returns data with qualitative information based on how farmers perceive and experience current agro-economic and rural development practices in Zimbabwe.

The target population was smallholder tomato farmers practicing communal land tenure. Five wards of the district with important tomato production potential and existing market opportunities were purposively selected and therefore these wards were the unit of analysis. However, participants were mostly household heads who are tomato growers, local extension officers, and local community leaders.

3.3 Sampling Procedure

Multi-stage sampling was used. In the first stage purposive sampling method was used to select five wards that are characterized as being tomato production centers. The second stage involved proportional stratified random sampling in which 150 households were selected from each of the wards producing tomatoes. Each of the selected wards was a stratum. Additional interviews with agronomists, agricultural extension workers and market traders were conducted to gain further understanding into the role of the tomato value chain in food security.

3.4 Data Collection

Highly structured questionnaires were used to collect data on the tomato farmers' farm characteristics (size, yield), household wealth (income), food consumption pattern, and access to markets. The Household Food Insecurity Access Scale (HFIAS) and the Food Consumption Score (FCS) were also recorded. Focus group discussions were held to understand farmers' experiences, production constraints they face, and adaptive strategies to manage risk. Institutional support, infrastructure and value chain efficiency was explored through key informant interviews. Secondary data, such as tomato production trends, climate

data and market trends, was obtained from the Ministry of Agriculture, FAO and relevant local governmental offices.

3.5 Data Analysis

Quantitative data was analyzed using the Statistical Package for the Social Sciences (SPSS) and Stata. Descriptive statistics (means, percentages and frequency distributions) were utilized for the demographic and production characteristics.

Regression modeling was used to measure and predict the impact of tomato production on food security in Murehwa District. It assessed the relationship between tomato production (cultivated area, yield and income from production) and food security indicators (availability, dietary diversity and stability). A regression model estimates a relationship between a dependent variable (such as crop yield and food security) and one (or more) independent variables (such as rainfall, temperature, soil nutrients, area under cultivation, etc.). The models can be linear or nonlinear. In linear modeling, a linear relationship is assumed between the dependent and the independent variables, whereas nonlinear modeling assumes a curve to depict the relationship (Archontoulis & Miguez, 2015; Byastinova, 2023). Modeling includes selecting variables, fitting a model with data, and estimating parameters of each variable to describe the strength and direction of the relationship with the dependent variable. The model performance is assessed with statistical metrics such as R-squared, root mean square error (RMSE), and mean absolute error (MAE) (Ashwitha et al., 2024; Kumar, 2023; Ingio et al., 2024).

The Household Food Insecurity Access Scale (HFIAS) and Food Consumption Score (FCS) were used to measure food security levels of smallholder tomato farmers. Food Insecurity Access Scale (HFIAS) and Food Consumption Score (FCS) are internationally standardized indicators for measuring different dimensions of household food security. The Household Food Insecurity Access Scale (HFIAS) is a measure of the access dimension of household food insecurity. The nine-item scale includes three domains: (1) worry and a feeling of uncertainty about the supply of food; (2) inadequate food quality; (3) inadequate food quantity and the physical consequences of a lack of food (Gebreyesus et al., 2015; Knueppel et al., 2009; Pandey & Bardsley, 2019; Pervaiz et al., 2022; Kabalo et al., 2019;

Mohammadi et al., 2011; Swindale & Bilinsky, 2006; Cooper, 2013; Nour & Abdalla, 2021). Using questions on each category to recall experiences over the previous 4 weeks, the answers are scored according to frequency and a score is given that places the household in one of four levels of food security: food secure, mildly food insecure, moderately food insecure, or severely food insecure (Mohammadi et al., 2011; Pervaiz et al., 2022). While the HFIAS has been commended for its simplicity, validity and suitability for use across cultures, it has been criticized for focusing on perceived rather than actual food security and not measuring food consumption and quality (Gebreyesus et al., 2015; Knueppel et al., 2009).

The FCS is a composite score constructed by the World Food Programme that considers dietary diversity, food frequency, and the quantity of each food group a household consumes during the previous seven days (, 2022; Markos et al., 2024; , 2009; Wubetie et al., 2023; Marivoet et al., 2019). Data was collected on the frequency at which households consumed each food group, and the weight of each food group reflects its nutritional value (heavier weights are associated with more nutritious food groups). The FCS is then calculated by multiplying each food group's weight by the frequency of consumption from that food group and summing over all food groups. Based on established cut-off values, households are classified as having poor, borderline, or acceptable food consumption (Markos et al., 2024; 2009; 2015; Wubetie et al., 2023; Marivoet et al., 2019). The FCS is a proxy for micronutrient adequacy and does not necessarily reflect attainment of their needs due to not accounting for portion size (Markos et al., 2024; 2015; Wubetie et al., 2023; Marivoet et al., 2019).

Thematic content analysis was employed to understand the constraints faced by the smallholder tomato farmers in Murehwa District. Thematic content analysis was important in identifying and analyzing the challenges faced by farmers, such as infrastructure shortcomings, pest risks, gender-based resource limitations, and price volatility. Thematic content analysis is a widely used qualitative analytic method for identifying, analyzing, and interpreting patterns of meaning within qualitative data, such as interview and focus group transcripts. Typically, thematic analysis is reported to include the phases of familiarization with the data, coding the data in relation to the research question, and coding the data in relation to anticipated or emergent patterns or themes. Researchers use these codes to construct categories, which can then be organized into themes (Naeem et al., 2023; Kiger & Varpio, 2020; Campbell et al., 2021; Clarke & Braun, 2017). Themes are the main results of

the analysis and pertain to the importance or value of the data and how the participants experienced or viewed the topic (Lochmiller, 2021; Naeem et al., 2023; Campbell et al., 2021; Clarke & Braun, 2017). Thematic analysis has been noted for its flexibility, in terms of theoretical framework, research model, and whether theory is applied in an inductive (themes are derived from the data) or deductive manner (theory is applied to the data) (Naeem et al., 2023; Clarke & Braun, 2017).

3.6 Ethical Considerations

Informed consent was obtained, confidentiality was observed, and participation were voluntary. The study protocol was submitted to a credible institutional review board, the Research Ethics Council of Zimbabwe, for approval prior to implementation. Data collected was anonymised to protect the identities of respondents, especially when feeding back research findings. The study resulted in context specific recommendations for improving smallholder tomato farmers' productivity, market access and food security. The results provided information that can be used by policymakers to inform interventions such as irrigation support, provision of subsidized inputs and training programs in communal areas.

3.7 Chapter Summary

The methods chapter applied a mixed-methods approach to explore the role of smallholder farming systems in food security in Murehwa District, Zimbabwe. A multi-stage sampling approach was utilized. The first stage purposively selected five wards based on accessibility and development projects. The second stage purposively selected villages within each ward. In the third stage, 248 households were systematically sampled (Manyanga et al., 2025). Data on the sampled households' demographics, land use, crop, and economic activities were collected from quantitative structured questionnaires. The data collected through quantitative analysis was complemented and verified by six focus group discussions (three male and three female focus groups) and six key informant interviews (community members and local stakeholders) (Manyanga et al., 2025). A combined approach using statistics and participatory methods enabled consideration of the views of a range of people and provide a holistic understanding of the economic and food security situation of smallholder farmers within the district (Manyanga et al., 2025).

REFERENCES

African Union Commission (AUC). (2014). Comprehensive Africa Agriculture Development Programme (CAADP) Results Framework 2015–2025. Addis Ababa.

Ahmed, M., Babayola, M., & Bake, I. (2024). Role of Horticultural Crops in Food and Nutritional Security: A Review. Journal of Nutrition and Food Processing, 7(8), 1–6.

Azadi, H., Ghazali, S., Ghorbani, M., Tan, R., & Witlox, F. (2023). Contribution of small-scale farmers to global food security: a meta-analysis. Journal of the Science of Food and Agriculture, 103(6), 2715–2726. https://doi.org/10.1002/JSFA.12207

Broeck, G. Van den, & Maertens, M. (2016). Horticultural exports and food security in developing countries. Global Food Security, 10, 11–20. https://www.sciencedirect.com/science/article/pii/S2211912416300207

Chenje, M., Sola, L., & Paleczny, D. (1998). The state of Zimbabwe's environment 1998. http://agris.fao.org/agris-search/search.do?recordID=XF2015020262

Chihambakwe, M., Mafongoya, P., & Jiri, O. (2021). Urban and peri-urban agriculture: an analysis of the perceptions and use of food sovereignty among low-income dwellers in Harare, Zimbabwe [Cogent OA]. In core.ac.uk (Vol. 7, Issue 1). https://doi.org/10.1080/23311886.2021.1944486

Chihambakwe, M., Mafongoya, P., & Jiri, O. (2021). Urban and peri-urban agriculture: an analysis of the perceptions and use of food sovereignty among low-income dwellers in Harare, Zimbabwe [Cogent OA]. In core.ac.uk (Vol. 7, Issue 1). https://doi.org/10.1080/23311886.2021.1944486

Chipere, K., Mujaju, C., Matyora, T., Mateta, C., & Msamala, D. (2025). An assessment of pesticide residues in tomatoes sold in selected markets in Zimbabwe.

Davies, F., & Bowman, J. (2014). Horticulture, food security, and the challenge of feeding the world. In XXIV International Horticultural Congress on Horticulture: Sustaining Lives, Livelihoods and Landscapes (IHC2014) (Vol. 1128, pp. 1–6). https://www.actahort.org/books/1128/1128_1.htm

Descheemaeker, K., Oosting, S. J., Homann-Kee Tui, S., Masikati, P., Falconnier, G. N., & Giller, K. E. (2016). Climate change adaptation and mitigation in smallholder crop–livestock systems in sub-Saharan Africa: a call for integrated impact assessments. Regional Environmental Change, 16(8), 2331–2343. https://doi.org/10.1007/S10113-016-0957-8

Dunjana, N., Nyamugafata, P., Shumba, A., Nyamangara, J., & Zingore, S. (2012). Effects of cattle manure on selected soil physical properties of smallholder farms on two soils of Murewa, Zimbabwe. Soil Use and Management, 28. https://doi.org/10.1111/j.1475-2743.2012.00394.x

Eigenbrod, C., & Gruda, N. (2015). Urban vegetable for food security in cities. A review. Agronomy for Sustainable Development, 35(2), 483–498. https://doi.org/10.1007/S13593-014-0273-Y

FAO. (2004). FAO - Twenty-Eighth Fao Regional Conference For Latin America And The Caribbean. Food Security as Rural Development Strategy. https://www.fao.org/4/J1562e/J1562e00.htm

Fenton, A., Gallagher, D., Wright, H., Huq, S., & Nyandiga, C. (2022). Addressing the adaptation finance gap: scaling up investment in climate change adaptation using blended finance solutions. Climate and Development, 6(4), 388–397. https://doi.org/10.1080/17565529.2014.953902

FNC, & WFP. (2022). MUREHWA District Food and Nutrition Security Profile. Food and Nutrition Council, 2022(December).

Friis-Hansen, E. (2025). Farmer Market School Evaluation In Zimbabwe. Adra.Dk. https://adra.dk/wp-content/uploads/2025/08/FARMER-MARKET-SCHOOL-EVALUATION-IN-ZIMBABWE.pdf

Gwetsayi, R., Dube, L., & Mashapa, C. (2016). Urban horticulture for food security and livelihood restoration in Mutare City, Eastern Zimbabwe. Greener Journal of Social Sciences, 6(3), 056–064.

Gwetsayi, R., Dube, L., & Mashapa, C. (2016). Urban horticulture for food security and livelihood restoration in Mutare City, Eastern Zimbabwe. Greener Journal of Social Sciences, 6(3), 056–064. https://www.academia.edu/download/53402244/Gwetsayi_et_al.pdf

Hanif, T., Murad, R., Amam, R. S., & Ishrat Fatima, M. (2024). Role of horticulture in addressing food security and global nutrition challenges. Cornous Biology, 2(1), 45–51. https://doi.org/10.37446/corbio/ra/2.1.2024.45-51

Irungu, J. (2009). Contribution of horticulture to food security in Kenya. In I All Africa Horticultural Congress (pp. 27–32). https://www.actahort.org/books/911/911_1.htm

Kapari, M., Hlophe-Ginindza, S., Nhamo, L., & Mpandeli, S. (2023). Contribution of smallholder farmers to food security and opportunities for resilient farming systems. Frontiers in Sustainable Food Systems, 7, 1149854. https://doi.org/10.3389/FSUFS.2023.1149854/FULL

Khan, M., Akram, M., Janke, R., Qadri, R., Al-Sadi, A., & Farooque, A. (2020). Urban horticulture for food secure cities through and beyond COVID-19. Sustainability, 12(22), 9592. https://www.mdpi.com/2071-1050/12/22/9592

Kulkarni, S., Hof, A., Ambrósio, G., Edelenbosch, O., Köberle, A. C., van Rijn, J., & van Vuuren, D. (2022). Investment needs to achieve SDGs: An overview. PLOS Sustainability and Transformation, 1(7). https://doi.org/10.1371/JOURNAL.PSTR.0000020

Makuvaro, V., Maparara, T., & Mukarati, J. (2023). Effects of COVID-19 on urban and peri-urban farmers in central Zimbabwe. African Journal of Food, Agriculture, Nutrition and Development , 23(6), 23786–23799.

Makuvaro, V., Maparara, T., & Mukarati, J. (2023). Effects of COVID-19 on urban and peri-urban farmers in central Zimbabwe. African Journal of Food, Agriculture, Nutrition and Development 23(6), 23786–23799. https://www.ajol.info/index.php/ajfand/article/view/255083

Mango, N., Makate, C., Tamene, L., Mponela, P., & Ndengu, G. (2021). Adoption of climate-smart agriculture and its implications for resilience to climate change in smallholder farming systems in Southern Africa. Scientific African, 12, e00757

Mangwanya, F., & Manyeruke, C. (2019). The political dynamics of food security and land reforms in Zimbabwe: 2000 and beyond. Journal of Social Sciences, 59(1–3), 17–27. https://doi.org/10.31901/24566756.2019/59.1-3.2245

Massawe, C. R. S. (2014). Impact of Nematode pest management strategies on Nematode communities in tomato production systems in Zimbabwe. http://www.alumni.uz.ac.zw/bitstream/handle/10646/1232/Massawe_Impact_of_Nematode_pest_management_strategies.pdf?sequence=1&isAllowed=y

Mhembwe, S., Chiunya, N., & Dube, E. (2019). The contribution of small-scale rural irrigation schemes towards food security of smallholder farmers in Zimbabwe. Jàmbá: Journal of Disaster Risk Studies, 11(1), 1–11. https://www.scielo.org.za/scielo.php?pid=S1996-14212019000100050&script=sci_arttext

Minakov, I., & Goncharova, N. (2022). State And Trends In Small-Scale Horticulture. European Proceedings of Social and Behavioural Sciences, 278–284. https://doi.org/10.15405/EPSBS.2022.02.34

Mintesnot, H. (2016). Review on contribution of fruits and vegetables on food security in Ethiopia. Journal of Biology, Agriculture and Healthcare, 6(11), 49–58. https://core.ac.uk/download/pdf/234662024.pdf

Motsi, E. (2021). Food processing, handling and marketing in Zimbabwe. In Environmental Resilience: Food and the City - Zimbabwe (pp. 47–67). Springer Singapore. https://doi.org/10.1007/978-981-16-0305-1_4

Msangi, J. (2014). Food security among small-scale agricultural producers in Southern Africa. Switzerland: Springer International Publishing, 15442. https://link.springer.com/content/pdf/10.1007/978-3-319-09495-3.pdf

Munyati, V., Mugabe, D., Chipunza, N., Vincent, M., Douglas, M., Nyasha, C., Never, M., Godfrey, C., & Joseph, M. (2013). An econometric approach to ascertain sorghum supply response in Zimbabwe. African Journal of Agricultural Research, 8(47), 6034–6038. https://doi.org/10.5897/AJAR12.7941

Muroyiwa, G., Mashonjowa, E., Mhizha, T., & Muchuweti, M. (2023). The effects of deficit irrigation on water use efficiency, yield and quality of drip-irrigated tomatoes grown under field conditions in Zimbabwe. Water SA, 49(4), 363–373. https://doi.org/10.17159/wsa/2023.v49.i4.3935

Muroyiwa, G., Mhizha, T., & Mashonjowa, E. (2022). Evaluation of FAO AquaCrop model for ability to simulate attainable yields and water use for field tomatoes grown under deficit irrigation in Harare, Zimbabwe. African Crop Science Journal, 30(2), 245–269. https://doi.org/10.4314/acsj.v30i2.10

Musara, J. P., Musemwa, L., Mutenje, M., Mushunje, A., & Pfukwa, C. (2018). Market participation and marketing channel preferences by small scale sorghum farmers in semi-arid Zimbabwe. Agrekon, 57(1), 64–77. https://doi.org/10.1080/03031853.2018.1454334

Mushiri, T., & Tende, T. (2020). Automated grading of tomatoes using artificial intelligence: The case of Zimbabwe. In AI and Big Data's Potential for Disruptive Innovation (pp. 216–239). IGI Global. https://www.igi-global.com/chapter/automated-grading-of-tomatoes-using-artificial-intelligence/236340

Mutambara, J., Jiri, O., & Mupangwa, W. (2013). Smallholder farming and food security in Zimbabwe: The role of crop diversification strategies. Journal of Development and Agricultural Economics, 5(3), 122–129.

Mwatawala, H., Mponji, R., & Sesela, M. (2019). Role of tomato production in household income poverty reduction in Mvomero District, Tanzania. International Journal of Progressive Sciences and Technologies, 14, 107–113. https://www.academia.edu/download/102464519/441.pdf

Nhachi, O. (2025). Climate change impacts on horticulture in Zimbabwe.

Nomura, H., Fikadu, A. A., Gebre, G. G., & Shah, P. (2024). Analysis of the Smallholder Horticulture Empowerment and Promotion ("SHEP") Intervention on Income and Food Security in Ethiopia. https://core.ac.uk/download/pdf/649350413.pdf

Ongeri, B. (2014). Small Scale Horticultural farming along the Kenyan Highways and Local economic development: Exploring the effect of factor prices. https://erepository.uonbi.ac.ke/handle/11295/80107

Rusinamhodzi, L., Corbeels, M., Zingore, S., Nyamangara, J., & Giller, K. (2013). Pushing the envelope? Maize production intensification and the role of cattle manure in recovery of degraded soils in smallholder farming areas of Zimbabwe. Field Crops Research, 147, 40-53. https://doi.org/10.1016/j.fcr.2013.03.014

Syafrial, S., Toiba, H., Retnoningsih, D., Purwanti, T. S., Rahman, M. S., Toiba, --Hery, Retnoningsih ---, ---Dwi, Sri, T., & Rahman, P.---M. S. (2022). Water use productivity and food security among smallholder homestead food gardening and irrigation crop farmers in North West province, South Africa. Journal of Agriculture and Environment for International Development (JAEID), 12(4), 250–259. https://doi.org/10.55493/5005.v12i4.4642

Tanyanyiwa, V. I. (2019). The Impact of Climate Change and Variability on Small-Scale Peri-Urban Horticultural Farmers in Domboshawa, Zimbabwe. In Research Anthology on Environmental and Societal Impacts of Climate Change (pp. 1535–1553). IGI Global.

Tselaesele, N., Bob, K., Torimiro, D., & Adebo, O. (2019). Small scale horticultural business: Challenges and (de) motivating factors of young farmers in Glen Valley horticultural farms of Botswana. Smallholder Farmers and Farming Practices: Challenges and Prospects, 203–224.

World Bank. (2013). What is Food Security? There are Four Dimensions. World Bank Group. https://www.worldbank.org/en/topic/agriculture/brief/food-security-update/what-is-food-security

Zingore, S., Tittonell, P., Corbeels, M., Wijk, M., & Giller, K. (2011). Managing soil fertility diversity to enhance resource use efficiencies in smallholder farming systems: a case from Murewa District, Zimbabwe. Nutrient Cycling in Agroecosystems, 90, 87-103. https://doi.org/10.1007/s10705-010-9414-0

Zvomuya, C. (2022). Determinants of Smallholder Tomato Farmers' Participation in High-Value Markets in Shurugwi, Zimbabwe. http://41.174.125.165:4024/jspui/handle/123456789/3787

CHAPTER IV

ASSESSING CHALLENGES FACED BY SMALLHOLDER TOMATO FARMERS IN MUREHWA DISTRICT

ABSTRACT

The tomato (Solanum lycopersicum) is one of the world's most meaningful and widely adopted vegetable crop species, and in Zimbabwe, smallholder farmers have taken tomato growing to a commercial scale. Tomato production has improved the livelihoods of communal farmers in Zimbabwe, but the same challenges still affect smallholder farmers. The study's aim was to examine the challenges that are faced by the smallholder tomato farmers in Zimbabwe. It selected a random sample of 150 respondents from smallholder tomato farmers currently in production of tomatoes from the selected wards of Murehwa District. The data that was obtained through the questionnaire conducted with the challenges measured on a 7-points Likert scale indicated that the challenges are experienced at various levels among the farmers. Other challenges perceived by the interviewed farmers included the internal factors (post-harvest and marketing), input and credit accessibility, and financial management, besides the rainfall variability, climate change, and pests and weed management. In conclusion, smallholders growing tomatoes are beset by inter-connected productivity, profitability, and investment barriers. Smallholder tomato growers would greatly benefit from further training in basic tomato agronomy, pest and weed control and climate smart agriculture practices. The unusually long rainy season last year led to late planting and harvesting, an increase in disease and a resultant reduction in yields and quality.

Keywords: Smallholder farmer, post-harvest losses, thematic analysis.

4.1 Introduction

Tomato could have great potential in reducing food insecurity and improving the income of smallholder tomato farmers, but tomato production is not yet an important contributor to food

security and improved rural livelihoods. This study attempted to assess the production constraints faced by smallholder tomato producers, the food security situation of tomato producing farmer households, and the effect of tomato production on food security status of the farmer households.

4.2 Material and methods

4.2.1 Description of the study area

Refer to 3.1

4.2.2 Research design

Refer to 3.2

4.2.3 Sampling procedure

Refer to 3.3

4.2.4 Data collection procedure

Refer to 3.4

4.2.5 Data analysis procedure

Refer to 3.5

4.2.6 Data collection challenges

As far as data collection was concerned, the interviewers faced a challenge in gathering broad descriptions and analyses of the research problem. The respondents were reluctant to talk about other challenges that they faced and hinted that they had political reservations in the issues which were being asked. Some respondents refused to answer any question relating to policies, as they associated the questions with politics. Though the respondents were persuaded by the researcher that the research was purely academic in nature, and they were persuaded to respond to other questions, the researcher decided to drop the matter as they were still reluctant.

4.3 Results and discussion

4.3.1 Smallholder farmers' issues in Murehwa

The following table contains results from the questionnaire pertaining to the constraints faced by smallholder tomato producers in Murehwa District.

Descriptive statistics

Table 4.1 Descriptive statistics for challenges faced by smallholder tomato farmers

Descriptive Statistics			
Challenges	N	Mean	Std. Deviation
1. Middlemen	372	3.3118	2.22690
2. Climate Change and shifting weather patterns	372	3.1828	2.07642
3. Cost of tomato production	372	2.9247	2.16434
4. Perishability of tomato	372	2.9462	2.14999
5. Access to finance	372	51290	2.00391
Valid N (listwise)	372		

The above table tries to show the response provided by the respondents of this research about the challenges which are being faced by the smallholder farmers. From the quantitative analysis concerning the challenges, it is clear that the challenge CH5 was the highest felt challenge which is followed by the challenges 1 and 2. This supports the statement in Azadi et al. (2023) that the factors affecting smallholder farmers in the developing countries, are the lowest on average for Challenge 4 and 3. Challenges 4 and 3 thus had the least impact. To gain more insights on the issues mentioned above, the next step undertaken was conducting interviews on some of the participants and analyzing the interviews using thematic analysis. The table below presents the codification and the responses which were obtained from the interviews conducted with the participants.

4.3.2 Thematic analysis of challenges faced by smallholder farmers in Murehwa

Table 4.2 Thematic analysis of the interviews on challenges faced by smallholder tomato farmers

AREA	QUESTION	RESPONSE	CODING	THEME
Tomato production	What are the main challenges you encounter in the production process of tomatoes (farming phase)	• Rainfall patterns • Technical knowledge is missing • Climate change • Weed & pest issues	• Rainfall • Knowledge • Climate change • Pests & weeds	• Challenges exist in the form of natural challenges and lack of technical knowledge
Tomato storage, marketing & sales	Which challenges occur in the storage, marketing and sales phase?	• Storage losses are heavy (perishable nature/ breakages/ transport losses) • Middlemen in marketing lower profits • Seasonal prices often lead to losses	• Post-harvest losses • Middlemen erode profit • Seasonal demand supply shifts	• Challenges seen as post-harvest loss, seasonal cyclic supply and actions of middlemen
Input acquisition & sources of finance	How easy is it to procure inputs and source finance for	• Sourcing inputs is relatively easy • Access to finance	• Inputs are available • Access to finance is a challenge • Third parties	• Although inputs are readily available, there are challenges

	expansion and smooth operations?	remains a challenge • We lack proper documentation to get finance from institutions • Government and NGO programs help at times with access to finance	help with access to finance	to access of finance especially because of lack of proper records however government and NGOs assist in securing finance
Financial management	How do manage (collect, store, reuse & invest) proceeds from your business	• Acquiring basic needs is the priority • Sending children to school is our priority • We have little left to invest • We buy furniture & also spend • We first secure inputs for next season then basics, then we buy furniture	• Proceeds are mainly used for basic goods and services • There is not much left to invest	• The financial management is limited to providing for basic goods

Source: Researcher (2026)

The above table is the summary of the different themes that emerged from the interviews done by the study. The objective of the study was to understand the challenges faced by tomato producers. The challenges can be grouped into production, sales, inputs and sources of funds. From the study, climate changes, rainfall patterns (climatic changes) and pest infestation are challenges to the production of tomatoes. This agrees with Motsi (2021), that challenges to tomato production are climatic conditions, rainfall patterns, pests, and diseases. The results indicated that the lack of technical know-how is a production challenge among smallholder tomato farmers, which is consistent with the findings of Mhembwe et al., (2019). On the post-harvest side, the respondents mentioned post-harvest losses as one of the major challenges with tomato storage. This was also argued by Makuvaro et al., (2023). Financial management challenges were also being experienced by farmers, according to the study. From the farmers' point of view the financial management problem is basically a problem of the fight against poverty, the fight for survival. Getting the basic necessities of life and sending children to school are the priorities. Very little, or no, surplus is available for investment because there is no surplus. The overall purpose of smallholder farming should not be to allow the smallholder to amass large income generating assets or livelihoods of their own, but rather to help them survive.

4.4 Conclusion

The chapter also showed that smallholder tomato farmers had multiple and interrelated obstacles that negatively affected productivity, profitability, and food security outcomes in the Murehwa District (Table 8). The quantitative findings suggested that farmers experienced multiple and overlapping challenges. Descriptive analysis indicates that Access to finance is ranked as the most important barrier, followed by middlemen, climate change and shifting weather. Cost of tomato production perishability of tomatoes are the least important. The percentage estimates indicate that barriers' magnitude is tied to the overall business environment such as production volumes, availability of resources, and the feasibility of on-farm production beyond the harvesting season. The thematic analysis of the interviews showed that farmers' challenges could be grouped as internal challenges, post-harvest and marketing challenges, input acquisition and finance-related challenges, and financial management challenges. Furthermore, a wide range of external conditions, mainly weather variability, climate change, and the pressure of pests and weeds, directly affected the

instability of tomato production. Thus overall in the context of Murehwa smallholder tomato farmers are faced with complex constraints that stifle both potential yield and the potential to make a profit and reinvest in the sector. Tomato production remains a viable opportunity but unless the underlying constraints are addressed, tomato production may not ensure livelihoods or food security in the long run.

4.5 Discussion

The results of the study's discussion identified the constraints to tomato production in Murehwa as existing both internally (intra-farm) and externally (in the surroundings and in the market). The study identified changing rainfall patterns, climate change, pests, and weeds as constraints to tomato production at the production level. This reinforces previous literature identifying climate risks and agronomic barriers as important barriers to productivity and prevention investments, but the smallholders also perceive a lack of technical know-how as an internal barrier. The implication is that productivity could be increased even where inputs are available and there is scope for their use, but the necessary skills are lacking, e.g. the timing of field and pest/disease management actions, and appropriate agronomic practices.

Because tomatoes are highly perishable, storing, handling, and transporting them tends to be difficult, leading to meaningful post-harvest losses. Marketing-related variables have been found to negatively impact farmers' profits when growing tomatoes. Tomato middlemen erode profits for farmers and cause swings in seasonal pricing which contribute to high income uncertainty. Scarce resources force farmers to prioritize household food, school fees and other subsistence, and leave little for tomato production investment. The result is that tomato production is shown to be less an agricultural activity than a survival strategy dependent on risk, uncertainty and limited economic resilience.

4.6 Recommendations

To improve the livelihoods of smallholder farmers producing tomatoes in the Murehwa District, this study recommends increased capacity building that includes providing training for smallholder farmers in improved tomato agronomy, pest and weed control, and climate-smart agricultural practices. Increased knowledge of the best practices identified in this study is needed. Second, extension services should provide training on post-harvest management and guide farmers on how to store and handle their produce in a way that reduces breakages and spoilage, thereby avoiding post-harvest loss.

Third, access to markets can be improved by reducing intermediation of farmers through structured aggregation, price discovery and increased price information, and farmer cooperatives or farmers' marketing groups. Fourth, access to finance for farmers can be improved through encouraging basic record keeping systems of production and sale and linking farmers to institutional finance. Intervention should, where possible, be based on multiple seasons of planning. This would provide farmers with a longer lead time for decision making and allow the reinvestment capacity to build during the season.

References

Azadi, H., Ghazali, S., Ghorbani, M., Tan, R., & Witlox, F. (2023). Contribution of small-scale farmers to global food security: a meta-analysis. *Journal of the Science of Food and Agriculture*, *103*(6), 2715–2726. https://doi.org/10.1002/JSFA.12207

Broeck, G. Van den, & Maertens, M. (2016). Horticultural exports and food security in developing countries. *Global Food Security*, *10*, 11–20. https://www.sciencedirect.com/science/article/pii/S2211912416300207

Chenje, M., Sola, L., & Paleczny, D. (1998). *The state of Zimbabwe's environment 1998*. http://agris.fao.org/agris-search/search.do?recordID=XF2015020262

Chihambakwe, M., Mafongoya, P., & Jiri, O. (2021). Urban and peri-urban agriculture: an analysis of the perceptions and use of food sovereignty among low-income dwellers in Harare, Zimbabwe [Cogent OA]. In *core.ac.uk* (Vol. 7, Issue 1). https://doi.org/10.1080/23311886.2021.1944486

Chipere, K., Mujaju, C., Matyora, T., Mateta, C., & Msamala, D. (2025). *An assessment of pesticide residues in tomatoes sold in selected markets in Zimbabwe*.

Davies, F., & Bowman, J. (2014). Horticulture, food security, and the challenge of feeding the world. In *XXIV International Horticultural Congress on Horticulture: Sustaining Lives, Livelihoods and Landscapes (IHC2014)* (Vol. 1128, pp. 1–6). https://www.actahort.org/books/1128/1128_1.htm

Eigenbrod, C., & Gruda, N. (2015). Urban vegetable for food security in cities. A review. *Agronomy for Sustainable Development*, *35*(2), 483–498. https://doi.org/10.1007/S13593-014-0273-Y

FAO. (2004). FAO - Twenty-Eighth Fao Regional Conference For Latin America And The Caribbean. *Food Security as Rural Development Strategy*. https://www.fao.org/4/J1562e/J1562e00.htm

Fenton, A., Gallagher, D., Wright, H., Huq, S., & Nyandiga, C. (2022). Addressing the adaptation finance gap: scaling up investment in climate change adaptation using blended finance solutions. *Climate and Development*, *6*(4), 388–397. https://doi.org/10.1080/17565529.2014.953902

FNC, & WFP. (2022). MUREHWA District Food and Nutrition Security Profile. ***Food and Nutrition Council, 2022*****(December).**

Friis-Hansen, E. (2025). Farmer Market School Evaluation In Zimbabwe. ***Adra.Dk*****. https://adra.dk/wp-content/uploads/2025/08/FARMER-MARKET-SCHOOL-EVALUATION-IN-ZIMBABWE.pdf**

Gwetsayi, R., Dube, L., & Mashapa, C. (2016). Urban horticulture for food security and livelihood restoration in Mutare City, Eastern Zimbabwe. ***Greener Journal of Social Sciences*****,** ***6*****(3), 056–064. https://www.academia.edu/download/53402244/Gwetsayi_et_al.pdf**

Hanif, T., Murad, R., Amam, R. S., & Ishrat Fatima, M. (2024). Role of horticulture in addressing food security and global nutrition challenges. ***Cornous Biology, 2*****(1), 45–51. https://doi.org/10.37446/corbio/ra/2.1.2024.45-51**

Irungu, J. (2009). Contribution of horticulture to food security in Kenya. In ***I All Africa Horticultural Congress*** **(pp. 27–32). https://www.actahort.org/books/911/911_1.htm**

Kapari, M., Hlophe-Ginindza, S., Nhamo, L., & Mpandeli, S. (2023). Contribution of smallholder farmers to food security and opportunities for resilient farming systems. ***Frontiers in Sustainable Food Systems*****,** ***7*****, 1149854. https://doi.org/10.3389/FSUFS.2023.1149854/FULL**

Khan, M., Akram, M., Janke, R., Qadri, R., Al-Sadi, A., & Farooque, A. (2020). Urban horticulture for food secure cities through and beyond COVID-19. ***Sustainability, 12*****(22), 9592. https://www.mdpi.com/2071-1050/12/22/9592**

Kulkarni, S., Hof, A., Ambrósio, G., Edelenbosch, O., Köberle, A. C., van Rijn, J., & van Vuuren, D. (2022). Investment needs to achieve SDGs: An overview. ***PLOS Sustainability and Transformation*****,** ***1*****(7). https://doi.org/10.1371/JOURNAL.PSTR.0000020**

Makuvaro, V., Maparara, T., & Mukarati, J. (2023). Effects of COVID-19 on urban and peri-urban farmers in central Zimbabwe. ***African Journal of Food, Agriculture, Nutrition and Development*** **,** ***23*****(6), 23786–23799. https://www.ajol.info/index.php/ajfand/article/view/255083**

Mangwanya, F., & Manyeruke, C. (2019). The political dynamics of food security and

land reforms in Zimbabwe: 2000 and beyond. *Journal of Social Sciences*, *59*(1–3), Musara, J. P., Musemwa, L., Mutenje, M., Mushunje, A., & Pfukwa, C. (2018). Market participation and marketing channel preferences by small scale sorghum farmers in semi-arid Zimbabwe. *Agrekon*, *57*(1), 64–77. https://doi.org/10.1080/03031853.2018.1454334

Mushiri, T., & Tende, T. (2020). Automated grading of tomatoes using artificial intelligence: The case of Zimbabwe. In *AI and Big Data's Potential for Disruptive Innovation* (pp. 216–239). IGI Global. https://www.igi-global.com/chapter/automated-grading-of-tomatoes-using-artificial-intelligence/236340

Mwatawala, H., Mponji, R., & Sesela, M. (2019). Role of tomato production in household income poverty reduction in Mvomero District, Tanzania. *International Journal of Progressive Sciences and Technologies*, *14*, 107–113. https://www.academia.edu/download/102464519/441.pdf

Nomura, H., Fikadu, A. A., Gebre, G. G., & Shah, P. (2024). *Analysis of the Smallholder Horticulture Empowerment and Promotion ("SHEP") Intervention on Income and Food Security in Ethiopia*. https://core.ac.uk/download/pdf/649350413.pdf

Ongeri, B. (2014). *Small Scale Horticultural farming along the Kenyan Highways and Local economic development: Exploring the effect of factor prices*. https://erepository.uonbi.ac.ke/handle/11295/80107

Syafrial, S., Toiba, H., Retnoningsih, D., Purwanti, T. S., Rahman, M. S., Toiba, --Hery, Retnoningsih ---, ---Dwi, Sri, T., & Rahman, P.---M. S. (2022). Water use productivity and food security among smallholder homestead food gardening and irrigation crop farmers in North West province, South Africa. *Journal of Agriculture and Environment for International Development (JAEID)*, *12*(4), 250–259. https://doi.org/10.55493/5005.v12i4.4642

Tanyanyiwa, V. I. (2019). The Impact of Climate Change and Variability on Small-Scale Peri-Urban Horticultural Farmers in Domboshawa, Zimbabwe. In *Research Anthology on Environmental and Societal Impacts of Climate Change* (pp. 1535–1553). IGI Global.

Tselaesele, N., Bob, K., Torimiro, D., & Adebo, O. (2019). Small scale horticultural

business: Challenges and (de) motivating factors of young farmers in Glen Valley

CHAPTER V

ASSESSING FOOD SECURITY LEVELS FOR SMALLHOLDER TOMATO FARMERS IN MUREHWA DISTRICT

ABSTRACT

Despite its potential, communal areas of Zimbabwe remain food insecure and low-producing due to factors such as insects and disease, poor-quality inputs, limited access to water, and climate change. These biophysical constraints limit smallholder tomato farmers' ability to earn enough income to achieve food security for their households and improve their livelihoods. The purpose of the study was to ascertain the food security status of smallholder farmers who were practicing tomato production in Murewa District. The study population was the smallholder farmers practicing tomato production in the five wards of Murewa District and 150 farmers were selected. Of the 151 questionnaires distributed, a total of 128 were returned (an 85% response rate). Corresponding to the interviews, data collection was stopped once the point of saturation had been reached (that is when no further themes were emerging). Food security was measured by questionnaire items and analyzed descriptively. Results are presented descriptively, with multiple food security indicators provided to show variation throughout food security across the various indicators. The authors explain the difference with tomatoes as a livelihood activity, which has improved income, revenues and marketing. While limited, the study provides perception into the relationships between the measures, including factor loadings, and the covariances between constructs. While some indicators loaded positively and considerably, other indicators had weak or non-important

loadings, probably indicating a problem of directionality, coding and/or how well the questionnaire items corresponded with the way farmers' conceived the indicators. The study concludes that tomato production and marketing activities have a relationship with food security. However, the quantitative model results should be treated with caution, given the low goodness of fit. This suggests that measurement tools should be refined to provide a better predictive explanation of food security in smallholder tomato farmers in Murehwa.

Keywords: Food security, tomato production, communal arears.

5.1 Introduction

Food security in the communal areas of Zimbabwe is an active crisis and households in the Murewa District have been food insecure for years due to climate change and other internal and external factors. Smallholder farmers have responded by increasing their production of horticultural crops including tomatoes and purchasing cereals. This study's objective was to determine the extent of food security of smallholder farmers producing tomatoes in Murewa District.

5.2 Material and methods

5.2.1 Description of the study area

Refer to 3.1

5.2.2 Research design

Refer to 3.2

5.2.3 Sampling procedure

Refer to 3.3

Table 5.1 Response rate

Instrument	Issued	Returned	Percentage
Questionnaire	150	128	85%

Source: Researcher's output (2026).

From the above table, the response rate was observed to be 85% which is significantly recognisable as sufficient for a study as was argued by Saunders et al., (2019).

From the interviews conducted, the responses were obtained using saturation methodology. The saturation point was achieved at the 11th respondent for the interviews and as such the response rate for the interviews was 11 people.

5.2.4 Data collection procedure

Refer to 3.4

5.2.5 Data analysis procedure

Refer to 3.5

5.2.6 Challenges encountered during data collection

The main challenge which was encountered in the study was gathering comprehensive qualitative data to substantiate the understanding of the food security status of the respondents. However, the results were substantiated through using quantitative analysis methods to obtain the data through questionnaires.

5.3 Results and discussion

Table 5.1 Food security levels of smallholder farmers engaged in tomato production

Descriptive Statistics			
	N	Mean	Std. Deviation
1. Poverty and financial distress	372	2.8172	2.10222
2. Inrease in on disposable income, profit and sales of tomatos	372	5.5054	1.95156
3. Use of technology in marketing and sales of tomato	372	5.0538	2.16498
4. Significant improvement in production methods	372	3.4194	2.09388
5. Improved livelihoods of community	372	3.2258	2.18857
Valid N (listwise)	372		

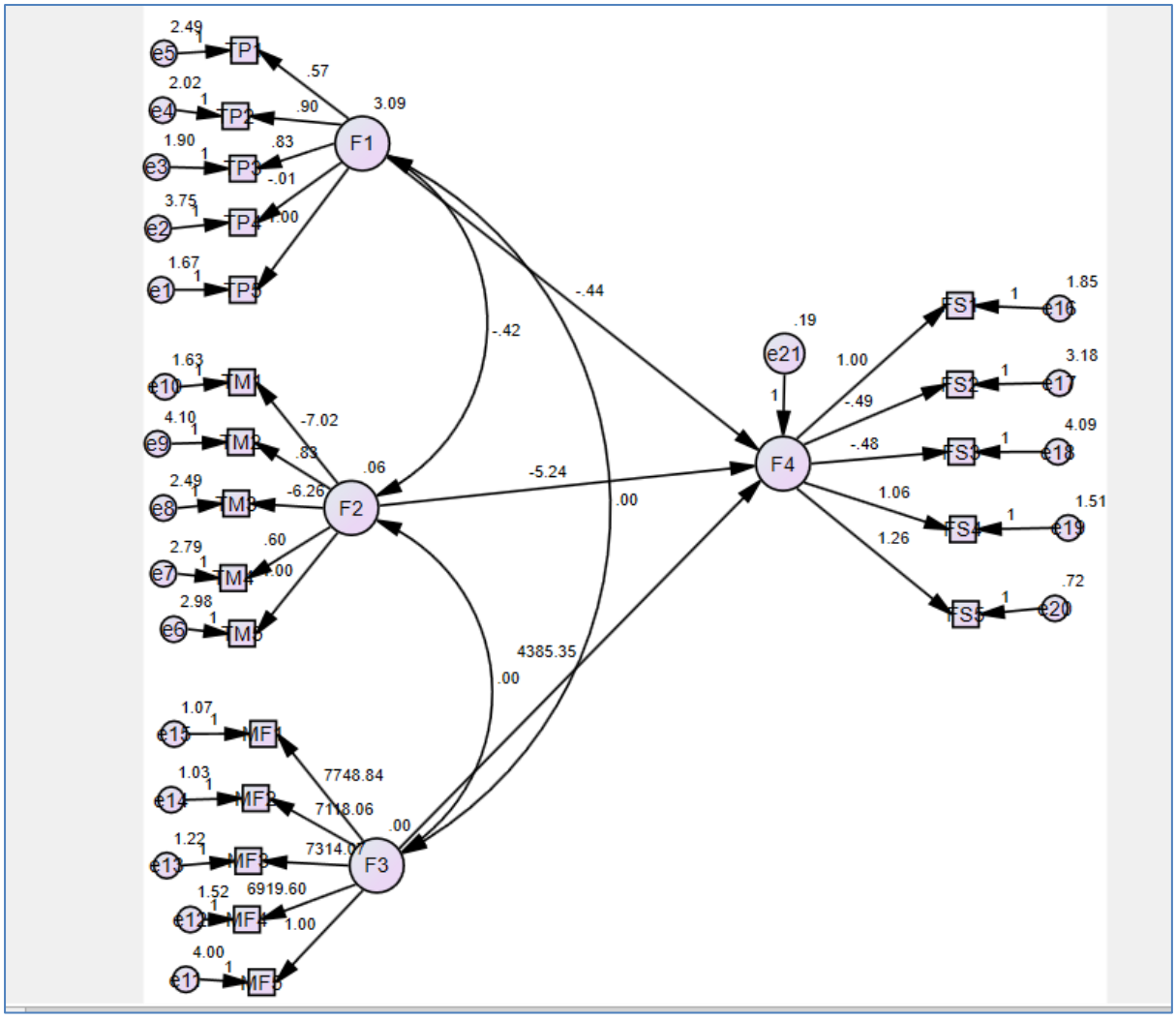
Fig 5.1 Structural equation modelling output

In the table above, the findings from the questionnaire about the food security of the smallholder farmers are displayed in order to investigate the link between food security and the farmers' activities. At a macro level, the study found that there has been an increase in disposable income, and revenues and profits from tomato production and sale. It also found an increase in the marketing of tomatoes due to technological advancements such as social media. The existence of a wider market and the proximity of this market for purposes of

marketing are consistent with Khan et al. (2020); Mangwanya and Manyeruke (2019); Mango et al. (2020) findings that there was an important improvement in the financial performance of smallholder tomato farmers in Zimbabwe.

5.3.1 Food security levels among smallholder farmers in Murehwa District

To analyze the smallholder farmers' food security levels in Murehwa district, a thorough regression model using SPSS with Amos was run. SPSS with Amos made it easy for structural equation modeling (SEM) to be used in the understanding of the relationships between variables of the study and how they related to food security levels of the study population.



Source: Researcher's data output (2026)

The above analysis shows results obtained when the study conducted structural equation model to understand the relationship between the variables in the study. The main aim of the

SEM analysis was to determine the food security levels among the respondents. The above SEM output is substantiated by the estimates in the following tables and shows in detail what the overall food security levels are in the Murehwa region and which factors are playing important roles in influencing the level of food security among the smallholder farmers in this region.

Table 5.1 Model fit

CMIN					
Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	48	1428.315	183	.000	7.805
Saturated model	231	.000	0		
Independence model	21	4136.338	210	.000	19.697

Source: Researcher's output (2026)

The SEM conducted suggests that the proposed model did not fit the data well. This is evidenced by the high value of the ratio between the chi-square statistic and the degrees of freedom of the model (CMIN/DF = 7.805), the important chi-square test statistic (p = .000), the unsatisfactory absolute fit indices RMR (= .392), GFI (= .729), AGFI (= .657) and a high RMSEA value (.135). The incremental fit indices provide further evidence for the lack of model fit (NFI = .655, TLI = .604, CFI = .636, and IFI = .683). Although the model is good for interpreting the relationships among constructs, the model should be revised based on its fit indexes, consistent with Kulkami et al., (2022) study.

Table 5.2 RMR and GFI results

RMR, GFI				
Model	RMR	GFI	AGFI	PGFI
Default model	.392	.729	.657	.577
Saturated model	.000	1.000		
Independence model	1.382	.300	.230	.272

For tomato production (Factor F1), TP1, TP2 and TP3 considerably and positively load on the factor. TP1 has a strong loading of Estimate = 0.553 ($p < .001$), TP2 of Estimate = 0.883 ($p < .001$), and TP3 of Estimate = 0.826 ($p < .001$), which are similar to those of Mhembwe et al. (2019). Nevertheless, TP4 did not load considerably (Estimate = −0.007, $p = 0.905$) on the underlying tomato production construct in this case, differing from the pattern found in Minakov and Goncharova (2022). While this may be a result of TP4 being misunderstood by respondents, it may also have been incorrectly reverse coded in this data set or it may be tapping a sub-dimension of the tomato production experiences that is not identified by the F1 factor imposed in the model.

Table 5.3 Baseline comparisons

Baseline Comparisons					
Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.655	.604	.685	.636	.683
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

As with most of the output, the SEM model is compared against a "baseline" model, usually the independence model in AMOS, in which all variables are assumed to be uncorrelated and not hypothesized to be related. The baseline comparison part of the output suggests that the hypothesized model does not fit the data much better than the baseline model. The NFI, TLI, CFI, and IFI statistics were all below the .90 cut-off that is usually considered to be a good level of improvement. The results indicate that the model's specification does not explain much of the covariance between the indicators over and above the comparison to the

independence model. Contrary to Mintesnot (2016), a meaningful model fit was found for the baseline comparison. This confirms the results of the absolute fit indices in that the model needs to be improved by checking the indicator coding (particularly for those items which have negative or non-important loadings), by dropping or trimming weak indicators, or by allowing theoretically plausible modifications in order to better represent the relationships between the constructs.

Table 5.4. Parsimony-adjusted measures

Parsimony-Adjusted Measures			
Model	PRATIO	PNFI	PCFI
Default model	.871	.571	.595
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

Parsimony-adjusted measures have similar meaning: the SEM fails to provide good fit even when taking into account parsimony. Parsimony-adjusted indices penalize the model for using many parameters without increasing the explained covariance enough. Thus, values that remain outside of acceptable ranges indicate the additional complexity does not improve representation of the relationships among the constructs to a sufficient level compared to simpler alternative models. This is also consistent with the rest of your model fit statistics above (e.g., the poor absolute fit statistics like RMSEA = 0.135 and the poor incremental fit indices NFI, TLI, CFI all well below .90). So the parsimony adjusted indices suggest that the present specification is not yet an efficient model of the data.

Table 5.6 NCP

NCP			
Model	NCP	LO 90	HI 90
Default model	1245.315	1128.717	1369.358
Saturated model	.000	.000	.000
Independence model	3926.338	3721.021	4138.933

In SEM, the NCP provides a figure for the deviation of the chi-square from the degrees of freedom of the tested model for the model under "perfect fit". The NCP can be interpreted as a figure of misfit, the higher the NCP, the worse the proposed model is (the worse it is to reproduce the covariance structure of the variables). In sum, this leads to the conclusion that the model is able to reproduce the important chi-square test statistic (p = .000) but also very weak model fit indices (RMSEA = 0.135, CMIN/DF = 7.805). In substantive terms, this means that the factor structure and/or indicator relationships (including negative and non-meaningful loadings for a few items) do not reproduce the measurement relationships as they are assumed to be in the population. Therefore, given this NCP, there is evidence that further respecification of the model is necessary to improve the SEM model's fit to the data(even if the factor loadings are large).

Table 5.7 FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	3.850	3.357	3.042	3.691
Saturated model	.000	.000	.000	.000
Independence model	11.149	10.583	10.030	11.156

FMIN (and the various change/improvement statistics in AMOS) are used as an indicator of the amount of discrepancy that remains between the sample covariance matrix and the model-implied covariance matrix once the model has been fitted. When interpreted in conjunction with other indices, a meaningful value suggests the model is still suffering from misfit (Motsi, 2021). Furthermore, since the overall chi-square is meaningful (p = .000), the CMIN/DF is low (7.805) and the RMSEA is high (0.135), the results of the FMIN support the conclusion that the proposed SEM does not yet fit the data adequately, even though some of the regression paths/indicator loadings of the SEM results are meaningful because the model fit is weak. Substantively, this means that the model's current factor structure and relations with indicators (including statistically non-important indicators such as TP4 and TM2/TM4 and the presence of negative factor loadings, which may be due to reverse coding) are inadequate for capturing well the covariance structures in the data under study and model re-specification is warranted to reduce model discrepancy.

Table 5.8. RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.135	.129	.142	.000
Independence model	.224	.219	.230	.000

The RMSEA (Root Mean Square Error of Approximation) indexes how well the SEM data fits. For the SEM built in this output, RMSEA equals 0.135, which exceeds the most often referenced cut-off values of 0.080 (acceptable) and 0.100 (poor fit). This means that, on average, the model-implied covariance structure is not very close to the observed covariance matrix, when taking into account the model complexity. This also supports the impression we had from the other fit indices that our hypothesized SEM specification does not fit the relationships among the constructs very well. In practical terms, this implies that parts of the model, such as weak or even non-important indicator loadings, inconsistent directions of indicators due to possible reverse coding, or theoretically constrained covariance of errors or factor respecifications, should be altered in order to achieve a better overall fit of the model to the data.

Table 5.9. AIC

Model	AIC	BCC	BIC	CAIC
Default model	1524.315	1530.367	1712.422	1760.422
Saturated model	462.000	491.123	1367.264	1598.264
Independence model	4178.338	4180.985	4260.634	4281.634

This can be compared to the other SEM model with a lower AIC. As can be seen in the AIC result, a lower value necessarily implies a better fit for the degree of model complexity. On the other hand, the overall quality of model fit was weak, as was clear from the figures of RMSEA (which is high at 0.135) and CFI and TLI (both of which were below the cut-off value of 0.95). The model was inefficient in reproducing the model-implied covariance matrix, despite the AIC comparison. Therefore, the AIC results are in line with the earlier suggestion that re-specification might improve goodness of fit without the addition of complexity. Therefore, because the SEM fit statistics (e.g., RMSEA or CFI/TLI) were unsatisfactory, the AIC results provide support for testing against other possible model

specifications (e.g., removing or replacing weak indicators, using reverse-coded indicators, theoretically justified modifications) to locate the model with the lowest AIC.

Table 5.10 ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	4.109	3.794	4.443	4.125
Saturated model	1.245	1.245	1.245	1.324
Independence model	11.262	10.709	11.835	11.270

The output labeled ECVI (Expected Cross-Validation Index) gives an estimate of the expected predictive/generalizable fit of the model in an independent/replicated sample. This statistic should be minimized. In the above output, weak-to-poor levels of fit are still achieved in terms of the RMSEA = 0.135 (basically indices like CFI, TLI, and IFI are low, e.g., CFI = .636, TLI = .604, IFI = .683 as previously stated). Thus ECVI results also suggest poor generalization performance for model estimated by the present SEM. In other words, it is possible that the modeled covariance structure does not hold true when the model is tested on the same data structure in a cross-validation fashion. Thus, the ECVI results have suggested once again the model specification should be reexamined and improved (e.g., indications of weak/non-meaningful indicators stressed, item-direction/coding reversed as indicated by negative loadings, or factor structure re-examined conceptually) to provide a better fit for both current data and new data samples collected or analyzed in the future.

Table 5.11 HOELTER

Model	HOELTER .05	HOELTER .01
Default model	56	60
Independence model	22	24

The Hoelter results indicate the sample size at which the model would reach an acceptable fit criteria. Taking the RMSEA as an example, with RMSEA = 0.135 and poor overall fit (like CMIN/DF = 7.805 or CFI/TLI = 0.551), this would also mean that the model Hoelter value would be low or inadequate, meaning that even after adjusting for sample size for the fit to be acceptable, the model will not reach a state of stable adequacy. Consequently, the Hoelter findings support that the SEM specification does not adequately fit the data.

Table 5.6 Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
F4	<---	F1	1.396	1.819	.767	.443	
F4	<---	F2	7.795	13.487	.578	.563	
F4	<---	F3	.338	.228	1.481	.139	
TP5	<---	F1	1.000				
TP4	<---	F1	-.007	.060	-.119	.905	
TP3	<---	F1	.826	.055	15.154	***	
TP2	<---	F1	.883	.058	15.339	***	
TP1	<---	F1	.553	.054	10.220	***	
TM5	<---	F2	1.000				
TM4	<---	F2	.506	.377	1.342	.180	
TM3	<---	F2	-5.833	2.035	-2.866	.004	
TM2	<---	F2	.336	.423	.794	.427	
TM1	<---	F2	-6.090	2.118	-2.875	.004	
SL5	<---	F3	1.000				
SL4	<---	F3	.873	.044	19.919	***	
SL3	<---	F3	-.412	.057	-7.172	***	
SL2	<---	F3	-.433	.051	-8.525	***	
SL1	<---	F3	.838	.045	18.505	***	
FS1	<---	F4	1.000				
FS2	<---	F4	.172	.103	1.667	.095	

			Estimate	S.E.	C.R.	P	Label
FS3	<---	F4	.781	.110	7.084	***	
FS4	<---	F4	1.633	.148	11.003	***	
FS5	<---	F4	1.220	.124	9.843	***	
FS6	<---	F4	1.110	.117	9.453	***	

Regression weights results provide the relationship (also called factor loadings) between the observed variables and the latent variable in the measurement model of the SEM. A positive, important relationship between the latent variable of tomato production (F1) and the three observed variables TP1, TP2, and TP3 (Estimate = 0.553, $p < .001$, Estimate = 0.883, $p < .001$, Estimate = 0.826, $p < .001$) shows that they are reliable indicators in the context of this research. TP1, TP2 and TP3 were important for tomatoes, but TP4 was not important (Estimate = -0.007, $p = .905$). For tomato marketing (F2), TM1 and TM3 were important and negative (TM1: Estimate = -6.090, $p = .004$; TM3: Estimate = -5.833, $p = .004$), but TM2 and TM4 were non-important. This pattern suggests the items for marketing are at least partially reverse coded, or that the marketing construct is statistically opposite in direction to that which is modeled, and this should be checked. For SL (F3), SL1 and SL4 load positively and considerably (SL1: Estimate = 0.838, $p < .001$; SL4: Estimate = 0.873, $p < .001$). SL2 and SL3 load negatively and considerably (SL2: Estimate = −0.433, $p < .001$; SL3: Estimate = −0.412, $p < .001$). Similarly, for F4, food security, as with SL, the reverse-wording of these items and/or the theoretically different way farmers think about these items could account for the weak loadings. Nonetheless, the loadings would still be positive and meaningful, certainly for FS3 (Estimate = 0.781, $p < .001$), FS4 (Estimate = 1.633, $p < .001$), FS5 (Estimate = 1.220, $p < .001$), FS6 (Estimate = 1.110, $p < .001$), and weakly positive but not important for FS2 (Estimate = 0.172, $p = .095$). Thus, most factor loadings appear to well reflect the latent factors, with the exception of a few indicators that do not reflect the construct well. This may help to explain the overall poor fit of the model and the need for better item coding and selection of indicators.

Table 5.7. Co-variances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label

			Estimate	S.E.	C.R.	P	Label
F1	<-->	F2	-.478	.169	-2.818	.005	
F2	<-->	F3	-.449	.160	-2.810	.005	
F1	<-->	F3	2.876	.279	10.308	***	

The estimated co-variances provide evidence that there are important relationships among the latent constructs in the SEM model. According to the covariance terms, there was a negative and important covariance between F1 (tomato production) and F2 (tomato marketing) that indicated that the higher the value of F1, the lower the value of F2 among the selected sample (F1-F2 cov. The covariance between the marketing F2 and livelihood/SL factor (F3) was also negative and statistically meaningful (Estimate = −0.449, p = .005), suggesting that improvements in the SL factor are negatively reflected in the marketing F2. This suggests a negative covariance between tomato production and marketing factors, or that the marketing factor is measured in the opposite way to the livelihood/SL factor. On the other hand, the covariance between F1 (tomato production) and F3 (SL) is quite high (Estimate = 2.876, p < .001), suggesting a large relationship between tomato production and the SL construct. Overall, the relatively large covariances may suggest that the variances of the constructs appear to be poorly discriminated. The negative covariances associated with F2 may be due to measurement direction issues (i.e. reverse-coded items) or a conflict between the production experience and the marketing experience of farmers in the Murehwa communal areas. This finding is consistent with the results of Massawe (2014).

Table 5.8. Variances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
F1			3.146	.344	9.141	***	
F2			.070	.049	1.439	.150	
F3			3.803	.357	10.665	***	
e21			.315	.310	1.017	.309	
e1			1.617	.156	10.364	***	

			Estimate	S.E.	C.R.	P	Label
e2			3.750	.275	13.620	***	
e3			1.887	.160	11.821	***	
e4			2.069	.176	11.739	***	
e5			2.531	.194	13.046	***	
e6			2.968	.218	13.605	***	
e7			2.790	.205	13.616	***	
e8			2.330	.201	11.568	***	
e9			4.135	.304	13.619	***	
e10			1.824	.177	10.306	***	
e11			.974	.120	8.118	***	
e12			1.473	.136	10.846	***	
e13			4.029	.301	13.405	***	
e14			3.085	.232	13.309	***	
e15			1.735	.151	11.475	***	
e16			2.322	.181	12.844	***	
e17			3.824	.281	13.606	***	
e18			2.979	.225	13.259	***	
e19			1.635	.159	10.259	***	
e20			2.051	.167	12.273	***	

e22 2.090 .167 12.542 *

As shown in the covariance table, the factors are also reliably correlated with one another. In particular, the covariance between F1 and F2 is statistically meaningful and negative (Estimate = −0.478, p = .005) as is the covariance of F2 and F3 (Estimate = −0.449, p = .005). The covariance of F1 and F3 is positive and important (Estimate = 2.876, p < .001), meaning that an increase in the quantity of tomato production (F1) was related to an increase of the SL-related construct (F3). This negative relationship between tomato marketing (F2) and both F1 and F3 could be interpreted either as a situation where increased production does not lead to better livelihood/SL outcomes because of unfavourable marketing conditions for producers, or it could suggest that marketing constraints determine both production experiences and livelihood/SL indicators in the reverse directions.5.4 Conclusion and Discussion.

This means that the model which the study intended to utilize was not meaningful enough to imply a meaningful relationship between the study's variables including the livelihood of the people in Murehwa District. The quantitative data which was obtained was not enough to point towards the livelihood of the Murehwa District smallholder tomato farmers. The problem with this quantitative data however is that it could not give the exact levels of food security of the smallholder farmers in Murehwa District at the time of the study. The negative loading of the other variables in terms of their regression relationships in the findings was however more a function of the questionnaire design. The questionnaire was designed with both positive and negative oriented questions so that the rest of the answers were not one sided. This was done in order to improve the internal consistency for the reliability of the questionnaire.

5.5 Recommendations

To improve the construct and measurement of food security in future studies in the Murehwa District, it is suggested that researchers revise the items in the questionnaire that measures food security indicators (SL1 to SL5). Specifically, the latent constructs in the SEM should also be revalidated. This includes careful review of positively- and negatively-worded items for wording errors and for coding or response inconsistencies to ensure that items are interpreted as intended.

Second, pretesting and cognitive interviews with smallholder farmers should be followed to improve construct validity and low or not important factor loadings by identifying and

correcting any potentially confusing wording or words that are interpreted differently among households.

Third, you could refine the indicator variables to represent other aspects of food security (e.g., dietary diversity, coping strategies, seasonality of food availability) , and re-run the SEM with these refined measurement approaches.

Finally, studies in the future may want to consider other modelling approaches (e.g., confirmatory factor analysis and model respecification) to achieve better generalizability to the relationships between tomato production, marketing, livelihoods and food security.

References

Byrne, B. M. 2016. Structural Eqution Modelling with AMOS: Basic Concepts, Applications and Programming (3rd ed). Routledge

Khan, M., Akram, M., Janke, R., Qadri, R., Al-Sadi, A., & Farooque, A. (2020). Urban horticulture for food secure cities through and beyond COVID-19. Sustainability, 12(22), 9592. https://www.mdpi.com/2071-1050/12/22/9592

Kulkarni, S., Hof, A., Ambrósio, G., Edelenbosch, O., Köberle, A. C., van Rijn, J., & van Vuuren, D. (2022). Investment needs to achieve SDGs: An overview. PLOS Sustainability and Transformation, 1(7). https://doi.org/10.1371/JOURNAL.PSTR.0000020

Mango, N., Makate, C., Tamene, L., Mponela, P., & Ndengu, G. (2021). Adoption of climate-smart agriculture and its implications for resilience to climate change in smallholder farming systems in Southern Africa. Scientific African, 12, e00757

Mangwanya, F., & Manyeruke, C. (2019). The political dynamics of food security and land reforms in Zimbabwe: 2000 and beyond. Journal of Social Sciences, 59(1–3), 17–27. https://doi.org/10.31901/24566756.2019/59.1-3.2245

Massawe, C. R. S. (2014). Impact of Nematode pest management strategies on Nematode communities in tomato production systems in Zimbabwe. http://www.alumni.uz.ac.zw/bitstream/handle/10646/1232/Massawe_Impact_of_Nematode_pest_management_strategies.pdf?sequence=1&isAllowed=y

Mhembwe, S., Chiunya, N., & Dube, E. (2019). The contribution of small-scale rural irrigation schemes towards food security of smallholder farmers in Zimbabwe. Jàmbá: Journal of Disaster Risk Studies, 11(1), 1–11. https://www.scielo.org.za/scielo.php?pid=S1996-14212019000100050&script=sci_arttext

Minakov, I., & Goncharova, N. (2022). State And Trends In Small-Scale Horticulture. European Proceedings of Social and Behavioural Sciences, 278–284. https://doi.org/10.15405/EPSBS.2022.02.34

Mintesnot, H. (2016). Review on contribution of fruits and vegetables on food security in Ethiopia. Journal of Biology, Agriculture and Healthcare, 6(11), 49–58. https://core.ac.uk/download/pdf/234662024.pdf

Motsi, E. (2021). Food processing, handling and marketing in Zimbabwe. In Environmental Resilience: Food and the City - Zimbabwe (pp. 47–67). Springer Singapore. https://doi.org/10.1007/978-981-16-0305-1_4

CHAPTER VI

ASSESSING THE EFFECT OF TOMATO PRODUCTION ON FINANCIAL PERFORMANCE AND LIVELIHOOD OF SMALLHOLDER TOMATO FARMERS IN MUREHWA DISTRICT.

ABSTRACT

Therefore, this paper sought to report on the effect of tomato production on the profitability and the livelihood of Murehwa District smallholder tomato producers of Murehwa District, Zimbabwe. This paper was informed by the third specific objective. The paper is divided into methods, results or findings, and discussion sections. The study used a mixed methods approach. The dominant research methodology applied was the quantitative regression analysis to examine the extent to which tomato production contributes towards food security and the livelihoods of smallholder farmers based on data collected from the smallholder farmers using structured questionnaires. Follow-up interviews were held with smallholder farmers to provide qualitative information to interpret some of the quantitative data. The relationship between tomato production and tomato marketing/sales and food security was tested through regression analysis with the Statistical Package for the Social Sciences (SPSS) software. The model showed that there was statistically important positive correlation between food security and tomato production output. In respect to tomato production, the regression output had an R2R2R2 value of about 0.515, with the ANOVA being statistically important ($p < 0.05$). Tomato production is responsible for approximately 52% of the variance in food security, while the inclusion of tomato marketing and sales increases the variance explanation to $R^2 \approx 0.566$. Production and marketing together account for a variance of $R^2 \approx 0.649$ in the food security index, this has been demonstrated. Tomato-related activities increased Murehwa livelihoods, and the weak or negative relationships between certain production and marketing independent variables and food security did not overturn this finding.

Keywords: Quantitative regression, market indicators, financial performance

6.1 **Introduction**

Tomato production has the potential to improve food security and rural livelihoods of smallholder farmers in communal areas. The current study sought to discuss the effect of tomato production on financial performance and livelihood of the smallholder farmers in Murehwa District. This is related to the study's third goal.

6.2 **Material and methods**

6.2.1 **Description of the study area**

Refer to 3.1

6.2.2 **Research design**

Refer to 3.2

6.2.3 **Sampling procedure**

Refer to 3.3

6.2.4 **Data collection procedure**

Refer to 3.4

6.2.5 **Data analysis procedure**

6.2.**6 Problems encountered and where they arose**

The problem of data collection in this research is the interviews with people not sharing information which showed negative opinions. The challenge was mainly that some issues were politically sensitive especially when the respondents were asked during interview sessions about the challenges they are facing. Few problems were encountered in the collection of the data using the questionnaires. There were, however, some questionnaires that were not returned, and two questionnaires which were destroyed that were not included in the response rate calculations.

6.3 Results and discussion

In the following section, the study will deliberate its results in respect of the third objective of the study.

6.3.1 Effects of tomato production on food security in Murehwa District

To establish the nature of the relationship existing between tomato production and food security in the Murehwa District, the data collected was analyzed through regression analysis using SPSS software as discussed below. The results obtained are reported in this section.

Model summary

Table 6.1 Tomato production and food security in Murehwa District model summary.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.718[a]	.515	.509	.86736
a. Predictors: (Constant), TP5, TP4, TP1, TP3, TP2				

Source: Researcher (2026)

Table 5 displays the model summary of regression results for tomato production and food security relationship for Murehwa District. The regression model depicts the coefficient of determination (R-square) of 0.515. This explains that the predictor variables in the model explain 52% of the occurrences in the dependent variable under investigation. Thus, a change of a unit in the production of tomato affects a change of 52% in a unit of food security. According to Saunders et al., (2019), this is a positive relationship.

ANOVA

The table below shows the results of the analysis of variance (ANOVA) performed on the tomato production and food security study that was carried out.

Table 6.2 ANOVA for tomato production and food security

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	292.635	5	58.527	77.796	.000[b]
	Residual	275.345	366	.752		
	Total	567.980	371			
a. Dependent Variable: AFS						
b. Predictors: (Constant), TP5, TP4, TP1, TP3, TP2						

Source: Researcher (2026)

The above ANOVA table shows the regression model between the tomato yield and the food security status. The ANOVA table shows the importance value of the regression model as 0.000 which is less than the cutoff value of 0.05 (Creswell & Creswell, 2020). Hence the regression model is sufficient for describing the relationship between the variables even at a very small sample size. In that regard, the regression model can be relied upon for accurate determination of the relationship between the variables. The f value was also highly important meaning that there is considerably greater variation between the sample groups than there is within the sample groups (Saunders et al., 2019) which is strong evidence that we can reject the null hypothesis.

Coefficients

The coefficients of the regression relationship between tomato production and food security are provided in the table.

Table 6.3 Coefficients of tomato production and food security

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.023	.167		12.139	.000
	TP1	-.019	.027	-.028	-.686	.493
	TP2	.029	.031	.051	.956	.340
	TP3	.157	.032	.255	4.963	.000
	TP4	.032	.023	.050	1.377	.169
	TP5	.294	.026	.519	11.201	.000
a. Dependent Variable: AFS						

Source: Researcher (2026)

In the study, the coefficients that have been obtained were also observed to have a p-value of less than 0.05, thus indicating that the TP3 and TP5 coefficients may also have an important value of less than 0.05 so that through regression analysis, the TP3 and TP5 coefficients can be used as important factors. The unstandardized coefficients for TP3 and TP5 are 0.157 and 0.294. The regression effect of the regression model can be greater if 2 variables are selected. However, the overall model can be interpreted as follows:

Food security = 2.032 -0.19TP1 + 0.029TP2 + 0.157TP3 + 0.032TP4 + 0.294TP5

The above equation is well suited for the current application but can be applied in its modified form to the meaningful values and in other occasions as follows:

Food security = 2.032 + (0.157 x TP3) + (0.294 x TP5)

The modified model can be estimated with a confidence level due to the variables' important p-value (less than 0.05), and its estimation has proved to have a small margin of error in terms of predicting food security. In line with the findings here, the research conducted by Rubhara et al. (2020) has also found that cash-crops have an increasing positive impact on food security on a national level.

6.1.2 The effect of tomato marketing and sales on food security in the Murehwa District

In order to assess the relationship between tomato marketing and food security in the Murehwa District, a regression analysis was done, and the data collected was analyzed using the SPSS data analysis program. The results obtained from the study are as follows.

Model summary

Table 6.4 Model summary for tomato marketing and food security

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.752[a]	.566	.560	.82066
a. Predictors: (Constant), TM5, TM1, TM4, TM2, TM3				

As seen in the table above, the regression model explaining the relationship between tomato marketing and food security in Murehwa District had an R-squared value of 0.566, implying that, the independent variables explained about 57% of the variation in the dependent

variable (the number of occurrences). This means that there is a 57% unit increase in food security with each unit increase in tomato production. This implies a positive relationship as observed by Saunders et al., (2019).ANOVA

Table 6.5 ANOVA for tomato marketing and food security

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	321.483	5	64.297	95.468	.000[b]
	Residual	246.497	366	.673		
	Total	567.980	371			
a. Dependent Variable: AFS						
b. Predictors: (Constant), TM5, TM1, TM4, TM2, TM3						

The above table depicts the ANOVA regression run between tomato marketing and food security. The P value of 0.000 is less than the cut off of 0.05 (Creswell & Creswell, 2020) hence indicating the ANOVA regression model between the tomato marketing and food security is meaningful at a sample size lower than that recommended by the literature. On the other hand, the regression model is a true indicator of the dependent and independent variable's relationship if the f-value obtained is extremely high as in this study (64.297). This implies that the variation between groups in the sample is greater than the variation within groups in the sample (Saunders et al., 2019). This means that there is great evidence to reject the null hypothesis. This is similar to what Madududu et al., (2021) saw in the Zhombe North rural district, Zimbabwe, where tomato production considerably improved smallholder farmers' livelihoods..

Coefficients

Table 6.6 Coefficients for tomato marketing and food security

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.278	.227		5.639	.000
	TM1	.244	.024	.416	10.136	.000
	TM2	.140	.023	.231	6.062	.000
	TM3	.246	.024	.432	10.259	.000
	TM4	.121	.027	.164	4.560	.000
	TM5	-.098	.028	-.138	-3.480	.001
a. Dependent Variable: AFS						

In the study, most of the coefficients have a meaningful p-value of less than 0.05, which means the coefficient is important in the model. Thus, all the independent variables presented in the model have an important p-value lower than 0.05 and should be kept in the model. The interpretation of the model with all the independent variables follows.

Food security = 1.278 + 0.244 TM1 + 0.140 TM2 + 0.246 TM3 + 0.121 TM4 - 0.098 TM5

The model can be used in other situations in which the variables involved and the outputs obtained should be statistically meaningful and relevantly mapped by the equation with very little room for error. Sukume et al. (2022) further found that in Mazowe District in Zimbabwe, tomato production improved livelihoods which goes on to support the relationship found.

6.1.3 The combined effect of production, marketing and sales on food security in Murehwa District

Further regression analysis was also carried out to establish the relationship between tomato production, marketing, and food security in the Murehwa District. The results were analyzed

through SPSS as discussed in methodology and what follows below was what was obtained from the study.Model summary

Table 6.7 Model summary for combined effect of food security

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.805[a]	.649	.639	.74343
a. Predictors: (Constant), TM5, TP1, TP4, TM4, TP3, TM2, TP5, TM3, TM1, TP2				

However, the summary of the regression model of tomato production and marketing against food security in Murehwa District is shown in the table above. The summary of the regression model shows that the model had R-squared values of 0.649, which means that 65% of the occurrences in the dependent variable varied with the predictors in the model. For example, increasing the production and marketing of tomatoes is predicted to result in 65% more of a unit of food security. As such the relationship would be positive, according to the research of Saunders et al., (2019).ANOVA

Table 6.8. ANOVA for combined effect on food security

ANOVA						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	368.460	10	36.846	66.667	.000[b]
	Residual	199.520	361	.553		
	Total	567.980	371			
a. Dependent Variable: AFS						
b. Predictors: (Constant), TM5, TP1, TP4, TM4, TP3, TM2, TP5, TM3, TM1, TP2						

The above table shows the ANOVA analysis which was run to determine the statistical importance of the regression model between a combination of food production and food

marketing and the food security variable. The ANOVA found an importance value of 0.000 which is lower than the minimum required importance value of 0.05 (Creswell & Creswell, 2020). This indicates that the regression model explains the relationship, even with smaller samples. In this regard, the regression model can be relied upon for accurate determination of the relationship between the variables. The f-value, which is 66.667, indicates that there is a considerably higher variation in the sample groups than the variation within those groups (Saunders et al., 2019), which creates great evidence to reject the null hypothesis.Coefficients

Table 6.9 Coefficients for combined effect on food security

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.186	.213		5.572	.000
	TP1	-.106	.025	-.160	-4.241	.000
	TP2	-.008	.028	-.013	-.272	.785
	TP3	.094	.029	.153	3.293	.001
	TP4	.026	.023	.041	1.143	.254
	TP5	.176	.027	.310	6.508	.000
	TM1	.142	.028	.242	5.004	.000
	TM2	.113	.024	.187	4.734	.000
	TM3	.201	.024	.354	8.374	.000
	TM4	.139	.025	.188	5.475	.000
	TM5	-.079	.026	-.112	-3.066	.002
a. Dependent Variable: AFS						

By contrast, only 2 coefficients have a p-value (probability value) less than 0.05 which means that the two variables make statistical contributions to the regression model. Therefore, all variables except TP2 and TP4 should be considered in the model with $p < 0.05$ indicating the statistical importance of those variables as contributors. The model as a whole can therefore be interpreted:

Food security = 1.186 - 0.106TP1 - 0.008TP2 + 0.094TP3 + 0.026TP4 + 0.176TP5 + 0.142TM1 + 0.113TM2 + 0.201TM3 + 0.139TM4 - 0.079TM5.

The above equation is a good fit using certain combination of the data for application in other scenarios where the variables of the model are used for predicting food security. For instance, Mhembwe et al. (2019) observed that for smallholder farmers in irrigated areas, the possibility of attaining sustainable incomes and benefits from tomato production was high.

6.2 Conclusion

This chapter studied the effects of tomato production on the livelihoods and food security of smallholder tomato farmers in Murehwa District, Zimbabwe. The chapter focused on tomato production as a critical livelihood outcome. Using SPSS statistical software, this chapter applied a mixed-methods approach to statistical analysis of the data, concluding that tomato production has a statistically meaningful positive effect on food security. The regression results for tomato production and food security showed that the model summary was $R2 = 0.515$, indicating that about 52% of the variance in food security among the farmers could be explained by tomato production. The ANOVA table for the regression showed that tomato production had important explanatory power ($p < 0.05$).

Adding the variables for tomato marketing and sales into the model did not change the relationship with the $R2 \approx 0.566$, but suggests that in addition to tomato production, a household's ability to market and sell tomatoes was an important part of strengthening household food security. The production and marketing of tomatoes combined to have the highest explanatory power with $R2 \approx 0.649$, suggesting that the improvement of a livelihood is contingent on both actions. However, some of the production and marketing variables had weak or negative coefficients, indicating that further attention to construction of these variables or the underlying direction of the indicator may be needed.

6.3 Discussion

The regression results show that there is an important positive effect of tomato production on improved livelihood outcomes in the Murehwa District of Zimbabwe in terms of household food security. This means that any increase in tomato production in the Murehwa District, Zimbabwe will translate into an increase in the income, purchasing power and the ability to meet household food needs in the production season and after. Relatedly, the finding is consistent with the livelihood pathway; cash crop income may help with food access, farm investment, and shocks.

It also studies the role of tomato sales and marketing in ensuring food security. This is due to production benefits being offset by impediments to the sale of tomatoes at an acceptable price or any price, and the access to markets. Where farmers have access to selling and marketing tomato production, and the capacity to invest in improved marketing, these can be important pathways for translating agricultural production into the financial capital to purchase food and improve food security (as also supported by the higher R2 values in the marketing and combined models).

The regression coefficients furthermore show that these associations tend to be lower or negative when both production and marketing indicators are included in the same model. This could reflect differences between questionnaire items in how well they capture production or marketing, differences in correlation between production and marketing, or other parameters limiting the extent to which production leads to livelihood improvements, including the price, cost of marketing, or the time between harvest and sale, or trade-offs at the household level. In summary, while we find a meaningful overall effect, strength varies per indicator, implying features of production and marketing matter.

6.4 Recommendation

The results indicate that interventions should prioritize assisting farmers with reaching the right market, obtain a fair price, aggregate and post-harvest handling of the tomatoes to avoid loss and wastage and to improve farmers' incomes from selling their produce. Support for such tomato-based livelihood innovations may be helpful, and may signal future research in the Murehwa District. Because the combined production-marketing model explained the most variation in food security, improving the two stages of the continuum may improve livelihood outcomes.

Second, extension services and non-governmental organizations (NGOs) should provide farmers with access to yield-stabilizing inputs and technology (to reinforce the production side) and help strengthen the marketing side by connecting farmers to markets.

Third, future studies should consider expanding quality of the production and marketing indicators so that wording and measurement direction of items are consistent. This would allow for the possibility that small or negative coefficients are due to a few items. Finally, it may be useful to explore mediating factors such as output price, input prices, access to credit, and seasonality in relation to tomato income and household food security.

References

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.

Khan, M., Akram, M., Janke, R., Qadri, R., Al-Sadi, A., & Farooque, A. (2020). Urban horticulture for food secure cities through and beyond COVID-19. *Sustainability*, *12*(22), 9592. https://www.mdpi.com/2071-1050/12/22/9592

Mhembwe, S., Chiunya, N., & Dube, E. (2019). The contribution of small-scale rural irrigation schemes towards food security of smallholder farmers in Zimbabwe. Jàmbá: Journal of Disaster Risk Studies, 11(1), 1–11. https://www.scielo.org.za/scielo.php?pid=S1996-14212019000100050&script=sci_arttext

Nhachi, O. (2025). Climate change impacts on horticulture in Zimbabwe.

Saunders, M.N.K., Lewis, P. and Thornhill, A. (2019) Research Methods for Business Students. 8th Edition, Pearson, New York

CHAPTER VII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

The chapter covers the final research summary, conclusion, the research policy implications and proposed areas for more studies based on its findings.

7.2 Summary of the study

This study explored determinants for participating in tomato contract farming (TCF) among smallholder tomato farmers in Murehwa District, Mashonaland East Province. The study was based on the practical model. The research employed a mixed-methods approach in the quantitative and qualitative data analyzes. The sample was selected purposively from the five wards of Murehwa District where tomato is grown: Ward 5, Ward 8, Ward 11, Ward 27 and Ward 30. The sampling procedures followed are discussed below in Chapter Three. Structured questionnaires and follow-up interviews were used to collect data, which were analyzed descriptively, and inferentially where appropriate. Qualitative data responses were thematically analyzed to identify and describe the patterns in how farmers live their lives.

The first study objective was to investigate and document the challenges being faced by smallholder tomato farmers in Murehwa District and how these challenges are affecting their production and livelihoods. The second study objective was to determine the food security status of the smallholders using quantitative indicators and modeling. Objective 3: To analyze the effect of tomato production and marketing on financial performance and other livelihood outcomes and the interplay of tomato production and marketing on the financial performance and other livelihood outcomes, the coefficients of the regression equation were determined: the strength and direction of the relationship.

A second challenge was obtaining data from qualitative instruments, such as information derived from open-ended questions posed during interviews. Farmers' reluctance to talk about issues which were perceived to be politically sensitive or negative sometimes impeded the study's ability to gain information. However, the questionnaire did have enough responses to make up for this, and very few questionnaires were not returned, spoiled or incomplete. The results of this study complement existing research with empirical evidence

on the constraints, food security outcomes and livelihood impacts of smallholder tomato production in Murehwa District and inform efforts to improve productivity and household resilience.

7.3 Study conclusion

This study concludes that smallholder tomato production in Murehwa District is constrained by yield and income instability and vulnerability to production shocks. The results show challenges in production, post-harvest, marketing and access to financial support in production and post-harvest in the tomato production system. Such factors also limit the prospects for tomato farming to contribute to household food security.

The study concludes that tomato farmers' food security is neither always good nor always bad, but varies according to which food security indicator is considered. Food security is improved when production and marketing systems are linked, farmers have guaranteed production and better bargaining power in determining the prices of the tomatoes. Even though these constraints are likely to make the resilience of these systems less likely, the regression results show that tomato production is associated with improved livelihood outcome indicators, in particular food security, both when only production variables are entered (scenario 1) as well as when marketing/sales variables are added (scenario 2). This is a better fit with the marketing/sales model, in which production improvements by themselves are insufficient. Marketing interventions include better access to markets, reduction of post-harvest losses, and availability of affordable inputs and finance.

In conclusion, tomato production can be a pathway into, and a tool for achieving, food and income security for smallholder farmers in Murehwa District of Zimbabwe if farmers' constraints are dealt with and production systems are improved in order to ensure that profitable and stable household outcomes are achieved.

7.4 **Policy Implications and Recommendations**

1. According to the findings of the research, The Government should treat tomato production as a food security strategy and include it in food security policies.

2. This study recommends increased capacity building that includes providing training for smallholder farmers in improved tomato agronomy, pest and weed control, and climate-smart agricultural practices to improve the livelihoods of smallholder tomato farmers.

3. Strengthening Agricultural extension services on providing training on post-harvest management and guide farmers on how to store and handle their produce in a way that reduces breakages and spoilage, thereby avoiding post-harvest loss.

4. Improving access to markets by reducing intermediation of farmers through structured aggregation, price discovery and increased price information, and farmer cooperatives or farmers' marketing groups.

5. Access to finance for farmers can be improved through encouraging basic record keeping systems of production and sale and linking farmers to institutional finance. Intervention should, where possible, be based on multiple seasons of planning. This would provide farmers with a longer lead time for decision making and allow the reinvestment capacity to build during the season.

6. The study recommends that Government and policymakers give priority to expand on irrigation schemes and encourage water harvesting technologies for communal smallholder farmers

7.5 Areas of further study

Although this study provides evidence on challenges and livelihood outcomes of smallholder tomato farmers in Murehwa District, several gaps remain that require additional research. Future studies should broaden understanding of the causal pathways and contextual factors that affect how tomato production translates into food security and financial performance.

1. Longitudinal studies: This study used cross-sectional data, which captures relationships at one point in time. Future research should adopt longitudinal designs to track changes across seasons, especially because tomato production is seasonal and affected by rainfall patterns, pests, and price fluctuations. Longitudinal studies would strengthen understanding of sustainability and dynamic livelihood effects.

2. Impact evaluation of interventions: Further study should evaluate specific interventions such as improved storage technologies, climate-smart agriculture training, integrated pest management programs, and cooperative marketing models. Experimental or quasi-

experimental designs would help establish whether these interventions cause measurable improvements in income, food security, and resilience.

3. Household and socio-demographic determinants: Since food security is influenced by factors beyond tomato production and marketing, future studies should explore how household size, gender roles, education level, household labor availability, and asset ownership affect the livelihood impact of tomato farming.

4. Value chain analysis and market power: More research could investigate tomato value chain structures in Murehwa District, including the roles of intermediaries, wholesalers, transporters, and buyers. Understanding market power and pricing mechanisms can inform strategies for improving farmers' bargaining positions.

5. Access to finance and risk management: Future studies should explore how smallholder farmers obtain credit, repayment behaviour, and the effectiveness of different financing mechanisms. Research could also examine crop insurance feasibility and how farmers manage production and market risks.

6. Measurement refinement for food security modelling: Given the weaker model fit in some analyses, future research should refine measurement instruments and ensure alignment between questionnaire items and farmers' lived experiences of food security. Validation studies could improve the reliability and predictive power of future models.

Overall, these areas of further study can deepen policy relevance and help build stronger, evidence-based strategies for improving livelihoods through smallholder tomato production in Zimbabwe.

REFERENCES

African Union Commission (AUC). (2014). *Comprehensive Africa Agriculture Development Programme (CAADP) Results Framework 2015–2025*. Addis Ababa**.**

Chihambakwe, M., Mafongoya, P., & Jiri, O. (2021). Urban and peri-urban agriculture: an analysis of the perceptions and use of food sovereignty among low-income dwellers in Harare, Zimbabwe [Cogent OA]. In *core.ac.uk* (Vol. 7, Issue 1). https://doi.org/10.1080/23311886.2021.1944486

Descheemaeker, K., Oosting, S. J., Homann-Kee Tui, S., Masikati, P., Falconnier, G. N., & Giller, K. E. (2016). Climate change adaptation and mitigation in smallholder crop–livestock systems in sub-Saharan Africa: a call for integrated impact assessments. *Regional Environmental Change*, *16*(8), 2331–2343. https://doi.org/10.1007/S10113-016-0957-8

Gwetsayi, R., Dube, L., & Mashapa, C. (2016). Urban horticulture for food security and livelihood restoration in Mutare City, Eastern Zimbabwe. *Greener Journal of Social Sciences*, *6*(3), 056–064.

Rusinamhodzi, L., Corbeels, M., Zingore, S., Nyamangara, J., & Giller, K. (2013). Pushing the envelope? Maize production intensification and the role of cattle manure in recovery of degraded soils in smallholder farming areas of Zimbabwe. *Field Crops Research*, 147, 40-53. https://doi.org/10.1016/j.fcr.2013.03.014

Dunjana, N., Nyamugafata, P., Shumba, A., Nyamangara, J., & Zingore, S. (2012). Effects of cattle manure on selected soil physical properties of smallholder farms on two soils of Murewa, Zimbabwe. *Soil Use and Management*, 28. https://doi.org/10.1111/j.1475-2743.2012.00394.x

Zingore, S., Tittonell, P., Corbeels, M., Wijk, M., & Giller, K. (2011). Managing soil fertility diversity to enhance resource use efficiencies in smallholder farming systems: a case from Murewa District, Zimbabwe. *Nutrient Cycling in Agroecosystems*, 90, 87-103. https://doi.org/10.1007/s10705-010-9414-0

FAO. (2021). *State of Food Security and Nutrition in the World 2021*. Rome: Food and Agriculture Organization of the United Nations.

FAO. (2022). *FAOSTAT Statistical Database*. Food and Agriculture Organization of the United Nations.

Government of Zimbabwe. (2018). *National Agriculture Policy Framework (2018–2030)*. Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement.

Government of Zimbabwe. (2020). *Horticulture Recovery and Growth Plan (2020–2025)*. Cabinet Office, Harare.

Makuvaro, V., Maparara, T., & Mukarati, J. (2023). Effects of COVID-19 on urban and peri-urban farmers in central Zimbabwe. *African Journal of Food, Agriculture, Nutrition and Development* , *23*(6), 23786–23799.

Mango, N., Makate, C., Tamene, L., Mponela, P., & Ndengu, G. (2021). Adoption of climate-smart agriculture and its implications for resilience to climate change in smallholder farming systems in Southern Africa. *Scientific African, 12*, e00757

Motsi, E. (2021). Food processing, handling and marketing in Zimbabwe. In *Environmental Resilience: Food and the City - Zimbabwe* (pp. 47–67). Springer Singapore. https://doi.org/10.1007/978-981-16-0305-1_4

Munyati, V., Mugabe, D., Chipunza, N., Vincent, M., Douglas, M., Nyasha, C., Never, M., Godfrey, C., & Joseph, M. (2013). An econometric approach to ascertain sorghum supply response in Zimbabwe. *African Journal of Agricultural Research, 8*(47), 6034–6038. https://doi.org/10.5897/AJAR12.7941

Mutambara, J., Jiri, O., & Mupangwa, W. (2013). *Smallholder farming and food security in Zimbabwe: The role of crop diversification strategies.* Journal of Development and Agricultural Economics, 5(3), 122–129.

Nhachi, O. (2025). Climate change impacts on horticulture in Zimbabwe.

Introduction

Greetings, my name is Fungai Mpeswe, I am a Master's degree student at Bindura University of Science Education pursuing a degree in __. In partial fulfilment of the requirements of the

degree I am carrying out this dissertation which you have been selected to be a part of. Please tick the consent box below to show your informed consent to participating in this study:

Consent

The study seeks to explore how tomato (*Solanum lycopersicum*) is useful as a cash crop in addressing food security for smallholder farmers in communal areas, with a narrow focus on Murehwa Disctrics in Mashonaland East in Zimbabwe.

You are reminded that participation in this study is not forced, you are free to stop answering the questionnaire at your own will. This information is for academic use only and will be treated as confidential. You are being reminded to be as truthful as you best can. The following guidelines will help you to answer the questions:

SD= Strongly disagree; D= Disagree; N = Neutral; A =Agree; SA= Strongly agree

Section A: Demographic data

Head of household gender

Please indicate your gender:

Male		Female	

Age range of head

Please indicate your age range:

Below 18 years		18-35 years		36-50 years		51-60 years		Above 60 years	

Occupation of head

Please indicate your occupation (You can tick multiple boxes if they apply):

OCCUPATION	Tick if it applies
Formal private sector job	
Farming	
Vending	
No employment	
Mining and mining related activities	
Government employment/civil service	
Consultancy/ expert service provider	

Level of education of head

Please indicate your highest educational level:

EDUCATION LEVEL	Tick if applicable
No education	
Primary education	
Secondary education	
Advanced level education	
Diploma/ graduate degree	
Post graduate degree/qualification	
Professional qualification	

Family size

Please tick the appropriate family size:

1-5 people		6-10 people		11-15 people		Above 15 people	

Family age distribution

Indicate the family demographic setup:

AGE RANGE	INDICATE NUMBER OF PEOPLE
Below 18 years	
18-35 years	
36-55 years	
Above 55 years	

Land size

Please indicate the size of the land upon which you do your farming activities:

LAND SIZE	Tick if applicable
Below 1 Acre	
Between 1 acre and 1 hectare	
Between 1 hectare and 2 hectares	
2 -5 hectares	
5-10 hectares	
Above 10 hectares	

Assets

Please indicate the assets you own:

ASSETS	Tick if applicable	Description	Estimated value (in $USD)
Land (in hectares)			
Tractor			
Farming equipment			

(planter, sprayer etc)			
Livestock			
Buildings & living quarters			
Livestock shelter			
Storerooms/warehouses			
Vehicles			
Other			

Livestock ownership

Do you own any livestock?

Yes		No	

If yes, please describe it below:

Description (e.g Cattle)	Number

Section B: Challenges faced by smallholder tomato farmers

Question/phrase	**SD**	**D**	**N**	**A**	**SA**
The middlemen in the tomato business disadvantage the smallholder					

farmer leading to very low yields.					
Issues of climate change and shifting weather patterns make tomato growing a difficult business					
The costs associated with tomato growing are significant and pose as a barrier to entry and a productivity inconvenience					
Tomato is a perishable product which is easily damaged making it hard to grow, store and move to market.					
There are challenges in accessing finance to grow the business for smallholder farmers					

Section C: Food security levels of smallholder farmers engaged in tomato production

Question/phrase	**SD**	**D**	**N**	**A**	**SA**
The poverty and financial distress has significantly decreased for tomato growers in Murehwa district					
Tomato growers have seen an increase in their disposable income, profit and sales of tomatoes					
The use of technology in marketing and sales of tomatoes has led to increase in the overall production of tomatoes by smallholder farmers					
There is a significant improvement in the production methods leading to high yield of tomatoes which generate more income for the smallholder farmer					
The production of tomatoes has improved the livelihood of the Murehwa community with them now being able to send children to school, afford clean water and other basic needs at ease.					

Section D: Tomato production

Question/phrase	**SD**	**D**	**N**	**A**	**SA**

The procuring of inputs and fertilisers for tomato production is relatively easier					
Costs of producing tomatoes are significantly high such that the profit margin is relatively lower.					
Growing tomatoes requires technical knowledge as they are exposed to various threats including disease and sensitivity to changes in weather.					
The experience I have from growing tomatoes gives me advantages in achieving high yields.					
The assistance we get from technical people in government, consultants and other farming assistance from the suppliers increases our chances of achieving higher returns on our investments.					

D (i): Tomato marketing and sales

Question/phrase	**SD**	**D**	**N**	**A**	**SA**
The market for tomatoes is readily available					
The logistics of getting our tomatoes to the market are not very demanding					
The market determines the price of tomatoes, giving us less influence on the selling price and sales of tomatoes					
Tomatoes are high risk selling products because they have a lot of damages and a very short shelf life.					
I keep records of my tomato sales and am very keen in understanding the financial implications of the tomato business.					

D (ii): Food security

Question/phrase	**SD**	**D**	**N**	**A**	**SA**
The tomato business has given us substantial income to sustain our					

basic needs.					
Through the tomato business, I have managed to save my family from hunger and extreme poverty.					
I have noticed an increase in the family's disposable income as a result of the tomato business.					
The tomato business does not return as high as anticipated because of the market dynamics and the excessive influence of middlemen.					
The food security on the larger scale of the whole country does not seem to get better because of increased tomato production because smallholder farmers merely do it to fight poverty and survive.					

D (iii): Macroeconomic factors

Question/phrase	**SD**	**D**	**N**	**A**	**SA**
The government offers support for the growth and improvement of smallholder farmers					
The economic policies in place do not fully support the growth of smallholder farming endeavours especially for tomato growers					
The Zimbabwean social community embraces the efforts of tomato growers and supports the efforts through making repeated purchases of tomatoes from smallholder farmers					
Technology has made marketing and communication easier leading to improved sales returns and ease of market access.					
The environment in Murehwa District is conducive for tomato farming leading to high yields					

Thank you for your time, end of questionnaire.

Interview Guide

Introduction

Interviewer's Note:

- Introduce yourself and explain the purpose of the interview.
- Obtain consent to participate in the study and assure confidentiality.

Greeting:
"Hello, my name is Fungai Mpeswe. I am a Master's degree student at Bindura University of Science Education, and I appreciate your time today. We will discuss tomato farming and its impact on food security in Murehwa District. Your insights are invaluable for my research."

Consent:
"Please confirm your consent to participate in this study."

Section A: Demographic Data

1. **Years of Experience:**
    - How many years have you been involved in farming?
2. **Education Level:**
    - What is your highest level of education?
3. **Dependents:**
    - How many people depend on you for food?

Section B: Tomato Production

1. **Input Procurement:**
    - How easy is it for you to procure inputs and fertilizers for tomato production?
2. **Cost of Production:**

- Can you describe your thoughts on the costs associated with producing tomatoes?

3. **Technical Knowledge:**
    - In your experience, how important is technical knowledge for successful tomato farming?
4. **Experience Impact:**
    - How does your experience in farming influence your tomato yields?
5. **Assistance from Experts:**
    - How has assistance from technical experts impacted your ability to generate returns from tomato farming?

Section D: Tomato Marketing and Sales

1. **Market Availability:**
    - How would you assess market availability for your tomatoes?
2. **Logistics:**
    - Can you share your experiences with the logistics of getting your tomatoes to market?
3. **Price Influence:**
    - How do you feel about the market's influence on the selling price of your tomatoes?
4. **Product Risk:**
    - What challenges do you face with tomatoes being a high-risk selling product?
5. **Record Keeping:**
    - How important is it for you to keep records of your tomato sales? How do you approach this?

Section E: Food Security

1. **Income from Tomatoes:**

- How has tomato farming impacted your household's ability to meet basic needs?

2. **Hunger Prevention:**
    - Can you describe how tomato cultivation has helped your family avoid hunger and extreme poverty?
3. **Disposable Income:**
    - Have you observed any changes in your family's disposable income since you started tomato farming?
4. **Market Dynamics:**
    - In what ways do you find the market dynamics affecting the returns from tomato farming?
5. **Community Food Security:**
    - How do you view the impact of increased tomato production on broader food security in your community?

Section F: Macroeconomic Factors

1. **Government Support:**
    - How would you describe government support for smallholder tomato farmers?
2. **Economic Policies:**
    - Do you feel that current economic policies adequately support your farming efforts?
3. **Community Support:**
    - How supportive is your community of smallholder tomato growers?
4. **Technology Impact:**
    - In what ways has technology improved marketing and communication for your tomato sales?
5. **Growing Conditions:**
    - How conducive do you find the environment in Murehwa District for tomato farming?

Section G: Challenges Faced by Smallholder Tomato Farmers

1. **Role of Middlemen:**
    - What impact do middlemen have on your profitability as a tomato farmer?
2. **Climate Challenges:**
    - How are you affected by climate change and shifting weather patterns?
3. **Production Costs:**
    - What financial barriers do you encounter when growing tomatoes?
4. **Perishability:**
    - How does the perishable nature of tomatoes complicate your farming and sales process?
5. **Access to Finance:**
    - What challenges do you face in accessing financial resources for your farming activities?

Section H: Food Security Levels of Smallholder Farmers Engaged in Tomato Production

1. **Poverty Reduction:**
    - Has your income from tomato farming led to a decrease in poverty or financial distress?
2. **Income Increase:**
    - Can you share examples of how disposable income has changed for tomato growers?
3. **Technology in Sales:**
    - How has technology facilitated your marketing and sales operations?
4. **Production Methods:**
    - Have you noticed improvements in production methods that yield greater income?
5. **Community Livelihood:**

- How has tomato production influenced the overall livelihoods of families in your community?

Conclusion

Closing Statement:

"Thank you for your time and insights. Your contributions are invaluable to this research and will help highlight the role of tomato farming in enhancing food security for smallholder farmers in Murehwa District."