

**Factors Influencing the Participation of Smallholder Crop Farmers in Agro-processing  
Industries: A Case Study of uMshwathi Local Municipality**

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## ABSTRACT

Agro-processing can enhance rural livelihoods, reduce post-harvest losses, and promote inclusive economic growth. Yet, smallholder crop farmers in the uMshwathi Local Municipality, KwaZulu-Natal, face persistent barriers and limited access to capital, knowledge, and infrastructure, hindering their participation in value-adding activities. This study investigates factors influencing smallholder participation in agro-processing, aiming to identify key activities, assess knowledge and awareness, examine resource accessibility, and explore decision-making processes. It is grounded in the Sustainable Livelihoods Framework (SLF) and Innovation Diffusion Theory (IDT), linking farmers' resources and innovation uptake to agro-processing engagement.

A mixed-methods design was employed, using surveys, focus group discussions, and key informant interviews with 30 purposively selected farmers. Quantitative data were analysed using IBM SPSS, and qualitative responses were thematically coded in NVivo 15, with triangulation ensuring robust insights. Findings show that 73% of farmers engage in home-based agro-processing (e.g., baking, juice-making, mushroom drying), but participation is limited by poor access to credit (87%), processing equipment (90%), and infrastructure, with formal training being irregular. Farmers rely heavily on informal knowledge and peer learning, constraining their ability to act on the recognised benefits.

The study demonstrates how livelihood assets, innovation characteristics, and contextual barriers jointly influence agro-processing participation. Recommendations include targeted credit schemes, consistent capacity-building initiatives, improved infrastructure, and cooperative promotion, guiding inclusive agricultural development aligned with national priorities and the UN Sustainable Development Goals.

## DECLARATION 1 – PLAGIARISM

I, **Thalente Minenhle Khumalo**, declare that:

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## DECLARATION 2 – DRAFT PUBLICATION MANUSCRIPT

Details of contribution to the draft publication manuscript that form part of and/or include research presented in this dissertation.

### **Publication manuscript 1 (Submitted for publication)**

T.M Khumalo and Dr K.D. Naidoo (2025): **An In-Depth Analysis of Agro-Processing Practices and Knowledge Levels Among Smallholder Crop Farmers in KwaZulu-Natal**

Author contributions: T.M Khumalo conceived the paper with Dr K.D. Naidoo, T.M Khumalo collected and analysed data, and wrote the paper. Dr. K.D. Naidoo guided the data collection and analysis, and the manuscript drafting and correction.

### **Publication manuscript 2 (Journal being identified)**

T.M Khumalo and Dr K.D. Naidoo (2025): **Exploring Resource Access and Decision-Making Drivers for Agro-Processing Among Smallholder Crop Farmers**

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## LIST OF FIGURES

<b>Figure 2.1:</b> Conceptual framework linking agro-processing activities, mediating factors (market access, finance, training), and livelihood outcomes, moderated by gender and climate within the broader institutional context .....	49
<b>Figure 2.2:</b> The integration of the Sustainable Livelihoods Framework (SLF) and Innovation Diffusion Theory (IDT) provides a comprehensive understanding of how agro-processing contributes to smallholder farmers' livelihoods.....	51
<b>Figure 3.1:</b> Sub-districts of Umgungundlovu District Municipality within KwaZulu-Natal Province. Source File: Map of KwaZulu-Natal with municipalities named and districts shaded by blue dots .....	64
<b>Figure 4.1:</b> Home-based processing activities .....	88
<b>Figure 4.2:</b> Equipment Used for Processing.....	90
<b>Figure 5.1:</b> Variables influencing agro-processing participation.....	125

## LIST OF TABLES

<b>Table 4.1:</b> Socioeconomic Demographics of Respondents .....	82
<b>Table 4.2:</b> Key Agro-Processing Activity Themes Emerging from FGD's .....	87
<b>Table 4.3:</b> Descriptive Statistics on Awareness and Perceived Benefits of Agro-processing .....	91
<b>Table 4.4:</b> Familiarity, Knowledge, and Sources of Information about Agro-processing .....	93
<b>Table 4.5:</b> Perceived Benefits of the Underlying Factors of Agro-processing.....	96
<b>Table 5.1:</b> Socioeconomic Characteristics of Respondents .....	114
<b>Table 5.2:</b> Availability and Accessibility of Resources for Agro-processing: Farmer Survey Responses .....	118
<b>Table 5.3:</b> Constraints to Access and Availability of Agro-processing Resources: Themes, Codes, and Contextualised Descriptions .....	119
<b>Table 5.4:</b> Factors Influencing Agro-processing Participation .....	122
<b>Table 5.5:</b> Correlation Trends amongst Economic, Social, and Institutional Factors Influencing SHFs' Participation in Agro-processing .....	129
<b>Table 5.6:</b> Barriers to Smallholder Farmers' Participation in Agro-Processing Activities.....	136

## **ABBREVIATIONS AND ACRONYMS**

<b>AFDB:</b>	African Development Bank
<b>APAP:</b>	Agricultural Policy Action Plan
<b>AAMP:</b>	Agricultural and Agro-processing Master Plan
<b>AU:</b>	African Union
<b>CAADP:</b>	Comprehensive Africa Agriculture Development Programme
<b>CCPP:</b>	Contagious Caprine Pleuropneumonia
<b>CSIR:</b>	Council for Scientific and Industrial Research
<b>DAFF:</b>	Department of Agriculture, Forestry and Fisheries
<b>DALRRD:</b>	Department of Land Reform and Rural Development
<b>DEFFE:</b>	Department of Forestry, Fisheries and the Environment
<b>DOA:</b>	Department of Agriculture
<b>ERDP:</b>	Economic Reconstruction and Development Plan
<b>FAO:</b>	Food and Agriculture Organisation
<b>FFBSs:</b>	Farmer Field Business Schools
<b>FGDs:</b>	Focus Group Discussions
<b>GAFs:</b>	Global Alliance for Food Security
<b>GDP:</b>	Gross Domestic Product
<b>IDP:</b>	Integrated Development Plan
<b>IDT:</b>	Innovation Diffusion Theory
<b>IPAP:</b>	Industrial Policy Action Plan
<b>KIIs:</b>	Key Informant Interviews
<b>KZN DARD:</b>	KwaZulu-Natal Department of Agriculture and Rural Development
<b>LED:</b>	Local Economic Development
<b>LEDAs:</b>	Local Economic Development Agencies
<b>LIT:</b>	Localised Irrigation Technology
<b>NAMC:</b>	National Agricultural Marketing Council
<b>NDP:</b>	National Development Plan
<b>PHL:</b>	Post-Harvest Loss
<b>PPECB:</b>	Perishable Products Export Control Board

<b>RAAVC:</b>	Revitalising of the Agriculture and Agro-processing Chain
<b>RADP:</b>	Recapitalisation and Development Programme
<b>SAPs:</b>	Sustainable Agricultural Practices
<b>SAPZs:</b>	Special Agro-Industrial Processing Zones
<b>SDGs:</b>	Sustainable Development Goals
<b>SHF/SHFs:</b>	Smallholder Farming/Smallholder Farmers
<b>SLF:</b>	Sustainable Livelihoods Framework
<b>SMMEs:</b>	Small, Medium and Micro Enterprises
<b>SSAs:</b>	Small-scale Agro-processors
<b>SSA:</b>	Sub-Saharan Africa
<b>UNDP:</b>	United Nations Development Programme
<b>VSLAs:</b>	Village Savings and Loan Associations

<b>ABSTRACT.....</b>	<b>II</b>
<b>DECLARATION 1 – PLAGIARISM.....</b>	<b>III</b>
<b>DECLARATION 2 – DRAFT PUBLICATION MANUSCRIPT .....</b>	<b>IV</b>
<b>ACKNOWLEDGEMENTS .....</b>	<b>V</b>
<b>LIST OF FIGURES .....</b>	<b>VI</b>
<b>LIST OF TABLES .....</b>	<b>VII</b>
<b>ABBREVIATIONS AND ACRONYMS.....</b>	<b>VIII</b>
<b>CHAPTER ONE.....</b>	<b>1</b>
<b>THE PROBLEM SETTING .....</b>	<b>1</b>
1.1. INTRODUCTION AND BACKGROUND .....	1
1.2. RESEARCH PROBLEM.....	3
1.3. OVERALL OBJECTIVES .....	4
1.3.1. <i>Specific objectives</i> .....	4
1.3.2. <i>Research Questions</i> .....	4
1.4. SIGNIFICANCE OF THE STUDY .....	5
1.5. ASSUMPTIONS .....	6
1.6. DEFINITION OF TERMS.....	6
1.7. DISSERTATION OUTLINE .....	7
1.8. SUMMARY .....	8
1.9. REFERENCES.....	10
<b>CHAPTER TWO .....</b>	<b>12</b>
<b>LITERATURE REVIEW .....</b>	<b>12</b>
2.1. INTRODUCTION.....	12
2.2. INTRODUCTION TO AGRO-PROCESSING AND FOOD SECURITY.....	12
2.2.1. <i>Definition and Scope of Agro-processing</i> .....	12
2.2.2. <i>Agro-processing within food systems</i> .....	15
2.3. AGRO-PROCESSING AS A STRATEGY FOR FOOD SECURITY.....	18
2.3.1. <i>Role of agro-processing in improving food availability, access, and stability (Global, SSA, South Africa)</i> .....	18
2.3.2. <i>Impact of Agro-Processing on Economic Empowerment, Gender Equality, and Rural Livelihoods</i> .....	20
2.3.3. <i>Economic Empowerment through Value Addition and Market Integration</i> .....	20
2.3.4. <i>Gender Equality and Women’s Empowerment through Agro-Processing</i> .....	21
2.3.5. <i>Rural Livelihoods, Food Security, and Sustainable Development</i> .....	22
2.3.6. <i>Synthesis and Policy Implications</i> .....	23
2.3.7. <i>Reducing post-harvest losses</i> .....	24
2.4. AGRO-PROCESSING AND SMALLHOLDER DEVELOPMENT POLICY CONTEXT.....	26
2.4.1. <i>Global (e.g., FAO strategies)</i> .....	26
2.4.2. <i>Sub-Saharan Africa (e.g., CAADP, African Union frameworks)</i> .....	27
2.4.3. <i>Saharan Africa (e.g., CAADP, African Union frameworks)</i> .....	27
2.4.4. <i>South Africa (e.g., NDP, APAP, RADP)</i> .....	28

2.5. AGRO-PROCESSING ACTIVITIES AMONG SMALLHOLDER CROP FARMERS.....	28
2.5.1. <i>Overview of Smallholder Crop Production Globally and Sub-Saharan Africa</i> .....	28
2.5.2. <i>Common Agro-processing Activities: Global Trends, Sub-Saharan African Experiences, and the South African Context</i> .....	30
2.6. KNOWLEDGE AND AWARENESS OF AGRO-PROCESSING .....	33
2.6.1 <i>Global and SSA awareness levels of agro-processing</i> .....	33
2.6.2. <i>Education and exposure factors to agro-processing</i> .....	35
2.7. PERCEIVED BENEFITS AND BARRIERS OF AGRO-PROCESSING .....	37
2.8. THE ROLE OF TRAINING AND CAPACITY BUILDING FOR AGRO-PROCESSING IN SOUTH AFRICA .....	40
2.9. FACTORS INFLUENCING SMALLHOLDER PARTICIPATION IN AGRO-PROCESSING IN SOUTH AFRICA .....	43
2.10. BARRIERS AND CONSTRAINTS TO PARTICIPATION IN AGRO-PROCESSING IN SOUTH AFRICA .....	45
2.11. CONCEPTUAL FRAMEWORK.....	48
2.12. THEORETICAL FRAMEWORKS .....	48
2.12.1. <i>Theoretical framework: Sustainable Livelihoods Framework (SLF)</i> .....	48
2.12.2. <i>Theoretical framework: Innovation Diffusion Theory (IDT)</i> .....	49
2.13. SUMMARY .....	50
2.14. REFERENCES.....	52
<b>CHAPTER THREE.....</b>	<b>62</b>
<b>METHODOLOGY .....</b>	<b>62</b>
3.1. INTRODUCTION.....	62
3.2. DESCRIPTION OF THE STUDY AREA .....	62
3.3. RESEARCH PHILOSOPHY .....	63
3.4. RESEARCH DESIGN .....	64
3.5. RESEARCH APPROACH.....	65
3.6. SAMPLING STRATEGY.....	65
3.6.1. <i>Inclusion and Exclusion Criteria</i> .....	66
3.7. DATA COLLECTION .....	66
3.8. DATA ANALYSIS.....	66
3.9. ETHICAL CONSIDERATIONS .....	67
3.10. LIMITATIONS .....	68
3.11. SUMMARY .....	68
3.12. REFERENCES .....	70
<b>CHAPTER FOUR.....</b>	<b>72</b>
<b>AN IN-DEPTH ANALYSIS OF AGRO-PROCESSING PRACTICES AND KNOWLEDGE LEVELS AMONG SMALLHOLDER CROP FARMERS IN KWAZULU-NATAL.....</b>	<b>72</b>
<b>ABSTRACT.....</b>	<b>72</b>
4.1. INTRODUCTION AND CONTEXTUALIZATION.....	73
4.2. THEORETICAL FRAMEWORK .....	74
4.2.1. <i>Characteristics of the Innovation</i> .....	74
4.2.2. <i>Communication Channels</i> .....	74
4.2.3. <i>Social Systems</i> .....	75
4.2.4. <i>Adopter's Characteristics</i> .....	75
4.3. CONTEXTUALISING THE STUDY WITHIN THE LITERATURE AND THEORETICAL FRAMEWORK .....	75
4.4. METHODOLOGY.....	76

4.4.1. <i>Description of the study area</i> .....	76
4.5. RESEARCH DESIGN .....	76
4.6. SAMPLING PROCEDURE, FRAME, AND SAMPLE SIZE.....	77
4.6.1. <i>Sampling Procedure</i> .....	77
4.6.2. <i>Sampling Frame</i> .....	77
4.6.3. <i>Sample Size</i> .....	77
4.7. DATA COLLECTION AND ANALYSIS.....	78
4.8. ETHICAL CONSIDERATIONS .....	80
4.9. RESULTS AND DISCUSSION .....	81
4.9.1. <i>Socioeconomic Characteristics and the Diffusion Context</i> .....	81
4.9.2 <i>Identifying the Agro-Processing Activities Carried Out by Smallholder Crop Farmers</i> .....	84
4.9.3. <i>Home-based Agro-processing Activities Reported by Farmers</i> .....	86
4.9.4. <i>Equipment Used for Processing</i> .....	88
4.9.5. <i>Determining the Level of Knowledge and Awareness About Agro-Processing and Its Potential Benefits</i> .....	89
4.9.6. <i>Farmers' Familiarity and Knowledge About Agro-processing</i> .....	91
4.9.7. <i>Perceived benefits of the underlying factors of agro-processing</i> .....	93
4.9.8. <i>Integration of Findings and Theoretical Interpretation</i> .....	95
4.10. CONCLUSION AND RECOMMENDATIONS.....	96
4.11. REFERENCES.....	97
<b>CHAPTER FIVE.....</b>	<b>105</b>
<b>EXPLORING RESOURCE ACCESS AND DECISION-MAKING DRIVERS FOR AGRO-PROCESSING AMONG SMALLHOLDER CROP FARMERS .....</b>	<b>105</b>
<b>ABSTRACT.....</b>	<b>105</b>
5.1. INTRODUCTION AND CONTEXTUALISATION.....	106
5.2. THEORETICAL FRAMEWORK.....	108
5.2.1. <i>Characteristics of the Innovation</i> .....	108
5.2.2. <i>Livelihood Assets</i> .....	109
5.2.3. <i>Vulnerability Context</i> .....	109
5.2.4. <i>Transforming Structures and Processes</i> .....	109
5.2.5. <i>Livelihood Strategies and Outcomes</i> .....	109
5.3. METHODOLOGY.....	110
5.3.1. <i>Description of the Study Area</i> .....	110
5.4. RESEARCH DESIGN.....	110
5.4.1. <i>Mixed-methods approach</i> .....	110
5.4.2. <i>Sampling technique and sample size determination</i> .....	110
5.4.3. <i>Data collection methods (surveys, interviews, focus groups)</i> .....	110
5.5. DATA ANALYSIS .....	111
5.5.1. <i>Quantitative Analysis</i> .....	111
5.5.2. <i>Qualitative Analysis</i> .....	111
5.5.3. <i>Integration of Data</i> .....	111
5.6. ETHICAL CONSIDERATIONS .....	112
5.7. RESULTS AND DISCUSSIONS .....	112
5.7.1. <i>Socio-economic characteristics of smallholder farmers and implications for agro-processing participation</i> .....	112

5.7.2. <i>Availability and accessibility of resources for agro-processing</i> .....	116
5.7.3. <i>Factors influencing participation in agro-processing</i> .....	121
5.7.4. <i>General Correlation Trends in the Livelihood Context</i> .....	124
5.7.5. <i>Challenges and opportunities in agro-processing</i> .....	132
5.8. CONCLUSION AND RECOMMENDATIONS .....	133
5.9. REFERENCES .....	135
<b>CHAPTER SIX .....</b>	<b>142</b>
<b>CONCLUSION AND RECOMMENDATIONS .....</b>	<b>142</b>
6.1. CONCLUSION .....	142
6.2. STUDY LIMITATIONS .....	143
6.3. SUGGESTIONS FOR FUTURE RESEARCH.....	143
6.4. RECOMMENDATIONS .....	144
<b>APPENDICES .....</b>	<b>146</b>

# CHAPTER ONE

## THE PROBLEM SETTING

### 1.1. Introduction and Background

Agriculture continues to be the primary source of national revenue for most developing countries. According to Statistics South Africa (2022), the agriculture industry increased by 19.2% and contributed 0.5 percentage points to GDP growth. There are various definitions of smallholder farming (SHF), but it is commonly described as farming activities on landholdings of two hectares or less. However, such a definition might oversimplify the complex nature of Smallholder farming (SHF), as the productivity and sustainability of smallholder systems are affected by land quality, agroecological conditions, and access to alternative income sources (Gomez y Paloma, Riesgo, and Louhichi, 2020). Despite their relatively small scale, smallholder farmers play a vital role in national and global food systems. To meet the rising food demands of a growing and increasingly urbanised global population, agriculture must undergo significant transformation in the coming decades (Hemathilake and Gunathilake, 2022). Smallholder farmers in developing countries are key to this transformation and are integral to ensuring global food security (Fan and Rue, 2020; Gomez y Paloma et al., 2020). Nonetheless, smallholders remain among the most vulnerable and marginalised groups, often neglected in policy frameworks and development planning. Akpan and Zikos (2023) note that these farmers represent a substantial proportion of the world's poor and undernourished populations.

Importantly, smallholder farmers play a significant role in the efforts aimed at achieving the United Nations Sustainable Development Goals (SDGs), adopted in 2015. Their meaningful participation in agriculture and agro-processing directly contributes towards achieving SDG 1 (No Poverty), SDG 2 (Zero Hunger), and SDG 8 (Decent Work and Economic Growth). SHFs also contribute to SDG 12 (Responsible Consumption and Production) by promoting sustainable agricultural practices and local food systems. When empowered and equitably included, smallholders also play a significant role in achieving SDG 5 (Gender Equality), SDG 10 (Reduced Inequalities), and SDG 13 (Climate Action), through inclusive development, income generation, and adaptive agricultural practices (Fan and Rue, 2020).

According to Adefila et al. (2024), integration into global and local agricultural value chains is essential for the advancement of smallholder farming in emerging economies. Agro-processing is one such value chain segment with significant potential to add value to agricultural produce, create employment, and diversify rural incomes. However, SHFs in Southern Africa, particularly new or emerging farmers, face

significant challenges in entering the agro-processing sector due to weak support structures, limited market access, and a lack of technical and financial resources (Mthombeni, Antwi, and Oduniyi, 2022). In South Africa, agriculture and agro-processing have been identified as strategic sectors in the national development and economic recovery plans. The National Treasury (2019/20) highlights the potential of these sectors to absorb low-skilled labour and promote inclusive growth by supporting the development of small and medium enterprises across the value chain. Agro-processing, in particular, has shown promise in addressing key socio-economic challenges. Khoza et al. (2019) argue that the sector contributes significantly to income generation, employment, improved food and nutrition security, and social well-being, all of which are essential key components of sustainable livelihoods for smallholder farmers.

Despite this potential, smallholder participation in agro-processing remains limited, especially in rural areas such as the uMshwathi Local Municipality in KwaZulu-Natal. This limited participation can be attributed to various interrelated factors such as lack of infrastructure, inadequate market linkages, limited technical knowledge, financial constraints, and weak institutional support (Khoza et al., 2019). In rural areas such as uMshwathi, these challenges are often exacerbated by spatial inequalities, underdeveloped transport networks, and limited access to extension services. The municipality, which is characterised by a large rural population and a strong dependence on agriculture, presents a critical case for understanding the dynamics of smallholder engagement in value-added agricultural activities. Enhancing SHF participation in agro-processing within this context could catalyse rural development, economic inclusion, and household-level food security (Ndlovu and Masuku, 2021).

While the agro-processing sector holds significant promise for rural development and inclusive growth in South Africa, there is a notable gap in empirical understanding of the factors influencing smallholder farmers' participation in this sector, particularly in rural communities such as uMshwathi. Existing literature has largely focused on national-level trends or commercial agricultural actors, with limited attention to the local-level dynamics, constraints, and opportunities affecting smallholders' involvement in value addition. This lack of contextualised evidence hampers the development of targeted interventions to enhance SHF integration into agro-processing value chains. This study, therefore, seeks to identify and analyse the factors that influence smallholder farmers' participation in agro-processing industries within the uMshwathi Local Municipality. By doing so, it aims to contribute to the broader discourse on rural transformation, value chain development, and sustainable

agricultural livelihoods in South Africa and the uMshwathi region.

## **1.2. Research Problem**

Smallholder farmers (SHFs) in South Africa have played a limited role in the agro-processing industry because they have not been successfully integrated into sustainable agricultural value chains. The problem lies in the weak linkages between SHFs and agro-processing activities, which limits their ability to add value to their produce, diversify income sources, and achieve sustainable livelihoods.

This is a problem because it undermines rural economic growth, constrains local employment opportunities, and perpetuates food insecurity in rural areas. Despite ongoing rural development initiatives and government support programs, SHFs continue to face barriers such as limited access to infrastructure, finance, markets, and technical knowledge. These challenges prevent them from engaging effectively in the value addition processes that could enhance profitability and resilience.

The affected stakeholders include smallholder crop farmers within the uMshwathi Local Municipality, local agro-processors, agricultural cooperatives, government institutions, and rural communities that depend on farming as their primary livelihood source.

The problem is situated within the uMshwathi Local Municipality, located in the uMgungundlovu District of KwaZulu-Natal. This area has one of the highest concentrations of smallholder farmers in the district and significant potential for agro-processing development, yet limited institutional and infrastructural support constrains progress.

The problem is ongoing, reflecting persistent structural and institutional barriers that have evolved over time. Despite several national and local initiatives to promote rural enterprise and agricultural development, SHFs remain excluded from the mainstream agro-processing sector.

Existing literature agrees that smallholder farmers' participation in agro-processing can significantly enhance rural livelihoods and food security (Melemebe et al., 2021; Mthombeni et al., 2022). Researchers widely acknowledge that agro-processing contributes to increased cash flow, improved value addition, and greater sustainability in farming systems.

However, the literature gap lies in the limited empirical understanding of the factors influencing smallholder farmers' participation in agro-processing at the local level, particularly within the uMshwathi Local Municipality. Few studies have explored farmers' knowledge, awareness, and decision-making processes related to agro-processing or examined the local institutional and infrastructural constraints that limit engagement.

The magnitude of the problem is considerable, as smallholder farmers constitute a major portion of South

Africa's rural agricultural sector. If the barriers to their participation in agro-processing are not addressed, the region risks continued rural poverty, underutilization of agricultural resources, and a failure to achieve inclusive economic development. Conversely, empowering SHFs to engage in agro-processing could significantly strengthen local food systems, generate employment, and promote sustainable livelihoods. Therefore, this study seeks to explore the factors influencing smallholder farmers' participation in agro-processing within the uMshwathi Local Municipality, identify existing challenges, assess levels of knowledge and awareness, and propose practical recommendations to enhance their involvement and strengthen rural economic resilience.

### **1.3. Overall objectives**

The overall objective of this study is to identify the factors that influence smallholder farmers' participation in agro-processing industries in the UMshwathi Local Municipality.

#### *1.3.1. Specific objectives*

- Identifying the agro-processing activities carried out by smallholder crop farmers in the area.
- Determining the level of knowledge and awareness about agro-processing and its potential benefits.
- To assess the availability and accessibility of resources for agro-processing activities among smallholder crop farmers.
- Exploring the factors that influence the decision-making process of smallholder crop farmers to engage in agro-processing activities.

#### *1.3.2. Research Questions*

- What agro-processing activities are commonly carried out by smallholder crop farmers in the area?
- To what extent do smallholder crop farmers possess knowledge and awareness about agro-processing and its potential benefits?
- How available and accessible are the resources for agro-processing activities to smallholder crop farmers?
- What factors influence the decision-making process of smallholder crop farmers to engage in agro-processing activities?

#### **1.4. Significance of the Study**

While previous research has highlighted the transformative potential of agro-processing in enhancing market access and improving livelihoods (Mmbengwa et al., 2020), there remains a lack of empirical evidence examining the specific factors influencing smallholder farmers' participation in agro-processing activities. This gap presents an opportunity to investigate the mechanisms through which agro-processing can serve as a vital pathway for economic growth, food security, and sustainable development in rural communities.

The study leverages the Innovation Diffusion Theory (IDT) and the Sustainable Livelihoods Framework (SLF). IDT posits that adoption of innovations is influenced by factors such as perceived benefits, social networks, and the characteristics of the innovation itself (García-Avilés, 2020). By analysing agro-processing as an innovative practice, this study explores how information dissemination and social interactions shape smallholder farmers' decisions to engage in value-adding activities. SLF provides a holistic understanding of how agro-processing contributes to livelihood resilience and diversification, emphasising asset access and adaptive capacity in the face of socio-economic and climate-related challenges (Tambe, 2022).

The study aligns with global and national policy priorities, particularly the United Nations Sustainable Development Goals (SDGs). It contributes to Goal 2 (Zero Hunger) by investigating agro-processing's role in enhancing food security and income generation, and to Goal 8 (Decent Work and Economic Growth) by identifying pathways for job creation and economic development in rural areas (United Nations, 2015). It also supports South Africa's National Development Plan (NDP) 2030, which advocates for agricultural productivity and sustainable rural development through value-added activities such as agro-processing (National Planning Committee, 2011).

Importantly, the findings of this study are designed to benefit key stakeholders. Smallholder farmers will gain insights into best practices, access to knowledge, and strategies for overcoming barriers to participation, improving livelihoods and economic resilience. Policymakers, development agencies, and extension officers will be able to use the evidence to design targeted interventions, provide capacity-building programs, and strengthen support structures that promote sustainable engagement in agro-processing. By addressing the identified research gap and providing stakeholder-specific recommendations, this study contributes to both the academic understanding of smallholder agro-processing and the practical advancement of inclusive agricultural development.

## 1.5. Assumptions

This study assumes that SHFs can participate in agro-processing activities, given that they are given governmental support to train them and enhance their skills and abilities and that this participation can influence their livelihoods and allow them food security. Moreover, this study assumes that SHFs will be interested in having the conversation, thus providing information that is reliable and accurate, and will not jeopardise the findings of this research.

## 1.6. Definition of Terms

**Agro-processing:** The transformation of raw agricultural produce, such as vegetables or fruit, into value-added products (e.g., pickles, juices) by smallholder farmers to improve income, reduce post-harvest losses, and support local food systems in uMshwathi (Urugo et al., 2024).

**Smallholder Crop Farmers:** Farmers in uMshwathi who cultivate relatively small plots of land, often using family labour, and grow staple or horticultural crops primarily for household consumption and local markets, with limited access to formal agro-processing value chains (Msomi and Zenda, 2024).

**Livelihoods:** What rural households in uMshwathi sustain their well-being, which includes income generation, food production, and access to assets, where participation in agro-processing is explored as a strategy to strengthen resilience and improve quality of life (Khowa and Mukasi, 2021).

**Food Security:** Refers to the consistent access by smallholder farming households to sufficient, safe, and nutritious food, which can be enhanced through agro-processing activities that reduce post-harvest losses and improve income (Christiana et al., 2022).

**Mixed Methods:** As per Taherdoost (2022), a mixed-methods approach combines both qualitative (focus group discussions and key informant interviews) and quantitative (semi-structured questionnaire) techniques to gain a comprehensive understanding of the factors influencing smallholder farmers' participation in agro-processing.

**Decision-making Process:** The cognitive and contextual factors that influence how smallholder farmers in uMshwathi choose whether to engage in agro-processing activities, including considerations of risk, resource availability, and perceived benefits (Taherdoost and Madanchian, 2024).

**Purposive Sampling:** A non-random sampling technique used to deliberately select smallholder farmers who are either actively engaged in agro-processing or represent specific characteristics relevant to the research objectives (Nyimbili and Nyimbili, 2024).

**Participation:** In this study, participation refers to the level and form of smallholder farmers'

involvement in agro-processing activities, including production, processing, and marketing along the agricultural value chain (Addink, 2019).

**Agricultural Value Chain:** The full sequence of activities from agricultural production to the final processed product, with specific attention to where and how smallholder farmers can add value through agro-processing in rural settings (Ndlovu, Thamaga-Chitja and Ojo, 2021).

**Rural Development:** The process of improving the economic and social well-being of people living in rural areas like uMshwathi, which this study links to increased agro-processing participation by smallholder farmers (Geza et al., 2022).

## **1.7. Dissertation Outline**

### *Chapter 1: Introduction*

In this chapter, the research unfolds with an exploration of the background and context of the study, setting the stage for an in-depth understanding of the factors influencing smallholder farmers' participation in agro-processing industries within the uMshwathi local municipality. The chapter delves into the specific research questions and objectives, addressing the identified problem statement. Furthermore, it underscores the significance of the study, establishes the boundaries of the research, outlines key assumptions, and provides precise definitions of essential terms.

### *Chapter 2: Literature Review*

This section critically reviews existing literature on agro-processing industries, with a specific focus on the factors shaping the participation of smallholder farmers in such ventures. The exploration encompasses economic, social, and environmental considerations, providing a comprehensive understanding of the landscape. Additionally, it draws on relevant studies in the field and scrutinises government initiatives and policies aimed at supporting smallholder farmers in agro-processing.

### *Chapter 3: Methodology*

Detailed insights into the study area, namely the uMshwathi local municipality, are provided in this chapter. The research design, including the carefully selected methods for data collection and analysis, is articulated. By presenting the methodology, the chapter establishes the robust framework employed to explore and interpret the factors influencing smallholder farmers' involvement in agro-processing industries.

*Chapter 4: Manuscript one: An In-Depth Analysis of Agro-Processing Practices and Knowledge Levels Among Smallholder Crop Farmers in KwaZulu-Natal*

This chapter presents the first manuscript, which explores the agro-processing activities undertaken by smallholder crop farmers and their knowledge of its potential benefits. The study found that most farmers engage in basic processing, such as drying and juicing, but show limited awareness of broader value-adding opportunities. Using the Innovation Diffusion Theory (IDT), the findings highlight that adoption is influenced by farmers' access to information, perceived benefits, and support systems. The chapter also examines how demographic factors and cooperative involvement shape knowledge levels, offering insights for targeted awareness and training interventions in rural communities.

*Chapter 5: Manuscript two: Exploring Resource Access and Decision-Making Drivers for Agro-Processing Among Smallholder Crop Farmers*

This chapter focuses on the second manuscript, which explores the availability and accessibility of critical resources required for agro-processing among smallholder farmers, as well as the factors influencing their decision-making processes. The analysis considers infrastructure, financial resources, technical support, and institutional linkages that shape farmers' capacity to participate in agro-processing. Using thematic and statistical analysis, the chapter identifies systemic barriers, motivational drivers, and cultural or economic constraints affecting participation. These findings are discussed concerning the Innovation Diffusion Theory and provide evidence-based insights to inform policy and development interventions tailored to the rural context of the Umswathi Local Municipality.

*Chapter 6: Conclusions and Recommendations*

The concluding chapter consolidates the study's outcomes, offering a succinct summary of the findings. Conclusions drawn from the research are presented, highlighting implications for policy and practice. The chapter concludes with specific recommendations tailored for smallholder farmers, government agencies, and other stakeholders, while also pinpointing areas meriting further research exploration.

**1.8. Summary**

This study investigates the persistent barriers and untapped potential surrounding smallholder farmers' participation in agro-processing industries in the uMshwathi local municipality, KwaZulu-Natal. Agriculture remains a vital economic sector in South Africa, yet smallholder crop farmers continue to

be marginalised in high-value activities such as agro-processing. Significant integration into agro-processing value chains is still scarce, especially in historically underdeveloped areas like uMshwathi, despite national initiatives to boost smallholders and revitalise rural economies.

The study is framed by the Sustainable Livelihoods Framework (SLF) and Innovation Diffusion Theory (IDT), which jointly investigate how asset-based resilience, institutional access, and knowledge dissemination affect farmers' involvement in agro-processing. The research aims to identify the specific agro-processing activities carried out by smallholder farmers, assess their levels of knowledge and awareness, evaluate resource availability, and explore decision-making factors affecting their participation. This focus responds to a critical development gap where smallholders remain excluded from sectors that could enhance food security, reduce poverty, and support sustainable development. The study is particularly significant given that uMshwathi is one of the most agriculturally active municipalities in the uMgungundlovu District, yet it suffers from poor infrastructure, weak market access, and limited support services. Findings from this research will not only contribute to the academic discourse but will also inform policy and programming aimed at strengthening smallholder participation in agro-processing industries.

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## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1. Introduction**

There are several types of agro-processing: primary, secondary, and tertiary. Primary processing involves basic operations that make raw agricultural products suitable for consumption or further processing, such as washing, peeling, chopping, ageing, milling wheat to make flour, and sugarcane processing. Secondary processing refers to more complex operations that transform primarily processed goods into value-added products, including mixing, depositing, layering, extruding, drying, fortifying, fermentation, pasteurisation, clarifying, and heating (Luan et al., 2020). Tertiary processing, on the other hand, produces ready-to-eat or convenience products, often packaged for retail, such as canned fruits, jams, frozen vegetables, and prepared meals. According to Mmbengwa et al. (2020), SHFs in South Africa have limited options for participating in the agro-processing industry. Participation in global value chains, which refer to the full range of activities required to bring a product from conception through production, distribution, and consumption across different countries, is considered crucial to include SHFs in the agricultural development of developing countries. Additionally, SHFs are known for engaging in local agro-food markets through informal trade and small-scale traders. This is largely because they lack economies of scale that would attract larger commercial buyers, making informal local marketing a common practice (Msomi and Zenda, 2024).

#### **2.2. Introduction to Agro-processing and Food Security**

##### *2.2.1. Definition and Scope of Agro-processing*

Agro-processing refers to the transformation of agricultural, forestry and fisheries outputs into products that are more useful to consumers or other producers. In the South African policy and industry context, agro-processing is commonly framed as the set of activities that add value to farm produce through physical, chemical or biological transformation, while creating employment and linkages between rural production and urban or export markets (Chitonge, 2021). For instance, DAFF's definition highlights agro-processing as the transformation of products originating from agriculture, forestry and fisheries into higher-value outputs and notes its role in rural industrialisation and employment creation. National industrial policy in South Africa also situates agro-processing within a broader strategy of local beneficiation and industrialisation, emphasising its potential to generate jobs and support rural development. Empirical studies from South Africa further illustrate this policy-

practice link by showing how local capacity building, business networks and targeted interventions facilitate small-scale agro-processors' participation in value chains (Manasoe et al., 2024).

Global perspectives on agro-processing expose a multifaceted sector that intertwines economic development, environmental sustainability, and social equity. As nations, particularly in the developing world, confront rising demands for food driven by population growth and urbanisation, the agro-processing industry emerges as a pivotal sector for enhancing economic resilience and food security. Empirical evidence from Taiwan illustrates that participation in agro-processing positively correlates with increased farm income and diversification, demonstrating the economic potential of this sector as a driver for rural livelihoods and economic transformation (Lin and Chang, 2021).

In Ghana, the agro-processing industry has assumed a critical role within the broader landscape of economic development, evolving into a significant facet of the manufacturing sector (Mohammed et al., 2023). The capacity of agro-processing to enhance food production, support employment generation, and increase income is linked to its substantial contribution to sustainable growth. However, the growth of agro-industrialisation in Ghana must be pursued with caution due to potential environmental repercussions, balancing economic gains against ecological sustainability (Kwaku et al., 2024). Brazil's experience in building agro-industrial capabilities reflects a similar dualistic challenge, emphasising the need for investments in domestic agro-industrial sectors that foster resilience while avoiding the social and environmental costs associated with simplistic agricultural expansion. As Brazil's agribusinesses strive to cultivate robust agro-industrial capabilities, they contribute to the self-sufficiency of domestic industries while promoting sustainable practices (Medina and Costa, 2023). This aligns with findings in other regions where developing sophisticated agro-industrial models underscores the importance of aligning development agendas with sustainability objectives, encouraging innovations that bolster both economic and environmental performance (Zolkin et al., 2024).

The establishment of agro-industrial clusters, which denote geographically concentrated groups of interrelated companies, suppliers, and relevant institutions in agro-processing, has gained prominence as a strategic approach to enhance regional competitiveness and synergies within the agro-processing sector. For instance, Kazakhstan's formation of agro-industrial clusters emphasises collaboration among various stakeholders to optimise resource utilisation and reinforce economic vitality within agricultural contexts (Tkacheva et al., 2024). The essence of agro-industrial clusters lies in their ability

to foster innovation, technological adoption, and capacity building, which are pivotal for transforming the agricultural sector.

The relationship between environmental practices and agro-processing firms warrants comprehensive scrutiny. Research shows that the adoption of environmental standards in agro-processing firms significantly influences farmers' practices and their environmental stewardship (Namagembe, 2020). These dynamics emphasise the interconnectedness between agro-industrial practices and sustainable agriculture, advocating for frameworks that enhance eco-efficiency within supply chains and promote sustainable agricultural practices (Zhao et al., 2018). Furthermore, ensuring alignment with market requirements is essential for boosting the competitiveness of agro-processed goods in both local and global markets.

Despite clear economic benefits related to increased incomes and employment outcomes, significant barriers to fully realising agro-processing's potential remain. Limited access to credit and inadequate infrastructural support are critical impediments that many agro-processing endeavours face, especially in regions like Ghana (Habiyaemye and Mupela, 2019). Addressing these bottlenecks through policy interventions and improved financial models is essential for unlocking the sector's full potential. The rise of certification schemes, which are formal, audited processes that verify compliance with specific standards (e.g., quality, sustainability, or ethical sourcing), reflects the evolving nature of agro-food markets where private standards increasingly dictate competitive positioning. As consumer preferences shift toward sustainability, adhering to relevant certifications has become a strategic necessity for firms within the agro-industrial complex (Ćoćkalo et al., 2019). This scenario presents both challenges and opportunities as stakeholders, including smallholders, navigate compliance and market access avenues.

Additionally, empirical findings from Ukraine highlight the urgent need to focus on innovative approaches and technological advancements for restoring and developing the agro-industrial sector in a post-war context. Such innovations are crucial for economic recovery and food security, positioning agro-processing at the forefront of national development strategies (Gavkalova, 2024). Effective management of agro-waste has become pivotal within the broader discourse of agro-processing sustainability. The implementation of techniques to enhance recycling and waste management within agricultural practices is essential for achieving a circular economy, an economic model where waste is minimised, and resources are kept in use for as long as possible (Liu et al., 2018).

According to Rushchitskaya et al. (2024), the global overview of agro-processing underscores the necessity for multidimensional frameworks that transcend traditional agricultural paradigms, emphasising agricultural innovation, economic resilience, environmental sustainability, and social equity. Integration of technology, stakeholder collaboration, and regulatory frameworks promoting sustainability is key to harnessing the transformative potential of agro-processing efficiently. By leveraging global insights, particularly from countries like Taiwan and Brazil, we can draw clear parallels to the African context. For instance, Taiwan demonstrates how innovation in agro-processing directly raises smallholder incomes, while Brazil highlights the importance of policy frameworks that balance economic growth with environmental sustainability. These lessons are especially relevant for Sub-Saharan Africa and South Africa, where infrastructural constraints, climate risks, and market exclusion remain barriers. Integrating such international experiences provides a stronger foundation for tailoring African strategies to strengthen smallholder participation in agro-processing.

### *2.2.2. Agro-processing within food systems*

Agro-processing plays a vital role within food systems, serving to enhance the efficiency, sustainability, and nutritional value of food products derived from agricultural activities. This process involves not only the transformation of raw agricultural materials into consumable products but also the associated management of resources, technological innovations, and socio-economic impacts that arise throughout the agro-food value chain. The integration of agro-processing within the broader framework of food systems requires a multidisciplinary approach, encompassing insights from areas such as economics, ecology, technology, and social sciences (Bilali, 2018).

One of the critical outcomes of agro-processing is the enhancement of food quality and safety, which is increasingly significant due to rising global food insecurity and nutritional challenges. Quality food production is essential for food security, as it directly affects consumer health and well-being. The proper management of agro-food systems must, therefore, focus on achieving quality assurance standards through effective processing techniques while considering the sustainability of natural resources (Bilali, 2018; Kadomtseva, 2022). Research indicates that the strategic incorporation of sustainable practices in agro-processing operations can significantly contribute to nutrition security, aligning with various Sustainable Development Goals (SDGs) (Bilali, 2018). A commitment to balancing efficiency with sustainability can help address the dual challenges of food quality and ecological integrity in an era of climate change and resource scarcity.

Inclusive stakeholder engagement is crucial for effective agro-processing strategies. This involves a collaborative approach that draws together farmers, processors, retailers, consumers, and policymakers. Decision-making must be informed by the diverse perspectives of these actors, as well as contemporary advancements in technological innovations that can drive efficiency and sustainability (Das Nair and Landani, 2020). For instance, improvements in bioenergy technology and waste management can lead to cost-effective and environmentally friendly processing solutions that benefit all parties involved in the agro-food supply chain (Chimphango and Görgens, 2015; Varchenko et al., 2017). Furthermore, the focus on digital transformation within agro-processing through the adoption of innovative digital technologies can enhance transparency and improve resource targeting in management processes (Dugina et al., 2023; Kolesnyak and Polyanskaya, 2024).

In addition to quality and stakeholder inclusivity, the management of agro-food systems must take into account the systemic aspects of agrarian and food technologies. The complexity of agro-processing necessitates a comprehensive understanding of its interconnected elements, ranging from production and distribution to consumption and waste (Kadomtseva, 2022). The interplay of these components reflects not only the complexity of food systems but also their dynamism in response to external challenges such as market fluctuations and regulatory requirements (Bilali, 2018; Shabalina and Kopteva, 2022). A systematic approach to agro-processing can therefore facilitate improved decision-making, allowing stakeholders to navigate the complexities of food production and distribution more effectively (Kadomtseva, 2022).

As agricultural sectors evolve, so too must the technologies employed in agro-processing. Innovations such as automation and artificial intelligence are transforming traditional practices, resulting in significant efficiency gains and enabling the development of flexible processing systems tailored to specific regional demands (Dugina et al., 2023). The impact of these technologies on the agro-food industry can be profound, facilitating rapid scalability and adaptability in response to changing market conditions and consumer preferences (Bryk, 2022). Moreover, the integration of sustainability into technological advancements ensures that agro-processing remains a viable option for resource management in the long term (Bilali, 2018; Dugina et al., 2023).

The socio-economic implications of agro-processing cannot be overlooked. Economic returns from enhanced processing capabilities can generate employment and improve livelihoods, particularly in rural areas (Shabalina and Kopteva, 2022). Infrastructure support is essential to facilitate the growth of agro-processing industries, enabling better access to resources, training, and markets, which may

further encourage small and medium-sized enterprises to invest in sustainable practices (Kovalenko and Ulez'ko, 2020). The promotion of cooperative models among producers can also foster greater collaboration and shared benefits, ensuring that economic gains are broadly distributed within communities.

Another crucial aspect of agro-processing is its relationship with environmental sustainability. As the agro-food sector grapples with the realities of climate change, there is an urgent need to implement environmentally friendly practices that minimise the ecological footprint of food production. This necessitates a transition to circular economies where waste is minimised and resources are efficiently recycled (Bilali, 2018; Shabalina and Kopteva, 2022). Strategies aimed at zero waste and resilience building must be prioritised within agro-processing frameworks to secure both ecological and economic sustainability (Bilali, 2018; Panfilov, 2020; Ksenofontov, 2025).

Moreover, understanding the cultural and regional specificities of agro-processing can help tailor interventions and technological innovations appropriately. Regional disparities in food production and processing capabilities challenge the standardisation of practices across diverse environments (Larionova and Nagiev, 2021). Both policy frameworks and technological solutions must, therefore, be designed to accommodate local conditions, preserving traditional knowledge while embracing modern advancements in processing technologies (Kolesnyak and Polyanskaya, 2024). Continued investment in research and development is paramount for innovating agro-processing technologies that enhance productivity while addressing pressing global issues. Collaborative research initiatives that bring together academia, industry, and government sectors can yield groundbreaking solutions that not only strengthen food systems but also contribute to resilience in times of environmental or economic stress (Bilali, 2018; Larionova and Nagiev, 2021).

The future of agro-processing within food systems is likely to be shaped significantly by the growing emphasis on digitalisation and data-driven management. The capacity to harness data in real time will allow stakeholders to make informed decisions regarding production, distribution, and consumption trends (OECD, 2021; Dugina et al., 2023). This integration of technology, combined with sustainable practices, positions the agro-food sector to respond proactively to evolving global challenges, ultimately enhancing food security and nutrition for all (Bilali, 2018; Zinina et al., 2023).

The integration of agro-processing within food systems is a multifaceted endeavour that demands a collaborative, interdisciplinary approach. It necessitates an acute awareness of the challenges and

opportunities presented by modern society, including technological advancements, environmental concerns, and socio-economic factors. The evolution of agro-processing technologies, supported by strong stakeholder engagement and sustainable practices, remains critical for fostering resilient, efficient food systems that serve current and future generations.

### **2.3. Agro-processing as a Strategy for Food Security**

#### *2.3.1. Role of agro-processing in improving food availability, access, and stability (Global, SSA, South Africa)*

Agro-processing has increasingly been recognised as a fundamental pillar in enhancing food availability, access, and stability across the globe, particularly in regions such as Sub-Saharan Africa (SSA) and South Africa. The intersection of agro-processing with economic development and food security provides a dynamic framework through which rural communities can navigate the dual challenges of poverty alleviation and hunger mitigation. Numerous studies underscore that effective agro-processing not only optimises the supply chain of food products but also promotes diversified income sources for farmers, mitigates post-harvest losses, and ultimately enhances food security (Clark and Hobbs, 2018; Khowa and Mukasi, 2021).

Studies indicate that agro-processing contributes substantially to farm income. Research conducted by Lin and Chang (2021) has demonstrated that farm households involved in agro-processing reported higher incomes compared to their non-agro-processing counterparts. This finding is supported by Mthombeni et al., who emphasise that agro-processing reduces food spoilage and waste, enhancing food security, especially in rural communities reliant on farming (Mthombeni et al., 2022). Additionally, the development of agro-processed products often leads to improved market access and price stability in the global market, essential for income security in agricultural communities.

The role of socio-economic factors in determining farmer participation in agro-processing cannot be overstated. Khoza et al. (2019) highlight the disparities in South Africa's agricultural landscape, noting that smallholder farmers, who predominantly belong to marginalised demographics, often lack access to formal markets (Khoza et al., 2019). This underaccess significantly limits their capacity to engage effectively in agro-processing, thus impairing their potential benefits. Enhanced access to agro-processing training and resources is essential to empower these smallholder farmers, enabling them to compete more effectively within the agricultural value chain. Another significant aspect of agro-processing is its potential for fostering sustainable local economic growth. As identified by Ominde et

al. (2022), agro-processing encompasses a diverse subsector that significantly supports food production and local economies through employment generation (Ominde et al., 2022). Moreover, the establishment of staple crops processing zones has been proposed as a strategic intervention to uplift local agricultural systems, promoting integrated food systems that bolster both processing and marketing practices (Vhumbunu, 2022). This approach enhances local farmers' engagement in broader markets while ensuring food access for local populations.

Furthermore, the engagement of agro-processors in production diversity has considerable implications for dietary diversity. In a study by Kissoly et al. (2018), a correlation was identified between increased farm production diversity and seasonal food consumption diversity, suggesting that fostering diverse production can mitigate food insecurity and enhance overall household nutrition (Kissoly et al., 2018). This idea is relevant not only in the context of SSA but across various global contexts, underscoring agro-processing's role in providing varied and stable food supplies.

In South Africa, local beneficiation policies, which are strategic interventions designed to process raw materials domestically to capture more value-added economic returns and create local jobs, are central to the government's strategy for addressing rural unemployment and advancing industrialisation within the agricultural sector (Habiyaemye and Mupela, 2019). However, the effectiveness of such policies often comes under scrutiny, particularly regarding their implementation and actual impact on rural economies. It is vital to adopt integrated approaches that reflect the complexities of the agro-processing landscape, recognising diverse market conditions and the capabilities of local producers.

The transition to modern agrifood systems has been catalysed by urbanisation, economic growth, and shifting consumer preferences. This shift is pivotal in shaping agrifood value chains that align with contemporary economic demands, as noted by Tefera et al. (2016). As agribusinesses adapt to these changes, the potential for agro-processing to serve as a stabilising force within food systems becomes increasingly apparent. The intersection of human and social capital, which is the value derived from social networks, shared norms, and trust among community members, in influencing agro-processing participation, is another critical consideration. Studies have shown that social networks and experience play pivotal roles in determining small-scale agripreneurs' involvement in agro-processing (Thindisa and Urban, 2018). Building social capital through enhanced community engagement, training, and support systems can significantly improve market access for smallholders, facilitating their growth within the agro-processing sector.

Sustainability within agro-food systems is increasingly emphasised through innovative practices tailored to local contexts. Bilali (2019) notes that sustainability transitions in the agro-food sector are vital for ensuring food availability, enhancing access, and improving overall stability. However, advancements must consider their ecological impacts, balancing productivity demands with environmental stewardship. Agro-financing initiatives play a crucial role in improving the resources necessary for effective agro-processing. Research indicates that increased access to financing positively impacts food production levels in countries like Nigeria, emphasising the importance of financial support for smallholder farmers to meaningfully participate in agro-processing (Osabohien et al., 2020). This financial empowerment is vital in nurturing the agro-processing ecosystem, allowing producers to invest in technologies and methods that enhance efficiency and product quality.

Considering the multifaceted benefits that agro-processing brings to food availability, access, and stability, it is apparent that strategic interventions are needed to foster its expansion, especially in developing regions. By focusing on local empowerment, economic diversification, sustainable practices, and enhanced market access, agro-processing can significantly contribute to achieving food security objectives amid the evolving global landscape.

### *2.3.2. Impact of Agro-Processing on Economic Empowerment, Gender Equality, and Rural Livelihoods*

Agro-processing serves as a pivotal mechanism for advancing economic empowerment, promoting gender equality, and strengthening rural livelihoods. In developing regions, where smallholder farmers dominate agricultural production, agro-processing offers a strategic pathway to diversify income, reduce vulnerability, and foster inclusive socio-economic growth. By enabling value addition to agricultural produce, agro-processing enhances farmers' profitability, supports employment creation, and contributes to sustainable rural transformation (Mmbengwa et al., 2018; Mmbengwa et al., 2020; Manasoe et al., 2020). While agro-processing strengthens economic empowerment and livelihoods, its contribution is also significant in addressing post-harvest inefficiencies that threaten food security.

### *2.3.3. Economic Empowerment through Value Addition and Market Integration*

One of the foremost benefits of agro-processing is its contribution to economic empowerment through income diversification and increased profitability. Lin and Chang (2021) demonstrated that households involved in agro-processing generally report higher incomes than those relying solely on raw agricultural production, owing to the value added through processing. Similarly, Ayompe et al. (2021) emphasise that smallholder farmers in developing contexts often receive lower economic

returns compared to commercial producers, highlighting the critical role of agro-processing in bridging this gap. Self-processing methods, which reduce outsourcing costs, have been found to yield greater profit retention, thereby promoting economic independence (Lin & Chang, 2021).

Crop diversification also plays a complementary role in strengthening economic resilience. Makate et al. (2016) observed that diversification expands market opportunities, stabilises income, and enhances smallholder adaptability to fluctuating market conditions. Through agro-processing, farmers can transform diversified outputs into products tailored for market demand, thereby maximising returns and improving economic stability. The establishment of cooperatives and agro-clusters further amplifies these benefits by pooling resources, fostering collaboration, and increasing market access (Tabe-Ojong and Dureti, 2022). These collective structures enhance farmers' bargaining power, reduce transaction costs, and create sustainable rural economies.

Integration into formal value chains further enables smallholders to access technology, training, and market information. Mmbengwa et al. (2020) highlight that such integration not only improves production techniques but also creates rural employment opportunities, alleviating poverty and driving community development. Similarly, Thindisa and Urban (2018) note that social and human capital, manifested through strong community networks and knowledge exchange, plays a crucial role in enabling farmers to participate effectively in agro-processing ventures. These networks facilitate collaboration, collective learning, and risk mitigation, reinforcing both individual and communal empowerment.

Despite its transformative potential, smallholder participation in agro-processing is often constrained by structural and infrastructural barriers, including limited access to inputs, finance, and technology (Eldridge et al. 2022; Mmbengwa et al., 2020). Addressing these limitations through targeted interventions, such as improved input supply systems, training, and credit schemes, can significantly enhance smallholder farmers' ability to benefit from agro-processing initiatives. Additionally, as Mekonnen and Kassa (2019) argue, agro-processing serves as an adaptation mechanism to climate variability by enabling farmers to convert perishable produce into durable goods, thereby ensuring income stability and reducing vulnerability to environmental shocks.

#### *2.3.4. Gender Equality and Women's Empowerment through Agro-Processing*

Agro-processing plays an instrumental role in promoting gender equality by expanding women's participation in economic activities, enhancing their decision-making power, and improving

household welfare. Women are central to agricultural production and often dominate small-scale processing and marketing activities. Bhusal et al. (2022) emphasise that when women are actively engaged in agro-processing, household incomes and food security improve markedly, and women gain greater economic autonomy.

Agro-processing creates opportunities for women to move beyond traditional subsistence roles by participating in higher-value segments of the agricultural value chain. In collective processing groups, women gain access to shared resources, technical training, and leadership opportunities that elevate their social and economic status (Thindisa & Urban, 2018; Mwangi et al., 2021). Evidence from rural South Africa and Ghana suggests that female participation in processing enterprises correlates with greater income control, improved livelihoods, and increased contributions to community development (Mmbengwa et al., 2019; Bhusal et al., 2022).

However, women's participation in agro-processing remains limited by gendered barriers such as unequal access to credit, technology, and land. Studies by Mthombeni et al. (2022) and Mohammed et al. (2023) reveal that women are underrepresented in formal agricultural training programs, restricting their ability to adopt modern technologies and enhance productivity. Addressing these disparities requires targeted gender-sensitive interventions, including capacity-building programs, microfinance access, and supportive policies that prioritise women's inclusion in agro-processing value chains. Furthermore, collective ownership models and women-led cooperatives can help redistribute economic opportunities more equitably, ensuring women are not marginalised within the agro-processing sector.

### *2.3.5. Rural Livelihoods, Food Security, and Sustainable Development*

Beyond economic and gender dimensions, agro-processing contributes significantly to improving rural livelihoods and food security. It reduces post-harvest losses, enhances the value of agricultural produce, and promotes stable food supply systems. Transforming raw commodities into marketable, long-lasting goods not only improves income but also supports household food security by ensuring consistent food availability and access (Khoza et al., 2019). The diversification of processed food products broadens dietary options and strengthens community resilience against food shortages.

Collective agro-processing models, such as cooperatives and rural clusters, also enhance community resilience by fostering social cohesion and promoting shared economic growth (Mwangi et al., 2021; Khowa and Mukasi, 2021). These models encourage peer learning, capacity development, and

resource pooling, key ingredients for sustainable rural transformation. Mmbengwa et al. (2019) argue that strengthening agricultural extension services and farmer education is vital to empowering rural communities with the skills and knowledge needed to manage processing activities efficiently.

Sustainability and environmental stewardship are also integral to the livelihoods dimension of agro-processing. Climate-smart and agroecological processing practices enable farmers to adapt to environmental changes while maintaining productivity (Mmbengwa et al., 2020; Naazie et al., 2023). Awazi et al. (2020) further assert that integrating sustainable technologies in processing can enhance resilience and reduce vulnerability to climate-related shocks through linking economic advancement with ecological sustainability, as agro-processing serves as a cornerstone for long-term rural development.

Innovative financing mechanisms complement these efforts by facilitating access to credit and investment capital for smallholder processors (Ravera et al., 2016; Khowa & Mukasi, 2021). Financial inclusion enables farmers to invest in modern equipment, expand operations, and increase productivity. Similarly, partnerships between smallholders and agro-industries promote mutual benefits; farmers supply raw materials while gaining technical assistance and assured market access (Mwangi et al., 2020). These collaborations strengthen local economies and embed smallholder farmers more deeply within national and global value chains.

### *2.3.6. Synthesis and Policy Implications*

The intersection of economic empowerment, gender equality, and rural livelihood improvement highlights the multifaceted potential of agro-processing in driving inclusive development. Empirical evidence underscores that agro-processing not only increases income but also enhances social cohesion, gender parity, and environmental sustainability. However, realising this potential requires an enabling environment supported by coherent policies, access to finance, and inclusive capacity-building frameworks (Njeshu et al., 2023). A comprehensive strategy that integrates agro-processing into rural development and gender equity policies is crucial. Such an approach would ensure equitable benefit distribution, strengthen local economies, and create resilient communities capable of adapting to changing socio-economic and climatic conditions.

Through targeted interventions that promote innovation, collaboration, and inclusivity, agro-processing can catalyse the transformation of rural livelihoods across South Africa and beyond.

### *2.3.7. Reducing post-harvest losses*

The significance of agro-processing for smallholder farmers in addressing rural post-harvest losses is a multifaceted issue that directly impacts food security, economic stability, and overall rural development. Agro-processing, defined as the transformation of raw agricultural products into consumable goods, plays a vital role in enhancing the income-generating capacity of smallholder farmers. This sector enables farmers to add value to their produce, thereby mitigating the drastic post-harvest losses that are often a consequence of inadequate storage, poor infrastructure, market access, and a lack of processing technologies (Suleiman and Rosentrater, 2015; Khowa and Mukasi, 2021).

High rates of post-harvest losses, which can reach up to 30-40% for various crops, particularly affect smallholder farmers in regions such as sub-Saharan Africa and South Asia due to inefficiencies in harvesting, handling, storage, and processing (Suleiman and Rosentrater, 2015). The phenomenon can be exacerbated by climatic conditions and pest infestations, leading to food waste and lowered income potential for these farmers. Implementing agro-processing technologies stands as a crucial approach for smallholder farmers to better manage their outputs, ultimately increasing the marketability and shelf life of their products (Chepwambok et al., 2021; Khandekar, 2021). Moreover, the introduction of post-harvest technologies can enhance the nutritional quality and market value of agricultural produce, thereby improving food security within rural communities (Ikegwu et al., 2022).

Agro-processing not only offers a means of economic empowerment for smallholder farmers but also contributes to rural employment. As highlighted in research from South Africa, smallholders' engagement in agro-processing industries is linked to enhanced rural employment opportunities and poverty alleviation (Habiyaemye and Mupela, 2019; Mmbengwa et al., 2020). The establishment of local agro-processing facilities fosters job creation within rural areas, thereby reducing the economic migration of labour to urban centres (Khowa and Mukasi, 2021). Furthermore, as farmers are grouped into cooperatives or agro-based groups, they gain access to shared resources and knowledge, which enhances their capacity to engage with more sophisticated processing technologies and broaden their market access (Khoza et al., 2019; Kabir et al., 2022).

Women have significant roles in agro-processing at the rural level, often serving crucial functions in food preparation, preservation, and marketing. Encouraging women's participation in agro-processing groups fosters a supportive environment for acquiring technological skills and knowledge on post-harvest practices, directly impacting their socio-economic standing (Awazi et al., 2020; Kabir et al.,

2022). Enhancing women's involvement in agro-processing can lead to substantial improvements in household income and food security, making them pivotal agents of change in rural development (Khoza et al., 2019).

The extent of infrastructure development, such as improved storage facilities and transport networks, cannot be understated. Research indicates that well-equipped rural infrastructure significantly reduces post-harvest losses by facilitating more effective transportation and storage of agricultural products (Hussain and Guha, 2023; Anyoha et al., 2023). The presence of adequate infrastructure ensures that produce can be taken to markets promptly and reduces the incidence of spoilage that often accompanies long transportation times or suboptimal storage conditions (Conteh et al., 2015). Therefore, investing in rural infrastructure is essential for the growth of the agro-processing sector and can provide the necessary framework for smallholder farmers to thrive (Khandekar, 2021; Budhathoki et al., 2022).

Moreover, smallholder farmers often lack access to information and technology regarding post-harvest handling practices. Education and training programs focused on agro-processing can greatly uplift these farmers by providing them with the skills necessary to minimise losses and enhance product quality (Ansah and Tetteh, 2016; Hengsdijk and Boer, 2017). Such programs, often facilitated by agricultural extension services, can also instill a better understanding of market demands and consumer preferences, allowing farmers to tailor their offerings and potentially participate in more profitable ventures (Silamat et al., 2024). This aligns with research advocating for a holistic approach to agricultural support, combining technical training with resource access and market linkages (Awazi et al., 2020).

Nevertheless, implementing agro-processing initiatives comes with its challenges. It requires significant investments, not only in terms of financial inputs but also in the cultivation of human capital and infrastructure development (West and Haug, 2017). The disparity between smallholder farmers and larger agricultural enterprises can manifest as a lack of access to capital necessary for investing in processing equipment (Khoza et al., 2019). Therefore, to bridge this gap, partnerships between government entities and private stakeholders are vital. Collaborative efforts can lead to the development of supportive policies that incentivise agro-processing investment among smallholders, subsequently enhancing the viability of rural economies (Habiyaremye and Mupela, 2019; Khowa and Mukasi, 2021).

Furthermore, agro-processing initiatives must be adaptable to local contexts and needs. Understanding

the specific challenges that smallholder farmers face in their respective regions is fundamental to designing effective interventions in agro-processing. For example, in regions where specific crops are predominant, targeted agro-processing technologies could be developed to cater specifically to the local agricultural landscape, ensuring maximum effectiveness in reducing post-harvest losses (Vishwakarma et al., 2019; Anyoha et al., 2023). By doing so, the agricultural community can promote greater resilience against market fluctuations and environmental challenges, thus securing the livelihoods of smallholder farmers.

Agro-processing represents a critical pathway for smallholder farmers to navigate the complex landscape of post-harvest losses. By harnessing the potential of this sector, smallholders can minimise losses, enhance food security, and uplift rural economies. Stakeholders must prioritise the integration of technology, education, infrastructure, and gender perspectives into agro-processing initiatives to drive holistic rural development and empower smallholder farmers effectively.

#### **2.4. Agro-processing and Smallholder Development Policy Context**

Strengthening agro-processing policies in South Africa requires locally grounded approaches that address the unique barriers faced by rural smallholders. Considering the challenges faced by smallholder farmers, such as restricted market access and susceptibility to climate change, policy frameworks like CAADP and RADP are formulated to offer focused assistance. These frameworks encompass initiatives for infrastructure development and climate-resilient agricultural practices, specifically aimed at addressing the barriers to participation in agro-processing.

##### *2.4.1. Global (e.g., FAO strategies)*

Globally, agro-processing is recognised as a driver of inclusive rural transformation, particularly through its ability to generate employment, reduce post-harvest losses, and increase smallholder incomes. The Food and Agriculture Organisation (FAO) advocates for agro-industrial development as a pathway to sustainable food systems, promoting value addition and market integration for smallholder farmers (FAO, 2021). These strategies support technological innovation, infrastructure development, and capacity-building to help smallholders transition from subsistence to commercial farming. The global policy landscape is further shaped by the UN Sustainable Development Goals (SDGs), with SDG 2 (Zero Hunger), SDG 8 (Decent Work), and SDG 9 (Industry and Innovation) all directly linked to the agro-processing sector. According to UNDP (2023), promoting agro-processing

aligns with broader goals of food security, rural livelihoods, and economic resilience. The Global Alliance for Food Security (GAFS) also highlights agro-processing as a mechanism to strengthen food value chains and reduce dependency on raw commodity exports.

#### *2.4.2. Sub-Saharan Africa (e.g., CAADP, African Union frameworks)*

In sub-Saharan Africa, the Comprehensive Africa Agriculture Development Programme (CAADP) prioritises agro-processing under Pillar II, which focuses on market access and value addition for smallholder farmers. The African Union (AU) Agenda 2063 calls for inclusive agro- agro-industrialisation to transform Africa's economies and reduce poverty (African Union, 2020). These frameworks promote the development of agro-processing zones, farmer cooperatives, and regional value chains that benefit rural producers. The global policy landscape is further shaped by the UN Sustainable Development Goals (SDGs), with SDG 2 (Zero Hunger), SDG 8 (Decent Work), and SDG 9 (Industry and Innovation) all directly linked to the agro-processing sector. According to UNDP (2023), promoting agro-processing aligns with broader goals of food security, rural livelihoods, and economic resilience. The Global Alliance for Food Security (GAFS) also highlights agro-processing as a mechanism to strengthen food value chains and reduce dependency on raw commodity exports.

#### *2.4.3. Saharan Africa (e.g., CAADP, African Union frameworks)*

In sub-Saharan Africa, the Comprehensive Africa Agriculture Development Programme (CAADP) prioritises agro-processing under Pillar II, which focuses on market access and value addition for smallholder farmers. The African Union (AU) Agenda 2063 calls for inclusive agro- agro-industrialisation to transform Africa's economies and reduce poverty (African Union, 2020). These frameworks promote the development of agro-processing zones, farmer cooperatives, and regional value chains that benefit rural producers.

The African Development Bank (AfDB) has also initiated programs like the Special Agro-Industrial Processing Zones (SAPZs) to support agribusiness growth and rural industrialisation. However, implementation challenges such as inadequate financing, weak rural infrastructure, and limited smallholder capacity often hinder progress (AfDB, 2021). Despite these setbacks, regional strategies emphasise agro-processing as a strategic intervention to enhance agricultural competitiveness and resilience.

#### *2.4.4. South Africa (e.g., NDP, APAP, RADP)*

In South Africa, agro-processing is prioritised as a catalyst for rural development and employment creation. The National Development Plan (NDP) 2030 highlights the role of agro-processing in transforming the rural economy by supporting smallholder farmers with infrastructure, credit, and technical training (National Planning Commission, 2012). The Agricultural Policy Action Plan (APAP) and the Revitalisation of the Agriculture and Agro-processing Value Chain (RAAVC) also outline sector-specific interventions to integrate smallholders into high-value markets (DAFF, 2017). Moreover, the Recapitalisation and Development Programme (RADP) was developed to address historical land imbalances and provide resources for previously disadvantaged farmers, including agro-processing equipment, extension support, and access to formal markets. However, fragmented implementation, limited coordination, and infrastructural deficits remain challenges (Mmbengwa et al., 2020; Manasoe et al., 2024).

Strengthening agro-processing policies in South Africa requires locally grounded approaches that address the unique barriers faced by rural smallholders. Considering the challenges faced by smallholder farmers, such as restricted market access and susceptibility to climate change, policy frameworks like CAADP and RADP are formulated to offer focused assistance. These frameworks encompass initiatives for infrastructure development and climate-resilient agricultural practices, specifically aimed at addressing the barriers to participation in agro-processing.

### **2.5. Agro-processing Activities among Smallholder Crop Farmers**

#### *2.5.1. Overview of Smallholder Crop Production Globally and Sub-Saharan Africa*

Smallholder crop production holds significant importance in the global agricultural landscape, particularly within Sub-Saharan Africa, where it represents a critical mechanism for food security and economic livelihood. Smallholder farmers, defined as those cultivating less than 10 hectares of land (often as little as 2 hectares), play a vital role in local food supplies, with estimates suggesting that they produce over 70% of the food consumed in the region (Reincke et al., 2018; Gumbi et al., 2023). However, these farmers face numerous challenges that adversely affect their productivity, income stability, and food security.

Crop production among smallholder farmers is shaped by a multitude of factors, including socio-economic conditions, access to resources, and environmental influences. The reliance on small-scale farming systems often results in low productivity due to the limited availability of inputs such as

fertilisers and improved seeds (Sibhatu and Qaim, 2017). Moreover, market access is frequently hindered by high transaction costs, market imperfections, and inadequate infrastructure, which further restrict smallholder farmers' ability to secure fair prices for their produce (Arouna, 2018). Agrarian policies, while aimed at improving production and securing livelihoods, can sometimes inadvertently favour larger agricultural enterprises, thereby excluding poorer smallholders from beneficial programs and resources essential for enhancing productivity (Srinatha et al., 2024).

Climate change exacerbates the vulnerabilities of smallholder farmers in Sub-Saharan Africa. With agriculture being predominantly rainfed, erratic weather patterns lead to unpredictable yields, significantly threatening food security (Dambeebo et al., 2022; Tantoh, 2023). Researchers have pointed out that the future yields of staple crops, particularly maize, are expected to decline due to changing precipitation patterns, underscoring the urgent need for adaptive strategies (Zuza et al., 2021). Sustainable agricultural practices (SAPs), including crop rotation, intercropping, and rainwater harvesting, have been recommended as pathways to bolster resilience against climate impacts, yet adoption remains low due to various socio-economic and cultural barriers (Myeni et al., 2019; Tantoh et al., 2022).

Investments in technology, including precision agriculture and the use of drones, hold promise for improving the efficiency of smallholder crop production (McCarthy et al., 2023). Drones can assist in data collection and improve on-farm decision-making, potentially enhancing productivity and reducing environmental impacts. However, the uptake of such technologies remains limited, with many smallholder farmers facing barriers such as low financial literacy, technical know-how, and access to training (McCarthy et al., 2023). Moreover, education on improved agricultural practices and nutrition is also crucial, as some studies indicate that smallholder farmers often lack awareness of the nutritional value of diverse crops, which can influence dietary choices and food security (Morales et al., 2021; Temesgen and Aweke, 2023).

Furthermore, the economic landscape of smallholder farming is heavily influenced by the nature of cash savings and access to financial systems. Research indicates that participation in savings programs can significantly enhance food security by providing the resources needed for investment in agriculture (Dinegde et al., 2022). Additionally, community-based initiatives, such as collective marketing approaches, have shown potential in empowering smallholder farmers by improving their bargaining position and market access, ultimately leading to enhanced food security outcomes (Arouna, 2018; Mwangi et al., 2020).

In summary, while smallholder crop production remains a cornerstone of food security in Sub-Saharan Africa, it faces multifaceted challenges that include climate variability, socio-economic constraints, limited access to markets, and inadequate adoption of technology. Addressing these challenges through targeted agricultural policy reforms, investment in sustainable practices, improved access to financial services, and education can create an enabling environment for smallholder farmers. Such efforts are imperative, as they not only bolster their productivity and resilience but also contribute significantly to alleviating food insecurity across the region.

In light of these considerations, it is evident that boosting smallholder crop production requires a multifaceted approach that encompasses social, economic, environmental, and technological dimensions. By ensuring that smallholder farmers receive the necessary support, resources, and knowledge, the agricultural sector can emerge as a powerful engine for sustainable development, capable of meeting the food needs of a growing population under changing climatic conditions.

#### *2.5.2. Common Agro-processing Activities: Global Trends, Sub-Saharan African Experiences, and the South African Context*

Agro-processing represents a vital segment of the agricultural sector, particularly in transforming raw agricultural products into consumable goods or intermediate products. It contributes significantly to economic growth, job creation, and food security across various regions, including Sub-Saharan Africa (SSA) and South Africa. This intricate nexus between agriculture and industry is paramount for enhancing the livelihoods of smallholder farmers, fostering local economies, and overall rural development (Mmbengwa et al., 2018; Chitonge, 2021).

The global trend in agro-processing exhibits an increasing integration of technology and innovation aimed at enhancing efficiency and sustainability. The focus has shifted towards incorporating advanced techniques that support not just productivity but also equitable value distribution through fair practices within agro-food chains. These practices are recognised as critical for empowering farmers and ensuring that benefits are equitably shared across the entire agricultural value chain, thus encouraging broader participation and investment in agro-processing sectors (Owoo and Lambon-Quayefio, 2017; Samoggia and Beyhan, 2022). Countries around the globe, including those in SSA, are learning from successful models and adapting them to their unique contexts.

In South Africa, the agro-processing sector is characterised by a dual structure wherein a limited

number of large commercial operations coexist with numerous smallholder farmers predominantly operating in the informal economy (Khoza et al., 2019). This dichotomy presents both challenges and opportunities. While smallholder farmers are often restricted to primary agriculture with limited access to processing facilities, there is substantial potential for integrating them into agro-processing activities to enhance their economic viability and overall social welfare. For instance, the Gauteng province has seen considerable interest from smallholder farmers in participating in agro-processing, which can be attributed to the increasing awareness of the economic benefits derived from processing their raw products (Mmbengwa et al., 2019).

Research indicates that smallholder farmers who possess greater experience in farming are more inclined to engage in agro-processing opportunities. This correlation may stem from their enhanced understanding of the financial and logistical benefits that agro-processing can yield, including reduced post-harvest losses. Notably, previous experiences with unprocessed crop failures often lead farmers to actively seek processing avenues that ensure better returns and decrease waste. This behaviour not only highlights the role of knowledge and experience in enhancing participation in agro-processing but also underscores the importance of training and education in the sector (Mthombeni et al., 2022).

The potential for agro-processing as a tool for poverty alleviation in South Africa, particularly in areas like the Raymond Mhlaba municipality, provides an interesting case study. Here, agro-processing initiatives have been linked to poverty reduction and local economic development, suggesting that well-structured agro-processing programs can foster economic independence among rural communities (Khowa and Mukasi, 2021). By leveraging local agricultural products, communities can establish cottage industries that resonate with the principles of sustainable development, creating employment opportunities while boosting local economies.

Challenges remain, however, in terms of providing adequate training and resources for smallholder farmers to engage fully in agro-processing ventures. Access to training programs that equip farmers with necessary business and technical skills is crucial for fostering participation (Mthombeni et al., 2022). Moreover, the establishment of financial intermediation plays a significant role in enhancing agro-industrialisation in SSA, facilitating investments and improving the connectivity between agricultural outputs and processing needs. Financial institutions are encouraged to create mechanisms that support the agro-processing industry, thereby linking agriculture with broader industrial growth (Enilolobo et al., 2024).

In the global context, the dynamics of agro-processing have shifted towards prioritising sustainability and environmental stewardship. The adoption of agro-technologies designed for climate-smart agriculture offers avenues for resilient production systems capable of withstanding climate extremes (Arenas-Calle et al., 2024). Such innovations, when integrated into SSA scenarios, can greatly enhance productivity and sustainability, addressing both food security and environmental concerns. For South African initiatives to mirror this approach, capturing the synergy between agro-processing and climate adaptation efforts becomes crucial.

Community participation is also vital for the success of agro-processing projects. Stakeholder engagements in the agricultural value chain can lead to enhanced collaboration among local communities, which is essential for implementing sustainable agro-technologies (Chassang et al., 2024). Emphasising the role of community-based agritourism that aligns with university social responsibility practices exemplifies how academic and local business collaborations can create multilayered benefits for rural communities while fostering a culture of sustainability.

As South Africa seeks to enhance its agro-processing industry, addressing the inherent challenges faced by smallholder farmers becomes imperative. This includes ensuring access to markets, financing, and training (Mmbengwa et al., 2019). Policies must advocate for equitable distribution of resources and opportunities that do not perpetuate existing inequalities within the agricultural landscape. Legislative measures that promote the integration of smallholder farmers into the agro-processing framework can be beneficial in creating a more balanced economic landscape.

Another notable aspect of agro-processing activities includes their impact on women and youth in agriculture. In many SSA countries, including South Africa, women constitute a significant portion of the agricultural workforce. Empowering women through targeted agro-processing initiatives can significantly enhance their economic agency and participation. Training programs tailored specifically for women and youth in agro-processing not only foster gender equity but also facilitate job creation, thereby addressing unemployment. To further strengthen the agro-processing sector, research and development should be prioritised. Innovations in agro-processing technology, waste management, and efficient resource use can pave the way for more sustainable practices that meet growing global food demands. Incorporating bioeconomy principles, which leverage biological resources sustainably, into agro-processing frameworks could unlock new opportunities for economic growth while ensuring environmental integrity.

Moreover, the establishment of networks among agro-processors can be a powerful tool for sharing knowledge, skills, and resources. These networks can facilitate peer learning, enabling smallholder farmers and processors to navigate the complexities of the agro-processing landscape more effectively (Mmbengwa et al., 2019). Government and non-governmental organisations should promote the formation of such networks, enhancing collaborative efforts towards achieving shared goals.

The intersection of global trends, regional experiences in SSA, and specific examples from South Africa illustrates the multifaceted nature of agro-processing. The potential to drive economic growth, improve food security, and uplift rural communities is substantial if there is a concerted effort from all stakeholders involved. By harnessing the strengths of local knowledge, integrating technological innovations, and fostering equitable partnerships, the agro-processing sector can significantly contribute to sustainable development in both South Africa and the broader SSA region.

## **2.6. Knowledge and Awareness of Agro-processing**

### *2.6.1 Global and SSA awareness levels of agro-processing*

Agro-processing holds significant potential for both economic development and food security in Sub-Saharan Africa (SSA). The awareness levels of agro-processing in this region are crucial to understanding its implications for rural income, job creation, and overall socio-economic transformation. In comparing global perspectives with those in SSA, it becomes evident that enhancing awareness around agro-processing strategies can foster sustainable agricultural practices and improve rural livelihoods.

The empirical evidence illustrates that participation in agro-processing correlates positively with increased farm income and diversification. For instance, Lin and Chang (2021) established that farm households engaged in agro-processing enjoyed higher incomes relative to those that were not involved in such activities. This affirms the traditional view that agro-processing can enhance the income potential of farmers, echoing findings from Habiyaremye and Mupela, who note that local beneficiation policies in their case study on Tzaneen, South Africa, have successfully improved rural income and employment through agro-processing initiatives (Habiyaremye and Mupela, 2019). Such outcomes underline the pivotal role of agro-processing as a catalyst for economic growth in rural areas. In terms of awareness levels, the study by Rohila et al. (2018) assessed awareness regarding essential agricultural and smart agricultural practices in Haryana, providing insights that can be echoed

in SSA about the need for increased awareness about agro-processing opportunities. Without this awareness, the potential benefits of agro-processing might remain untapped, indicating a pressing need for education and outreach initiatives. Financial intermediaries also play a vital role in enhancing awareness and facilitating the growth of agro-processing in SSA. Research by Enilolobo et al (2024) advocates for improved financial intermediation to bolster agricultural productivity, which directly supports the agro-industrial sector. By ensuring that farmers have access to necessary financial resources, awareness around agro-processing can translate into actionable practices, leading to greater investments in rural economies. This aligns with broader observations that more robust financial and agricultural frameworks can spur development by making agricultural products more viable for processing and market entry.

Moreover, the integration of renewable energy and innovative technologies could markedly elevate agro-processing activities within SSA. Mini-grids, for instance, have showcased promising prospects for electrifying rural farming communities, facilitating agro-processing endeavours (Pueyo et al., 2022). Given that energy access is often a limiting factor for agro-processing, raising awareness about these technological solutions can empower local farmers to adopt more efficient processing techniques, which ultimately leads to enhanced productivity and household incomes.

The connection between climate awareness and agricultural practices is also noteworthy. Although the study cited by Xie et al. (2022) focuses on agro-pastoralists in China, it highlights that awareness of climate change dynamics can correlate with farming experience, suggesting that educational interventions aimed at raising awareness could enhance adaptive practices among farmers. This is particularly significant when considering that awareness of agro-processing could similarly encourage sustainable practices that mitigate climate challenges.

Despite the evident benefits of agro-processing, barriers related to awareness and educational outreach persist. Many farmers, especially in rural and underprivileged areas, lack critical information regarding processing methods and local market demands. Efforts to establish centres for knowledge sharing that focus on agro-processing technologies and practices could help alleviate misinformation and enhance overall community knowledge. However, a relevant reference on this exact issue was not provided (Campenhout et al., 2020). By encouraging peer- to-peer learning and incorporating local success stories into these programs, a more profound understanding and wider acceptance can be fostered.

Nonetheless, the effects of socio-political environments on awareness levels must not be overlooked. Agro-processing in SSA often intertwines with policy support and initiatives from local governments and international organisations, as evidenced by the push towards local beneficiation and structural transformations in economies (Habiyaemye and Mupela, 2019). This suggests that raising awareness is not merely an educational endeavour, but one that requires strategic policy frameworks to create supportive ecosystems for agro-processing endeavours.

Moreover, as the competitive landscape shifts owing to globalisation and the demands of international markets, rural stakeholders must remain informed about trends impacting agro-processing. Effective communication strategies, targeting both farming communities and policymakers, can bridge the awareness gap. Continuous dialogue and workshops focused on the needs and challenges of agro-processors can strengthen the sector's resilience and adaptability (Amah and Oshi, 2023).

The awareness levels of agro-processing across Sub-Saharan Africa and globally indicate a critical pathway for developing sustainable agricultural systems, improving rural livelihoods, and achieving food security. While there have been notable strides in recognising the value of agro-processing, persistent barriers to awareness and educational outreach necessitate focused efforts from various stakeholders, including governments, NGOs, and the private sector. By fostering a comprehensive understanding of agro-processing, we can empower rural communities and contribute to socio-economic advancement that stands resilient against global agricultural challenges.

#### *2.6.2. Education and exposure factors to agro-processing*

The interplay of education and exposure is crucial in determining the effectiveness and participation rates of agro-processing initiatives, particularly among smallholder farmers and women in various regions, including South Africa and Ghana. Various studies have shown that educational attainment plays a significant role in enhancing participation in agro-processing activities. Mthombeni et al. argue that limited access to appropriate agro-processing training for small-scale crop farmers predominantly restricts their ability to adopt advanced technologies and modern practices (Mthombeni et al., 2022).

This restrictiveness is compounded by the underrepresentation of women in agricultural training programs, as other researchers have found that practical training is often favoured over theoretical learning, further marginalising female participation (Mthombeni et al., 2022; Mohammed et al., 2023).

The relationship between education and agro-processing participation is multifaceted. Thindisa and Urban (2018) quantify that a third of surveyed agripreneurs possess only a certificate or diploma, underscoring the potential benefits of higher education levels alongside agro-processing training. Evidence suggests that access to educational resources significantly boosts individuals' capacity to recognise and exploit agro-processing opportunities, enhancing their operational efficiencies and ultimately increasing their farm income (Lin & Chang, 2021). For instance, in Taiwan, Lin and Chang (2021) demonstrate that farm households involved in agro-processing boast higher incomes than those who do not participate, putting a premium on education as a catalyst for diversification and improved incomes in agriculture.

Moreover, specific socio-economic factors significantly influence the decision to engage in agro-processing, as highlighted in a study that showcases the interplay of educational levels, land tenure, and specialised training in fostering participation among farmers in South Africa (Khoza et al., 2019). The study employs a double-hurdle model to reveal that merely 19% of smallholder farmers engaged in the agro-processing sector, reflecting the urgent need for educational initiatives and outreach programs to enhance overall participation (Khoza et al., 2019). This suggests that investing in comprehensive training programs could facilitate improved access to information and resources, leading to higher engagement in agro-processing.

Furthermore, the gender dynamics within agro-processing emphasise education as a pivotal factor for women's empowerment in rural settings. In the context of Ghana, Mabe found that women's participation in small-scale agro-processing is heavily influenced by access to education and formal training opportunities, as well as their social networks (Mmbengwa et al., 2019). Group participation, the influence of family members, and prior exposure to agro-processing practices are critical predictors of success (Mmbengwa et al., 2019). The research shows that when women are equipped with formal education and training tailored to agro-processing, they exhibit enhanced capabilities to improve their economic standing and community involvement (Mmbengwa et al., 2019; Mohammed et al., 2023).

Access to capital and market information also surfaces as vital components for successful agro-processing. As Mohammed et al. (2023) observed, the availability of financial services, such as loans specifically for women agro-processors, plays a crucial role in their operational capacity, enabling them to invest in training and resource acquisition to deepen their market penetration. This aligns with

broader studies indicating that conducive financial environments can encourage entrepreneurial pursuits among marginalised groups, including women involved in agriculture (Khoza et al., 2019; Mohammed et al., 2023).

Additionally, the cultural context surrounding education also impacts agro-processing participation. Nyame and Caesar (2022) highlight that intrinsic factors such as societal perceptions and norms can significantly affect decisions regarding agro-processing firm siting, reiterating the importance of cultural considerations alongside economic factors (Mabe, 2022). Therefore, enhancing education and entrepreneurial training must also consider cultural frameworks to foster widespread acceptance and greater participation in agro-processing.

Moreover, fostering agribusiness careers can attract rural and urban youth when they perceive profitability and practicality in agro-processing ventures (Nyame & Caesar, 2022). This notion not only speaks to the role of education in preparing young people for careers in agro-processing but also emphasises the need for innovative training programs that blend theoretical knowledge with real-world applications to stimulate interest and participation (Nyame & Caesar, 2022). Such strategies enhance understanding and interest in agro-processing, offering pathways for increased community engagement in agribusiness.

Education serves as a foundational pillar in the success and participation of individuals, particularly smallholder farmers and women, in agro-processing initiatives. The interdependencies between education, socio-economic factors, gender dynamics, and cultural contexts must be recognised and strategically enhanced to develop robust agro-processing sectors capable of driving economic growth and alleviating poverty in rural communities. As demonstrated, addressing educational gaps, providing targeted training, and designing supportive financial frameworks are essential steps for achieving higher rates of participation in agro-processing across various demographics.

## **2.7. Perceived Benefits and Barriers of agro-processing**

The perceived benefits and barriers of agro-processing in agriculture represent a complex landscape that significantly influences smallholder farmers' engagement and overall productivity. The benefits are multifaceted, ranging from economic and financial gains to social empowerment, particularly among marginalised groups such as women. Conversely, various barriers hinder broad participation, including a lack of training, inadequate infrastructure, and socio-economic conditions that discourage involvement.

One major benefit of agro-processing is its positive impact on farm income. Studies have shown that households engaging in agro-processing typically report higher incomes compared to those not participating. For instance, in Taiwan, farms adopting agro-processing methods experienced enhanced economic performance, corroborated by findings from Lin and Chang (2021) that indicated farm households participating in agro-processing had higher incomes compared to non-participants (Lin and Chang, 2021). This increased income stems from the ability to add value to raw agricultural products, thereby enhancing profitability and enabling farmers to invest further in their operations. In addition to economic benefits, agro-processing plays an essential role in enhancing women's empowerment, particularly in regions like the OTI region in Ghana. The work of Mabe underscores the significance of women-led agro-processing initiatives in fostering economic independence and access to resources such as land and livestock (Mabe, 2022). Empowering women through agro-processing is not just an economic strategy but a vital element in promoting gender equity and sustainable community development.

Moreover, agro-processing aligns with local beneficiation policies aimed at improving rural economies. In South Africa, local beneficiation strategies prioritise agro-processing due to its potential for job creation and economic revitalisation in rural areas suffering from high unemployment rates. Habiyaemye and Mupela (2019) discuss how agro-processing is central to South Africa's strategy for employment-intensive re-industrialisation. The employment opportunities created through agro-processing not only alleviate poverty but also enhance the overall quality of life in rural communities.

Despite these potential benefits, barriers to participation in agro-processing remain significant. A study conducted by Khoza et al. (2019) revealed that only a small fraction of smallholder farmers in Gauteng, South Africa, engage in agro-processing due to factors such as limited access to training and resources, insufficient educational qualifications, and ineffective land tenure systems. The findings emphasise the importance of targeted interventions to increase access to training and resources that could empower farmers to capitalise on the opportunities presented by agro-processing. Data on barriers also highlights the socio-economic context in which these farmers operate. Non-tariff barriers, particularly in cross-border trade, impede the capacity of small and medium-sized enterprises to thrive. The research by George (2021) indicates that addressing these barriers could unlock significant economic potential for agro-enterprises. Ensuring that agro-processing entrepreneurs navigate these challenges is vital for their sustainability and growth.

Infrastructure constraints also present formidable barriers to the effective engagement of farmers in agro-processing. Lack of access to reliable energy sources and sufficient transportation networks diminishes the ability of smallholder farmers to process and market their products effectively. As highlighted by various studies, addressing infrastructure deficits is imperative for transforming agro-processing into a viable income-generating activity (Ibitoye et al., 2021). Collaboration between stakeholders, government, industry, and academic institutions can be beneficial in fostering innovation and improving infrastructure. Furthermore, the socio-psychological dimensions of participation in agro-processing cannot be understated. The perceptions of risk and fear of investment in agro-processing ventures can deter farmers from engaging in these activities. Research indicates that fostering a supportive environment, which includes access to cooperative structures for shared risk management, can enhance participation rates among farmers (Jin et al., 2020). Trust among cooperative members also plays a critical role in stimulating involvement.

Training is particularly crucial as it serves to bridge the knowledge gap that many smallholder farmers face. Mthombeni et al. (2022) conclude that access to agro-processing training equips farmers with essential skills, enabling them to harness the benefits of processing and marketing. Creating robust training programs tailored to local contexts while ensuring inclusiveness for marginalised groups may significantly enhance participation rates and economic outcomes.

Economic disparities further exacerbate barriers to participation in agro-processing. For example, land tenure security and ownership significantly influence farmers' willingness to invest in processing capabilities. Areas with clear land rights may see greater engagement in agro-processing as farmers feel more secure in their investments (Mabe, 2022). Conversely, insecure land rights act as a disincentive, reflecting an essential aspect of agricultural policy reform needed to support agro-processing.

The perceived benefits of agro-processing encompass enhancements in income generation, women's empowerment, and contributions to local economic development. However, barriers, including lack of access to training, infrastructural challenges, socio-economic constraints, and psychological factors, remain prominent obstacles that must be navigated. Addressing these barriers through cooperative engagement, policy reform, and targeted training initiatives can pave the way for a more inclusive agricultural sector that leverages the potential of agro-processing.

## **2.8. The Role of Training and Capacity Building for Agro-Processing in South Africa**

Training and capacity building are pivotal for enhancing agro-processing in South Africa. The country's agro-processing sector is essential for economic growth and job creation, particularly among small-scale farmers. Smallholder farmers face several barriers to entry into the agro-processing industry, including limited access to technology, inadequate training, and insufficient participation in value chains. Addressing these gaps through targeted training and capacity-building initiatives can significantly empower these farmers, allowing them to improve their productivity and economic standing.

Agro-processing is crucial for the development of sustainable livelihoods in rural and peri-urban areas in South Africa. Political frameworks increasingly recognise the role of small-scale agro-processors in contributing to household income and food security, underscoring their importance in national development agendas (Manasoe et al., 2021). Indeed, small-scale agro-processing is not just about adding value to agricultural products; it's about integrating these farmers into broader global value chains, thereby enhancing their economic participation and resilience (Manasoe et al., 2021). The lack of participation of smallholder farmers in the commercial agro-processing sector indicates a systemic gap that requires deliberate intervention (Khoza et al., 2019).

Training specifically tailored for smallholder farmers is crucial in overcoming these barriers. Evidence suggests that many farmers struggle with limited technical skills, which inhibits their ability to exploit the potential benefits of agro-processing (Mthombeni et al., 2022). The findings suggest that current training programs frequently operate on demonstration plots, focusing more on practical applications than on providing comprehensive theoretical education (Mthombeni et al., 2022). This lack of a well-rounded training approach can be particularly evident among women, who remain underrepresented in agronomic and related training programs. Gender-sensitive initiatives need to be integrated into training frameworks to ensure equitable access and empowerment for all participants (Mthombeni et al., 2022; Manasoe et al., 2022). In addition to enhancing individual skills, there is a pressing need for wider awareness among farmers regarding the importance of agro-processing and the available resources for capacity building. Many smallholders remain unaware of the benefits and opportunities offered through agro-processing, resulting in under-participation. Increasing awareness through community engagement and tailored educational programs can significantly boost participation rates (Mmbengwa et al., 2020). Moreover, building networks and partnerships among farmers can facilitate

better access to resources, information, and technology critical for boosting their agro-processing capabilities (Manasoe et al., 2021; Bowman and Robb, 2025).

South Africa's local beneficiation policy emphasises the need for industrial growth in rural areas, aiming to address high unemployment and stimulate local economies (Habiyaemye and Mupela, 2019). Agro-processing has been identified as a priority area within this policy framework due to its capacity for both job creation and income generation. This strategic focus illustrates the importance of aligning training and capacity-building efforts with national policy objectives, ensuring that the skills developed will be directly applicable and beneficial in fostering economic development. The socio-economic context in which smallholder farmers operate cannot be ignored. Many of these farmers work under extreme conditions and face various economic pressures that affect their ability to invest in agro-processing training (Khoza et al., 2019). Consequently, capacity-building strategies must also address these socio-economic barriers, providing support mechanisms such as financial assistance, access to markets, and community-based training models that enhance the farmers' ability to participate in agro-processing (Rogerson and Nel, 2016).

Community-based training initiatives emerge as effective models for fostering skills development and personal empowerment among smallholder farmers. These initiatives can be structured to provide ongoing support and foster networks that facilitate knowledge sharing and collective problem-solving (Mmbengwa et al., 2020). Studies indicate that peer-to-peer learning and community engagement create sustainable pathways for building agricultural capacity by leveraging local knowledge and resources (Stewart et al., 2018). Technological innovation is another critical aspect of enhancing the agro-processing capabilities of smallholder farmers in South Africa. Access to modern processing technologies can drastically reduce post-harvest losses and enhance product quality, thus increasing market value (Mthombeni et al., 2021). Training programs need to encompass not just basic processing techniques but also advanced technological applications that can facilitate better resource management and product development (Mthombeni et al., 2021; Mthombeni et al., 2022). A focus on innovation and adaptation is fundamental in preparing these farmers for the evolving demands of the agro-processing industry.

Moreover, governance structures that support and incentivise capacity building are paramount. The integration of agro-processing capacity-building initiatives into local economic development policies can ensure that resources are allocated efficiently and that programs align with community needs and

aspirations (Rogerson and Nel, 2016). This requires a collaborative approach among government, educational institutions, non-governmental organisations, and the farmers themselves to create an ecosystem that facilitates effective learning and growth in the sector (Stewart et al., 2018; Tandoh et al., 2022).

Women's economic empowerment remains a critical area within agro-processing, reflecting broader socio-economic disparities in South Africa. Specialised training for female agro-processors can enhance their skills, enabling them to take leadership roles within agro-processing networks, thus promoting gender equity in economic participation (Manasoe et al., 2022). This empowerment can foster a more balanced representation in agro-processing, enabling women not only to participate in training initiatives but also to drive innovation within their communities.

It is essential to structure training and capacity-building initiatives to be adaptive and responsive to the dynamic challenges that smallholder farmers face due to climate variability and other stressors. Drought and changing climatic conditions intensify the risks associated with agro-processing, underscoring the need for resilient practices and sustainable techniques within these training programs (Katiyatiya et al., 2022). Strategies focused on building resilience through knowledge of adaptive agricultural practices can be implemented alongside agro-processing training for a more comprehensive approach to capacity building.

Moreover, the collaborative nature of agro-processing means that fostering relationships not only among farmers but also with other stakeholders, including local businesses and government agencies, is crucial. Strong networks can facilitate access to markets and broader value chains, enhancing the viability of smallholder agro-processors within the economy (Habiyaremye and Mupela, 2019; Manasoe et al., 2021). This interconnectedness can also aid in sharing the best practices and fostering innovative solutions to common challenges.

To further facilitate the role of small-scale farmers in the agro-processing sector, evidence-based policy frameworks need to be established that focus on capacity-building priorities. Such policies should consider the diverse needs of farmers across various agro-ecological zones and socio-economic backgrounds (Stewart et al., 2018). By grounding training initiatives in empirical research, policymakers can ensure that programs are relevant and effective in addressing the unique challenges faced by the agricultural sector. Lastly, reinforcing the importance of agro-processing literacy as a fundamental competency among smallholder farmers cannot be overstated. Training programs should

include components that educate farmers about market trends and consumer preferences, thereby enhancing their ability to innovate and adapt their offerings to meet demand effectively (Mabhaudhi et al., 2017).

This education can empower farmers to not only participate in agro-processing but also position themselves as competitive players in domestic and international markets, which is integral to enhancing the agro-processing sector in South Africa. By holistically addressing the barriers faced by smallholder farmers through tailored education, resource availability, and supportive policies, the potential of agro-processing can be maximised. These initiatives can lead to sustainable economic growth, improved livelihoods, and greater food security across the nation, reinforcing the critical role that agro-processing plays in South Africa's socio-economic landscape.

## **2.9. Factors Influencing Smallholder Participation in Agro-processing in South Africa**

The participation of smallholder farmers in agro-processing within South Africa is influenced by a myriad of interconnected factors, which can broadly be categorised into human capital, social capital, economic resources, environmental conditions, and institutional support. Understanding these factors is essential for promoting increased participation among smallholders in the value chain of agro-processing, thereby enhancing their livelihoods and contributing to wider economic development in rural areas. Human capital is a critical determinant of smallholder participation in agro-processing. Experience, education, and training play significant roles in farmers' decision-making processes. Mthombeni et al. (2022) highlight that farmers with extensive farming experience are more likely to engage in agro-processing activities since they are better equipped to comprehend the benefits and requirements of such ventures. Furthermore, Khoza et al. (2019) assert that training opportunities are crucial as they empower smallholders with the necessary skills to enhance their participation in the agro-processing industry, underscoring that inadequate training can lead to limited engagement. This assertion is also supported by Mmbengwa et al. (2019), who state that knowledge gained through training not only facilitates participation but also enhances productivity and competitiveness in the agro-processing sector. In addition to human capital, social capital significantly influences smallholder farmers' participation in agro-processing.

According to Thindisa and Urban (2018), relationships and networks among farmers can facilitate access to resources and information that are vital for participating in agro-processing. These social networks often provide smallholders with the collective bargaining power needed to negotiate better

prices for their products or to access markets more efficiently. Furthermore, the study conducted by Matlou et al. (2021) illustrates that social capital, in tandem with economic resources, directly contributes to the welfare of smallholder farmers, reinforcing the idea that social networks can serve as a critical support system for those involved in agro-processing.

Economic resources are another pivotal aspect affecting participation. Smallholder farmers with sufficient financial capital are more likely to invest in agro-processing activities. Mmbengwa et al. (2020) express that limited economic resources restrict smallholders' ability to engage in agro-processing due to high initial investment costs. This aligns with Khoza et al. (2019), who emphasise that access to credit is essential for farmers to cover the upfront costs of equipment and infrastructure necessary for processing their products. Furthermore, smallholders in financially stressed conditions are less likely to engage in agro-processing due to the associated risks, thus perpetuating a cycle of poverty and low participation rates (Mmbengwa et al., 2020).

Environmental factors, particularly access to land and water resources, are integral to a smallholder's ability to engage in agro-processing. The scarcity of arable land and water has been identified as a significant barrier to enhancing agricultural productivity and subsequently agro-processing participation (Thindisa and Urban, 2018; Tantoh, 2023). Mthombeni et al. (2022) also note that smallholder farmers often grapple with less-than-ideal agro-ecological conditions, limiting both their production capabilities and their ability to engage in value-adding activities such as processing. Additionally, climate change presents further challenges, as highlighted by Tantoh, who points out that adverse climatic conditions exacerbate vulnerabilities for smallholders in terms of both production and market access (Tantoh, 2023).

Institutional support plays a pivotal role in facilitating smallholder participation in agro-processing. Effective policy frameworks that promote access to training, market information, and credit are essential for empowering smallholders. Mmbengwa et al. (2019) advocate for the implementation of tailored extension services that not only provide agricultural training but also support the establishment of cooperatives among smallholders to enhance collective bargaining power. Furthermore, Khoza et al. (2019) argue that the available support structures must be systematically designed to foster an environment conducive to smallholder engagement in agro-processing, indicating that the lack of supportive institutions can impede participation. Moreover, the study by Mwangi et al (2018) highlights how contract farming arrangements can significantly improve market access for smallholder farmers, serving as a vital link between production and processing units (Thindisa & Urban, 2018).

By aligning farmers with larger agro-industrial entities, such arrangements can mitigate transaction costs and enhance overall participation in the agro-processing value chain.

Another noteworthy aspect is the psychological and attitudinal barriers faced by smallholder farmers. The motivations and perceptions of farmers towards agro-processing are crucial in influencing their engagement. As observed by Matlou et al. (2021), the positive expectation of returns on investment can motivate farmers toward exploring agro-processing as a viable pathway to enhance their livelihoods. Conversely, the fear of failure or perceived complexities associated with transitioning into agro-processing can inhibit their willingness to engage in such activities (Khoza et al., 2019). In light of these considerations, increasing smallholder participation in agro-processing requires a multifaceted approach that not only addresses individual knowledge and skills gaps but also circumvents economic, environmental, and institutional barriers. The interplay between these factors suggests that interventions must be holistic, promoting not only direct participation in agro-processing but also enhancing the overall resilience and productivity of smallholder farmers.

#### **2.10. Barriers and Constraints to Participation in Agro-Processing in South Africa**

Participation in agro-processing remains crucial for enhancing the livelihoods of smallholder farmers in South Africa. Nevertheless, several barriers and constraints hinder their active engagement in agro-processing, with implications that warrant comprehensive analysis. Factors such as limited access to knowledge and training, insufficient financial resources, and socio-economic constraints largely determine the capacity of these farmers to thrive within agro-processing activities. One prominent barrier to participation is the lack of technical knowledge and training opportunities available to smallholder farmers. Mthombeni et al. (2022) highlight that a significant number of small and medium-scale agro-processors fail to keep abreast of technological advancements due to restricted access to relevant training programs. This deficit in training is exacerbated by the limited capacity and outreach of advisory services that could assist small farmers in acquiring the necessary skills and competencies (Mthombeni et al., 2022). Specifically, fewer women engage in theoretical agronomic training, which affects their participation rates and subsequent success in agro-processing ventures (Mmbengwa et al., 2019).

Moreover, the socio-economic status of smallholder farmers significantly influences their decision-making regarding participation in agro-processing. According to Khoza et al. (2019), smallholder farmers often experience marginalisation, making it difficult for them to process their farm produce

and access commercial agro-processing value chains. This marginalisation emerges from various socio-economic factors, including poverty, lack of access to capital, and inadequate support from local governments and agricultural policies. The limited economic empowerment opportunities reveal systemic barriers that require government interventions to facilitate more equitable participation in agro-processing industries.

Access to financial resources also poses a considerable constraint on smallholder participation in agro-processing. In many instances, small-scale agro-processors struggle to obtain the necessary financial support to invest in equipment, technology, and scalable operations, which are pivotal for enhancing productivity (Manasoe et al., 2021). The presence of transaction costs, as emphasised in the study by Thindisa and Urban (2018), adds to these financial hurdles, as costs associated with market access, storage, and infrastructure further constrain the participation of small-scale farmers in the agro-processing sector. Consequently, the absence of competitive pricing models and inadequate market access perpetuates a cycle of underperformance for these farmers within the agro-processing value chain.

In addition to these barriers, governance and institutional support deficiencies play a significant role in limiting smallholder farmer engagement in agro-processing. Hall and Cousins (2017) underscore how corporate dominance in agrarian change restricts smallholders' ability to compete within the agro-food systems. This structural inequality is particularly pronounced in the South African context, where large-scale commercial farming has consolidated financial advantages, thereby marginalising smallholder farmers even further (Greenberg, 2017). Without adequate policy frameworks that cater to the specific needs of small-scale agricultural businesses, these farmers remain at a disadvantage.

Moreover, the development of networks and collaboration among small-scale agro-processors could enhance their ability to overcome these barriers. Preliminary evidence suggests that forming networks can help smallholders improve their internal resources, access valuable information, and establish marketplaces that provide more equitable trading opportunities (Manasoe et al., 2021). Mmbengwa et al. noted that fostering such collaborations and providing extension services could significantly enhance smallholder farmers' capacity to participate in agro-processing (Mmbengwa et al., 2019; Mmbengwa et al., 2020). Furthermore, cultural and gender norms may also serve as potential barriers to agro-processing participation, particularly concerning women's involvement. Gender disparities in agricultural participation remain significant, as studies indicate that women are often excluded from key decision-making processes in agro-processing activities, which impacts their development

and economic empowerment (Manasoe et al., 2022). To address these disparities, more tailored support and inclusive policies are essential to ensure that women have equal opportunities to engage in agro-processing.

Beyond these constraints, environmental factors are also critical, particularly as climate change impacts agricultural productivity in South Africa. Mmbengwa et al. (2019) report that unpredictable climate conditions pose additional challenges, leading to fluctuations in crop yields and, consequently, diminishing the scope of agro-processing that can be undertaken by smallholders (Munzhelele et al., 2016). This illustrates the multifaceted barriers that must be addressed concurrently to promote greater participation in agro-processing within the sector. The broader systemic issues, including logistical challenges and inadequate infrastructural development, present further obstacles for smallholder farmers looking to engage in agro-processing efforts. Ahmad (2020) emphasises the importance of well-developed supply chains and infrastructure in facilitating the growth of the agro-processing sector. Without significant investments in infrastructure to support smallholder agro-processors, the potential for rural economic development through agro-processing will remain unrealised.

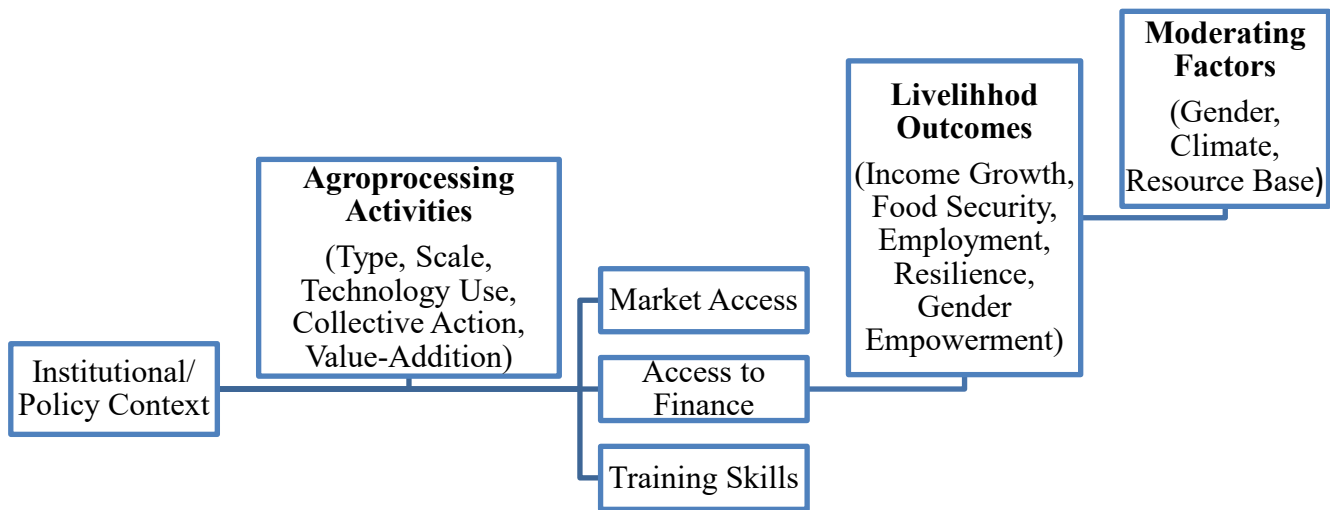
Lastly, the implications of global value chains must also be acknowledged. As Banga and Balchin (2019) note, linking smallholder farmers to global value chains can offer more substantial economic opportunities, yet access remains prohibitive without addressing underlying barriers. Hence, the promotion of an inclusive agro-processing environment requires a nuanced understanding of these barriers while also proposing multifaceted interventions that can empower smallholder farmers to participate actively.

While agro-processing serves as a viable avenue for enhancing the capacities and livelihoods of smallholder farmers in South Africa, significant barriers hinder their participation. Addressing these constraints through comprehensive policy interventions, tailored training programs, gender-sensitive approaches, and infrastructural investments will be crucial for facilitating greater involvement in the agro-processing value chain and enhancing the overall resilience of the agricultural sector. To encapsulate, exploring factors influencing smallholder participation in agro-processing in South Africa reveals a complex tapestry of interrelated elements. Human and social capital are paramount for empowering farmers, while economic resources and environmental factors create the necessary conditions for participation. Moreover, effective institutional support and favourable attitudes towards agro-processing significantly shape the engagement of smallholders in this critical sector. Addressing these multifaceted challenges will enhance participation rates and contribute to broader socio-

economic development goals in rural South Africa.

## 2.11. Conceptual Framework

This study’s conceptual framework links agro-processing activities (independent variables: type/scale of processing, technology use, collective action) to livelihood outcomes (dependent variables: household income, food security, employment, resilience), with mediating factors such as market access, access to finance, and training/extension services, and moderators such as gender, land access, and climate vulnerability. Policy and institutional context (e.g., local beneficiation policies, certification requirements) are treated as structural influences that shape both enabling conditions and constraints. The conceptual framework clarifies causal pathways tested in the study and identifies observable indicators for each construct (e.g., income change, post-harvest loss reduction, participation in cooperatives).



**Figure 2.1:** Conceptual framework linking agro-processing activities, mediating factors (market access, finance, training), and livelihood outcomes, moderated by gender and climate within the broader institutional context.

## 2.12. Theoretical Frameworks

### 2.12.1. Theoretical framework: Sustainable Livelihoods Framework (SLF)

The Sustainable Livelihoods Framework (SLF) provides a holistic lens to examine how agro-

processing affects rural households' assets and outcomes. Originating in the Institute of Development Studies (IDS) and the Department for International Development (DFID) livelihoods literature, the SLF emphasises five asset capitals, human, social, natural, physical, and financial, as the core resources households draw upon to construct livelihood strategies within a given vulnerability context (e.g., climate variability, market shocks). Transforming structures and processes (institutions, policies, markets, norms) condition access to assets and determine the feasibility of different livelihood strategies; the framework then links strategies to outcomes such as income, food security, and resilience (Goldman et al., 2000; Singh et al., 2024).

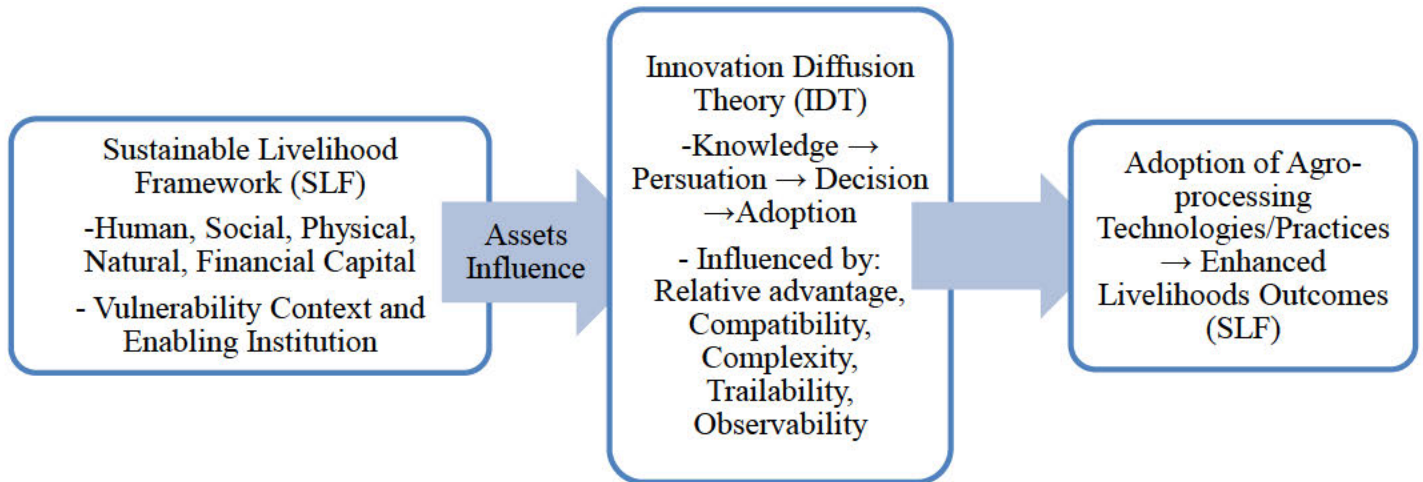
In this study, agro-processing is conceptualised as a livelihood strategy and a mechanism that interacts with household assets (e.g., processing skills = human capital; cooperatives = social capital; equipment = physical capital). The SLF helps explain how asset enhancements (through training, finance, improved infrastructure) and enabling institutions (policies supporting beneficiation) translate into improved livelihood outcomes for smallholder households engaged in agro-processing. Empirical South African studies (e.g., studies identifying capacity building and business networks as key to small-scale agro-processor empowerment) provide contextual support for employing SLF in this research (Mmbengwa et al., 2020).

### *2.12.2. Theoretical framework: Innovation Diffusion Theory (IDT)*

The Innovation Diffusion Theory (IDT) explains how, why and at what rate new ideas and technologies spread within social systems. Key concepts include the innovation-decision process (knowledge → persuasion → decision → implementation → confirmation), adopter categories (innovators → early adopters → early majority → late majority → laggards), and perceived attributes of innovations that influence adoption (relative advantage, compatibility, complexity, trialability, observability) (Miller, 2015). IDT has strong precedents in agricultural extension and technology adoption studies and is useful for analysing the uptake of agro-processing technologies and practices.

In this study, IDT is used to interpret variation in the adoption of agro-processing practices and technologies among smallholders. For example, perceived relative advantage (higher returns from processing), complexity (technical difficulty), and trialability (opportunities to experiment in a low-risk environment) will influence whether households proceed from awareness to adoption. IDT complements the SLF by explaining how changes in human and social capital (SLF assets) translate into actual uptake of agro-processing innovations. Recent agricultural adoption literature supports

combining SLF (for livelihoods & context) with IDT (for mechanisms of adoption) to provide a robust explanatory framework for studies of agro-processing (Ruzzante et al., 2021).



**Figure 2.2:** The integration of the Sustainable Livelihoods Framework (SLF) and Innovation Diffusion Theory (IDT) provides a comprehensive understanding of how agro-processing contributes to smallholder farmers’ livelihoods.

The SLF contextualises the socioeconomic and institutional environment influencing farmers’ capacity to engage in processing, while the IDT explains the mechanisms through which innovations and technologies are adopted within these contexts. Together, the frameworks illustrate both the structural enablers and behavioural pathways that shape farmers’ participation in agro-processing and its resultant impact on livelihood outcomes.

### 2.13. Summary

The literature review explores the critical role of agro-processing in enhancing food security, rural livelihoods, and economic development, particularly for smallholder farmers. It begins by presenting global perspectives, highlighting how agro-processing contributes to increased income, employment, and food quality while also emphasising environmental sustainability. Case studies from Taiwan, Ghana, Brazil, and Ukraine demonstrate both opportunities and challenges, such as infrastructure limitations and environmental concerns. The review underscores the importance of innovation,

certification, stakeholder collaboration, and policy support for maximising the potential of agro-processing systems globally.

Focusing on Sub-Saharan Africa and South Africa, the literature examines how agro-processing supports food availability, access, and stability. It notes its contribution to poverty reduction, post-harvest loss mitigation, and gender empowerment. The chapter also critiques policy contexts like CAADP and South Africa's NDP, RADP, and APAP, emphasising their role in enabling smallholder participation in agro-processing. Additionally, barriers such as limited market access, climate vulnerability, and insufficient training are explored, along with the potential of cooperative models and climate-smart practices to promote inclusive and sustainable agro-industrial development.

## 2.14. REFERENCES

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## CHAPTER THREE

### METHODOLOGY

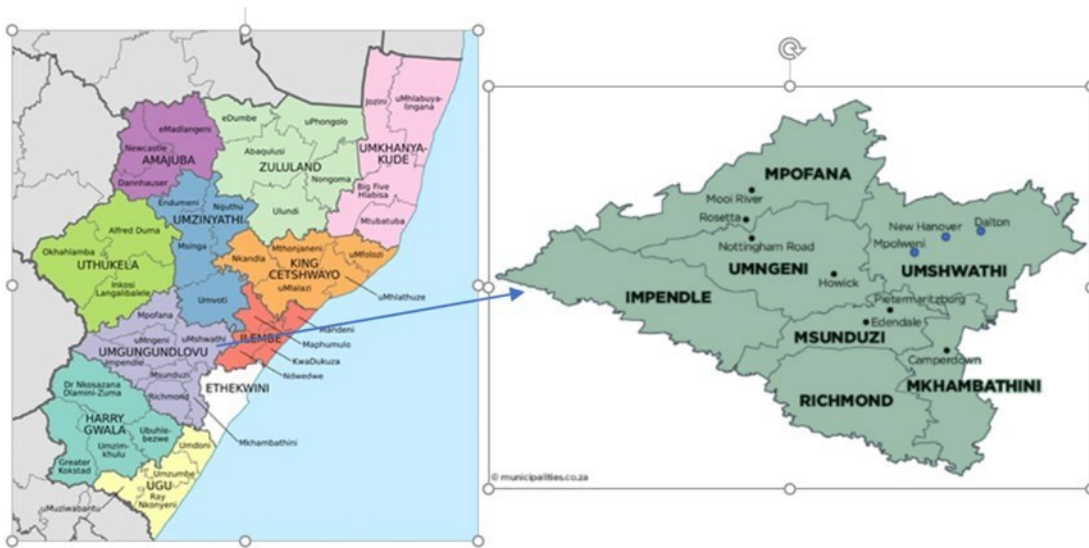
#### 3.1. Introduction

Agro-processing plays a vital role in enhancing rural livelihoods, promoting economic empowerment, and reducing post-harvest losses in South Africa, particularly among smallholder farmers in KwaZulu-Natal (Manasoe et al., 2022). Despite its potential, smallholder farmers continue to face systemic barriers such as limited access to resources, inadequate knowledge of processing techniques, and institutional constraints (Dhillon and Moncur, 2023). This study addresses these challenges by examining the current state of agro-processing activities, farmers' knowledge and awareness, and the socio-economic factors influencing participation in the uMshwathi Local Municipality, a predominantly rural area characterised by active smallholder farming and emerging agro-processing initiatives. Guided by insights from the literature, the study pursues four objectives: identifying existing agro-processing activities, assessing farmers' knowledge and awareness, evaluating resource accessibility, and exploring socio-economic and institutional determinants of participation. A mixed-methods case study design integrating quantitative surveys with qualitative interviews and focus groups was employed to capture both measurable trends and contextual depth. The chapter outlines the research philosophy, sampling strategy, data collection instruments, analysis procedures, and ethical considerations that underpin this investigation.

#### 3.2. Description of the study area

The study was conducted in the uMshwathi Local Municipality, located in the uMgungundlovu District of KwaZulu-Natal Province, South Africa. **Figure 3.1** illustrates the municipality's geographical position within the province, showing its administrative boundaries and neighbouring sub-districts. UMshwathi covers an estimated 1,818–1,866 km<sup>2</sup> and is predominantly rural, with approximately 95% of its population residing in traditional communal areas (uMshwathi IDP, 2023/24). The area experiences a moderate subtropical climate with variable rainfall, making it suitable for mixed farming systems that include maize, vegetables, and fruit production, alongside livestock such as cattle, goats, and poultry. These products provide direct opportunities for agro-processing, particularly in milling, fruit canning,

dairy production, and meat preservation.



**Figure 3.1:** Sub-districts of Umgungundlovu District Municipality within KwaZulu-Natal Province. Source File: Map of KwaZulu-Natal with municipalities named and districts shaded by blue dots, Nicol et al. (2022).

UMshwathi Local Municipality was selected due to its high climatic vulnerability, agricultural dependence, and socio-economic marginalisation conditions representative of many Sub-Saharan African contexts. Frequent droughts, erratic rainfall, and reliance on rain-fed agriculture undermine consistent agro-processing inputs. Limited education, high grant dependency, and gendered farming dynamics further constrain participation in value addition.

The area's staple crop and livestock production offer agro-processing potential, though hindered by poor infrastructure and market access. Institutional gaps, weak extension support, and reliance on informal knowledge systems restrict innovation uptake. Prior research presence, institutional partnerships, and alignment with both the IPCC vulnerability framework and the Theory of Planned Behaviour reinforce its suitability for studying smallholder agro-processing under climate stress.

### 3.3. Research Philosophy

This research adopted a philosophical stance that combines interpretivism and positivism to comprehensively explore smallholder crop farmers' participation in agro-processing activities in the uMshwathi Local Municipality. The use of interpretivism was central to addressing research objectives that required exploring the subjective experiences, perceptions, and decision-making processes of farmers.

Rooted in understanding the nuanced and context-specific realities of human behaviour and social phenomena (Alharahsheh & Pius, 2020), this paradigm aligned closely with Objective 2, which focuses on determining the level of knowledge and awareness about agro-processing and its potential benefits, and Objective 4, which involves exploring the factors that influence the decision-making process of smallholder crop farmers to engage in agro-processing. Interpretivism allowed for rich, qualitative insights into the socio-cultural and perceptual dynamics shaping farmers' engagement. Complementing this, a positivist approach was employed to collect quantifiable, structured data, enabling statistical analysis and generalisation across the study population. This paradigm supported Objective 1, which aimed at identifying the agro-processing activities carried out by smallholder crop farmers, and Objective 3, which focused on assessing the availability and accessibility of resources for agro-processing activities. Positivism provided the rigour and reliability needed to analyse trends, patterns, and relationships in farmers' responses (Park et al, 2020).

By integrating these philosophical orientations in a mixed-methods case study design, the study benefited from the complementary strengths of both paradigms. While interpretivism deepened the contextual understanding of agro-processing participation, positivism enabled empirical validation and the development of broader, evidence-based conclusions. This dual approach enhanced the validity, reliability, and robustness of the study, ensuring a holistic investigation of the economic, institutional, and perceptual factors influencing smallholder farmers in the uMshwathi local municipality (Adil et al., 2024). Thus, the integration of interpretivist and positivist philosophies directly informs the study's mixed-methods approach, ensuring a comprehensive exploration of both the subjective experiences and objective realities of smallholder farmers engaged in agro-processing. This connection provides a clear rationale for the subsequent research approach and methodology described in the following section.

### **3.4. Research Design**

A case study design has been chosen to provide an in-depth exploration of the factors affecting smallholder farmers' participation in agro-processing within the uMshwathi local municipality. This design facilitates a holistic understanding of the socio-economic and institutional dynamics unique to the area. By focusing on a specific locality, the research can generate detailed insights into the interplay of various factors, which may inform targeted interventions and policy recommendations. The case study approach also allows for the triangulation of data from multiple sources, enhancing the validity and reliability of the findings

(Quintão et al., 2020).

### **3.5. Research Approach**

Building on the philosophical foundation of interpretivism and positivism, the study employed a mixed-methods case study design, which is particularly well-suited for examining complex, socially embedded phenomena. This design employs quantitative surveys to identify and analyse the prevalence of agro-processing activities (Objectives 1 and 3) and qualitative interviews, including focus group discussions and key informant interviews, to explore farmers' knowledge, perceptions, and socio-economic and institutional barriers (Objectives 2 and 4), providing a nuanced understanding of their decisions and experiences. As noted by Tracy (2024), this approach prioritises capturing both measurable trends and the depth of participants' perspectives. Quantitative data were collected through questionnaires, enabling generalisable analysis across the sample (Zheng, 2021). For the qualitative component, focus groups and interviews were conducted to explore collective norms, shared barriers, and individual experiences (Giusto et al., 2023), such as challenges in accessing processing equipment. Triangulation of multiple data sources, including questionnaires, focus groups, interviews, and municipal reports, enhanced the study's credibility and ensured alignment with the research objectives. This approach also allowed flexibility in probing emergent themes, such as gender disparities in resource access and the role of cooperatives in influencing decision-making.

### **3.6. Sampling Strategy**

The sampling frame included smallholder farmers with at least two years of crop farming experience, as well as agricultural extension officers and representatives from the agro-processing industry. Purposive sampling was employed to ensure the inclusion of farmers both engaged and not engaged in agro-processing activities, capturing a diverse range of experiences relevant to the study objectives and enabling comparative analysis of their perspectives (Campbell et al., 2020). Snowball sampling was used to reach marginalised or less visible participants, facilitated through existing farmer cooperatives, allowing access to hard-to-reach farmers and ensuring a comprehensive understanding of agro-processing dynamics (Simkus, 2023). The study targeted a sample of 30 smallholder farmers, 28 actively engaged in agro-processing, and 2 not engaged. Additionally, three focus group discussions were conducted, each comprising 6 to 8 participants. Extension officers and stakeholders were interviewed individually to understand their experiences and opinions. Recruitment continued until data saturation was achieved, confirmed when iterative analysis revealed no emergence of new themes

(Braun and Clarke, 2021). Inclusion criteria required participants to cultivate crops either for sale or subsistence, while those involved exclusively in livestock farming were excluded from the study.

### 3.6.1. Inclusion and Exclusion Criteria

- **Inclusion Criteria:**

- Farmers actively engaged in crop farming for at least two years.
- Individuals involved or interested in agro-processing activities.
- Stakeholders with knowledge of agro-processing within the municipality.

- **Exclusion Criteria:**

- Farmers exclusively engaged in livestock farming.
- Individuals with no prior involvement or interest in agro-processing.
- Farmers who have ceased agricultural activities.

### 3.7. Data Collection

Data collection involved three methods. Printed questionnaires were administered to gather quantitative data on farmers' demographic profiles, farming practices, agro-processing involvement, and access to resources. These structured instruments facilitated standardised responses and statistical analysis (Mazhar et al., 2021). Semi-structured interviews, guided by questions mapped to specific objectives (e.g., *“Describe your experience with drying or milling crops”*), lasted 45–60 minutes and were audio-recorded with participant consent. Focus groups used thematic prompts (e.g., *“Discuss challenges in accessing markets for processed goods”*) to stimulate discussion, moderated by a neutral facilitator to mitigate interviewer bias and encourage open dialogue. Field notes were taken throughout all sessions to document non-verbal cues and contextual observations (e.g., farm size, infrastructure, group dynamics). This cross-sectional data collection approach provided a temporal snapshot of prevailing practices, perceptions, and challenges within the uMshwathi Local Municipality.

### 3.8. Data Analysis

Quantitative data were analysed using the Statistical Package for the Social Sciences (SPSS) version 26, employing descriptive statistics to summarise demographic characteristics, resource access, and

levels of agro-processing engagement. Frequency distributions and comparative analyses helped identify patterns aligned with the study objectives (Cooksey and Cooksey, 2020). For qualitative data, thematic analysis was conducted using NVivo version 15. Transcripts and field notes were first familiarised through repeated review. Line-by-line coding was applied to categorise data into descriptive labels (e.g., “post-harvest losses”), which were then clustered into broader interpretive themes (e.g., “Resource Limitations”). Member checking was used to validate themes with participants, while inter-coder reliability ( $\kappa > 0.8$ ) ensured consistency in theme development. Identified themes were systematically mapped to the study’s objectives; for instance, “Awareness Gaps” aligned with Objective 2, while “Cultural Barriers” addressed Objective 4. Additionally, codes such as “Home-based Processing,” “Use of Traditional Methods,” and “Processing Scale” were aligned with Objective 1, while themes like “Access to Credit,” “Infrastructure Challenges,” and “Equipment Availability” addressed Objective 3 (Allsop et al., 2022).

### **3.9. Ethical Considerations**

The University of KwaZulu-Natal’s research ethics office granted ethical clearance for this study. Ethical considerations are integral to the research, ensuring the protection of participants’ rights and well-being. The study adhered to the following measures:

- **Informed Consent:** Participants were provided with detailed information about the study, including its purpose, methods, and potential impacts. Written consent was obtained before participation.
- **Confidentiality:** All data was anonymised, with personal identifiers removed to protect participants' identities. Data was securely stored to prevent unauthorised access.
- **Voluntary Participation:** Participation was entirely voluntary, with individuals free to withdraw at any stage without any negative consequences.
- **Minimising Harm:** Every effort was made to prevent any physical, psychological, or social harm to participants during the research process.
- **Ethical Approval:** The study secured approval from the relevant institutional ethics committee before commencing data collection, ensuring compliance with ethical standards.

### **3.10. Limitations**

The study acknowledges several limitations. First, recall bias in self-reported data posed a risk to accuracy; however, this was mitigated by cross-verifying farmer accounts with stakeholder perspectives to enhance reliability. Second, the recruitment area posed structural constraints uMshwathi Local Municipality has a relatively limited number of smallholder farmers actively engaged in agro-processing, which contributed to the small sample size. While this constrains statistical generalisability, the case study approach enabled a focused, in-depth exploration of context-specific factors and allowed for rich triangulation of qualitative and quantitative data. Third, the concept of agro-processing was initially introduced to the broader community by agricultural extension officers, and evidence suggests that only a limited number of farmers expressed sustained interest, further narrowing the potential participant pool. Fourth, those currently engaging in agro-processing tend to exhibit a strong sense of personal agency, which may not be representative of the broader farming population, particularly those who remain disengaged due to structural or perceptual barriers.

Fifth, age-related limitations emerged, as older farmers often faced challenges adapting to agro-processing practices and experienced greater difficulty navigating poor infrastructure, such as inadequate roads or unreliable electricity. Lastly, the study's focus on a single municipality limits broad generalizability; however, it offers valuable insights for localised policy development and targeted interventions. Given these constraints, the mixed-methods case study design was deliberately chosen to maximise the depth, contextual understanding, and credibility of findings, despite the limited number of participants.

### **3.11. Summary**

This study employed a mixed-methods case study design to explore the factors influencing smallholder farmers' participation in agro-processing activities within the uMshwathi Local Municipality. Guided by both interpretivist and positivist paradigms, the research integrated qualitative tools such as focus group discussions and semi-structured interviews with quantitative surveys to capture both context-rich experiences and statistically measurable data. The purposive and snowball sampling strategies targeted smallholder crop farmers with at least two years of farming experience, along with agricultural stakeholders, to ensure inclusivity of both agro-processing and non-processing participants.

The study area was selected due to its agricultural potential, socio-economic marginalisation, and climate vulnerability. Data collection was conducted through questionnaires, interviews, and field observations, providing triangulated insight into infrastructural limitations, resource accessibility, and institutional barriers. Quantitative data were analysed using SPSS, while qualitative data were thematically analysed in NVivo. Ethical integrity was maintained through informed consent, confidentiality, and voluntary participation. Although limited by a small sample size, age-related challenges, and geographic constraints, the study's robust methodology offers credible insights and forms a valuable foundation for localised agricultural development strategies.

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## CHAPTER FOUR

### An In-Depth Analysis of Agro-Processing Practices and Knowledge Levels Among Smallholder Crop Farmers in KwaZulu-Natal

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#### **ABSTRACT**

This study investigates smallholder farmers' participation in agro-processing in the uMshwathi local municipality, KwaZulu-Natal, aiming to identify current activities and assess knowledge levels. Grounded in Everett Rogers' Innovation Diffusion Theory (IDT), the research examines how innovation characteristics, communication channels, social systems, and adopter traits influence agro-processing adoption. A mixed-methods design, using surveys and interviews, collected data from 30 smallholder farmers. Key findings reveal that 73.33% of smallholder crop farmers engage in home-based agro-processing like mushroom drying, juice-making, and baking. However, these activities are hampered by economic barriers, including limited credit, high transportation costs, and inadequate infrastructure. While farmers generally acknowledge agro-processing's potential for income generation and value addition, their understanding of its role in enhancing market access is more neutral. Furthermore, 60% do not use processing equipment, and 30% are unsure about its use, indicating resource constraints and knowledge gaps. Inconsistent information access, particularly from extension services, exacerbates these deficiencies. The study concludes that despite significant participation, systemic challenges, including limited resources, knowledge gaps, and insufficient policy support, impede the full economic benefits of agro-processing for smallholder farmers. Targeted interventions, such as tailored training, improved access to finance and equipment, and strengthened cooperative structures, are crucial to integrate farmers into value chains and unlock the region's agro-processing potential.

**Keywords:** Smallholder Farmers, Agro-Processing, uMshwathi Local Municipality, Knowledge Levels, Value Addition

#### **4.1. Introduction and Contextualization**

Globally, agro-processing is recognised as a crucial avenue for enhancing food security, reducing post-harvest losses, and improving rural livelihoods. This trend is particularly relevant in sub-Saharan Africa, where agro-processing can help diversify rural economies and strengthen agricultural value chains (Naazie et al., 2023). Despite this potential, smallholder farmers in many African countries face significant barriers to participation, including limited access to training, infrastructure, and market opportunities (Ndlovu and Masuku, 2021).

In South Africa, agro-processing is gaining traction among smallholder farmers as a strategy to reduce post-harvest losses and increase income (Mthombeni et al., 2021). However, participation remains uneven due to ongoing socioeconomic and structural challenges. This study, based in the uMshwathi Local Municipality in KwaZulu-Natal, addresses these gaps by identifying the agro-processing activities undertaken by smallholder crop farmers and assessing their knowledge and awareness of agro-processing and its benefits. Despite government support, smallholder farmers in South Africa remain underrepresented in the agro-processing sector, which is dominated by commercial agriculture (Mmbengwa et al., 2020; Mthombeni et al., 2022). Historical marginalisation, limited access to formal markets, and exclusion from sustainable value chains confine many smallholders to the informal and primary agricultural sectors. Nevertheless, participation in agro-processing offers potential for increased profitability and improved livelihoods (Abdullahi et al., 2021).

The effectiveness of agro-processing initiatives is influenced by agronomic and environmental considerations. The widespread use of agrochemicals raises concerns about health and ecological risks (Egbadzor & Sakyi, 2021), while pest infestations, particularly in maize systems, are worsened by poor agronomic practices (Mutymbai et al., 2022). Research and policy must tackle these challenges by promoting better inputs, adaptive practices, and climate-resilient technologies (Naazie et al., 2023). Comparative insights from Ghana reveal that agro-processing is more common among wealthier, better-educated farmers, with participation levels varying widely, from 19% to nearly 88% depending on the region and context (Khoza et al., 2018; Mthombeni et al., 2021). Understanding farmer perceptions and knowledge is essential for designing inclusive interventions.

This study in uMshwathi aims to address these knowledge gaps by evaluating smallholder farmers' understanding of agro-processing and the factors influencing their participation. Policy recommendations include promoting accessible investment capital, increasing awareness of micro-finance institutions, and developing local agro-processing facilities (Mohammed et al., 2022). Such

interventions can facilitate smallholder integration into the agro-processing sector and contribute meaningfully to economic development.

This research seeks to explore the untapped potential of smallholder crop farmers in KwaZulu-Natal by investigating their current agro-processing practices and knowledge levels. By addressing these challenges, we can empower farmers to adopt sustainable and profitable agro-processing techniques such as crop rotation, intercropping, cover cropping, and conservation tillage (Sithole and Olorunfemi, 2024). This will contribute to increased household incomes, improved livelihoods, enhanced food security, and stimulated rural economic growth (Rodriguez et al., 2021; Zou et al., 2024). Ultimately, this research aims to provide evidence-based recommendations to policymakers, development organisations, and agricultural extension services to support the development of a vibrant and sustainable agro-processing sector in KwaZulu-Natal.

## **4.2. Theoretical Framework**

The Innovation Diffusion Theory (IDT) serves as a solid theoretical framework for the current study, which aims to identify the factors influencing smallholder farmers' participation in agro-processing in the uMshwathi local municipality. Developed by Everett Rogers, the IDT provides a comprehensive lens to analyse the adoption and spread of innovations within a social system (Ham, 2020). In this context, the IDT is particularly relevant for understanding the dynamics of agro-processing activities among smallholder farmers.

### *4.2.1. Characteristics of the Innovation*

As per García-Avilés (2020), the IDT highlights the importance of specific attributes of innovations in influencing their adoption. In this study, agro-processing activities represent innovation, and the IDT facilitates an examination of the characteristics that make certain processing methods more appealing to smallholder farmers. The theory's parameters, including relative advantage, compatibility, and complexity, will be instrumental in evaluating why certain agro-processing practices gain traction in the uMshwathi local municipality.

### *4.2.2. Communication Channels*

Another crucial aspect of the IDT is the examination of communication channels through which information about innovations is disseminated (Takahashi et al., 2024). For the first objective of identifying agro-processing activities, the theory enables an exploration of how knowledge about

various processing methods spreads within the farming community. Understanding the communication channels will illuminate the information flow and social networks that contribute to the diffusion of agro-processing innovations among smallholder farmers.

#### *4.2.3. Social Systems*

The IDT emphasises social systems as determinants of innovation adoption (Ham, 2020). In the context of the second objective, which aims to assess knowledge and awareness levels, the IDT facilitates an analysis of how social systems within the uMshwathi local municipality influence farmers' understanding of agro-processing. This includes examining the role of social networks, community structures, and interpersonal relationships in shaping farmers' knowledge and awareness of the potential benefits of engaging in agro-processing activities.

#### *4.2.4. Adopter's Characteristics*

The theory acknowledges the significance of individual characteristics in the adoption process (García-Avilés, 2020). Applying IDT to the current study enables an exploration of the traits, attitudes, and perceptions of smallholder farmers that influence their decision-making regarding agro-processing participation. This aspect aligns with the second objective, offering insights into the cognitive processes and individual-level factors affecting knowledge and awareness levels among farmers. The Innovation Diffusion Theory provides a comprehensive framework for understanding the factors influencing smallholder farmers' participation in agro-processing in the uMswathi Local Municipality. By incorporating the theory's key concepts, the study aims to deliver nuanced insights into the diffusion dynamics of agro-processing innovations and the individual and social factors shaping farmers' engagement in these activities.

### **4.3. Contextualising the Study within the Literature and Theoretical Framework**

The study is grounded in the Innovation Diffusion Theory (IDT), which emphasises how the characteristics of innovations, communication channels, time, and social systems influence the adoption of new practices. Within the context of agro-processing, IDT provides a useful lens to understand how smallholder farmers decide whether to engage in value-adding activities, considering factors such as perceived benefits, complexity, trialability, and observability of processing innovations. Empirical studies on agro-processing among smallholder farmers have highlighted several determinants of participation, including access to information and training, availability of

resources, socio-economic constraints, gender dynamics, and institutional support (Khoza et al., 2019; Rusere et al., 2019; Stathers & Mvumi, 2020; Li et al., 2024). These studies demonstrate that even when farmers are aware of potential benefits, adoption may be limited by barriers such as insufficient infrastructure, lack of credit, and social norms.

By integrating IDT with these empirical insights, the current study situates its investigation of smallholder farmers' agro-processing activities within a framework that accounts for both innovation adoption processes and contextual realities. This approach ensures that the interpretation of findings reflects not only the individual and household-level factors influencing participation but also the broader structural and social dynamics. Introducing this literature-theory bridge strengthens the coherence of the study, providing a clear rationale for the research focus and enabling a smoother transition from the methodological framework to the empirical results presented in this chapter.

#### **4.4. Methodology**

##### *4.4.1. Description of the study area*

Please refer to Chapter 3 for the detailed description of the study area.

#### **4.5. Research Design**

A mixed-methods research design was implemented, combining both quantitative and qualitative approaches, which, according to Gilad (2021), is widely recommended for obtaining a comprehensive understanding of complex social phenomena such as agro-processing when studied in the context of smallholder farmers and rural development. Surveys were conducted to collect numerical data on agro-processing activities and knowledge levels, allowing for the identification of patterns and trends among smallholder farmers (Mthombeni et al., 2022). In-depth interviews and focus group discussions offered a deeper insight into the factors influencing participation, capturing the nuanced perspectives of individuals and contextual influences that quantitative data alone might overlook (Lim 2025). The sampling strategy employed purposive and stratified sampling to ensure a diverse and representative sample of smallholder farmers, aligning with best practices for studies aiming to explore both generalizable trends and in-depth experiences (Deepika et al., 2024).

## **4.6. Sampling procedure, frame, and sample size**

### *4.6.1. Sampling Procedure*

The sampling procedure for this study utilised a careful combination of purposive sampling to target individuals whose insights were critical for understanding the key dimensions of smallholder participation in agro-processing (Nyimbili and Nyimbili, 2024) and stratified sampling because it allows for better representation of smaller groups (Iliyasu and Etikan, 2021), which is the case for this study. Both procedures were applied to ensure a diverse and representative sample of smallholder farmers in the uMshwathi local municipality.

Purposive sampling was crucial for addressing the first objective of identifying agro-processing activities, as it aligns the sample with the study's goals and objectives, thereby enhancing the rigour and reliability of its data and findings (Campbell et al., 2020). Smallholder farmers who actively engaged in agro-processing were intentionally selected based on their expertise, experience, and involvement in various processing activities. This targeted approach ensures that the study captures a comprehensive range of agro-processing practices and methods prevalent among the smallholder farming community, mirroring the study conducted by Namambenge and Mbango (2023).

To further strengthen the study's robustness for both objectives, smallholder farmers were stratified based on critical factors such as geographical location, farm size, and the type of crops cultivated. These strata were identified in collaboration with local agricultural authorities and community leaders. Within each stratum, random sampling techniques were employed to select participants, minimising biases and enhancing the generalisability of the research findings (Nyimbili and Nyimbili, 2024).

### *4.6.2. Sampling Frame*

The sampling frame is a crucial component of this research, consisting of a dynamic list of smallholder farmers in the uMshwathi local municipality. This comprehensive list was obtained from local agricultural extension offices, farming cooperatives, and community-based organisations. To maintain its accuracy and relevance throughout the research process, the sampling frame was regularly updated to reflect changes in the farming population (Lohr, 2021).

### *4.6.3. Sample Size*

The determination of the sample size was guided by the saturation principle, ensuring that enough information is gathered to fulfil the study's objectives (Braun and Clarke, 2021). The sample size was

calculated separately for each objective, tailoring the approach to the unique requirements of the research to support in-depth case-oriented analysis (Lakens, 2022). During the research, a sample of 30 smallholder farmers who engage in agro-processing was sampled. This relatively small sample size is appropriate for this study because of the case study design, which prioritises depth over breadth (Sarfo et al., 2021).

*Objective 1 - Identifying Agro-Processing Activities:* For this objective, the sample size was driven by the need to include an ample number of smallholder farmers engaged in diverse agro-processing activities. Saturation principles guided the sampling to ensure a comprehensive understanding of various processing methods and practices (Alordiah and Oji, 2024). Bednarek (2024) supports striking a balance between depth and breadth of information, as it is a priority to facilitate a nuanced analysis.

*Objective 2 - Determining Knowledge and Awareness Levels:* To assess knowledge and awareness levels, a representative sample of smallholder farmers was carefully selected from different strata. The sample size calculation was rooted in statistical considerations to instil confidence in the generalizability of the findings (Lakerns, 2022). The inclusion of diverse perspectives was prioritised to capture a holistic view of knowledge levels among the smallholder farming community (Williams et al., 2020).

#### **4.7. Data Collection and Analysis**

This study employed a mixed-methods approach to data collection, utilising questionnaires, focus group discussions (FGDs), and key informant interviews to ensure both breadth and depth of information.

Quantitative data were collected through a structured questionnaire survey, as it enables the collection of focused, quantifiable data that complements qualitative insights and supports triangulation in a mixed-methods design (Oranga, 2025). Questionnaires offer several advantages, including high-quality data, high response rates, and the potential for anonymity, which can help minimise response bias (Jensen et al., 2025). However, limitations exist. They may not be suitable for participants with low literacy levels, visual impairments, or those not fluent in English. Additionally, researchers may face challenges in clarifying ambiguous responses or misunderstandings during completion (Pigeon et al., 2025).

To complement the survey data and capture richer, contextual insights, the study also incorporated focus group discussions (FGDs) and key informant interviews (KIIs). These qualitative methods enable researchers to explore diverse perspectives on the research topic and create a comfortable environment for participants to express their views (Kerr et al., 2021; Amir et al., 2024). FGDs are particularly valued for their economical and time-efficient nature, high face validity, and ability to generate data through purposeful social interaction. Nevertheless, they are not without limitations. Researchers have limited control over the discussion dynamics, and there is a risk of groupthink, where individual responses may be influenced by dominant voices within the group, potentially skewing the data (Lanfer et al., 2024).

KIIs' semi-structured approach promotes candid discussion and allows participants to voice their opinions without feeling constrained by strict questioning. Based on the participants' backgrounds, researchers frequently modify their approach, which can improve comfort and result in more comprehensive data gathering (Walls, 2021). Although KIIs are useful for obtaining a variety of viewpoints, there is a chance that some viewpoints will be over-represented, possibly marginalising others. This emphasises how important it is to carefully select and recruit informants to guarantee fair representation in study findings (Lanfer et al., 2024). Together, these methods provided a robust and comprehensive dataset, enhancing the credibility and validity of the study findings.

Data analysis in this study followed a mixed-methods analytical framework, integrating both quantitative and qualitative data to provide a comprehensive understanding of the research problem (Creswell and Inoue, 2025). The data collected through the structured questionnaire were coded and entered into the Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarise demographic information and key variables (Cooksey and Cooksey, 2020). Moreover, data collected through FGDs and KIIs were coded using version 15 of NVivo, which was chosen based on its capacity to support transparent and rigorous qualitative analysis. This made it particularly suitable for this case study research, where in-depth insight into farmer experiences and perceptions was essential (Limna, 2023).

Frequency analysis was employed to examine the distribution of responses across key variables, including demographic characteristics, levels of agro-processing involvement, access to resources, and perceived barriers. This method enabled the identification of commonalities and variations within the sample, offering a clear overview of how various factors influence agro-processing practices

(Åkerlind, 2024). Descriptive statistics such as percentages and means were used to summarise the data in a way that was accessible and informative. To ensure accuracy and consistency, data cleaning and validation procedures were conducted before analysis (Jean, 2024). The use of frequency analysis provided a foundational understanding of the dataset, which was further enriched through the integration of qualitative insights, enabling a comprehensive and triangulated interpretation of the findings.

The qualitative data obtained from the focus group discussions (FGDs) and key informant interviews (KIIs) were analysed thematically, following the six-step process of thematic analysis (Naeem et al., 2023). Audio recordings were transcribed verbatim and, where necessary, translated into English. The transcripts were then read multiple times to ensure familiarity, and initial codes were generated systematically. These codes were then grouped into broader themes reflecting recurring patterns, perceptions, and insights related to agro-processing participation, knowledge, barriers, and opportunities (Braun and Clarke, 2024). To enhance trustworthiness and credibility, triangulation was applied by comparing findings across the different data sources (questionnaires, FGDs, and KIIs). The integration of quantitative and qualitative findings allowed for cross-validation and enriched the analysis, offering a nuanced understanding of the determinants influencing smallholder farmers' engagement in agro-processing activities.

#### **4.8. Ethical Considerations**

The research adhered to ethical principles to ensure the protection and well-being of participants in line with the study's objectives. Informed consent was obtained from all smallholder farmers involved, ensuring they were fully aware of the study's purpose, procedures, and potential benefits, particularly in identifying the agro-processing activities they engage in and assessing their knowledge and awareness of agro-processing and its benefits. Privacy and confidentiality were strictly maintained to safeguard participants' personal information.

The study aimed to maximise its impact by accurately documenting the agro-processing activities carried out by smallholder farmers while evaluating their level of knowledge and awareness. Efforts were made to minimise any inconvenience or harm to participants throughout the research process. Fair and equitable selection ensured diverse representation, allowing for a comprehensive understanding of agro-processing practices in uMshwathi Local Municipality. Data collection and analysis were conducted with accuracy and validity to ensure that findings genuinely reflected the

experiences and perspectives of smallholder farmers. By upholding these ethical standards, the research contributes valuable insights into agro-processing practices and awareness levels, ultimately informing strategies to support and enhance the livelihoods of smallholder farmers in the region. Data collection and analysis were conducted with accuracy and validity to ensure that findings genuinely reflected the experiences and perspectives of smallholder farmers. By upholding these ethical standards, the research contributes valuable insights into agro-processing practices and awareness levels, ultimately informing strategies to support and enhance the livelihoods of smallholder farmers in the region.

#### 4.9. Results and Discussion

This chapter presents and discusses the empirical findings of the study, integrating both quantitative and qualitative data to examine the factors influencing smallholder farmers’ participation in agro-processing within uMshwathi Local Municipality. The discussion is grounded in the Innovation Diffusion Theory (IDT), which provides a framework for understanding how innovations, such as agro-processing, are adopted or resisted based on perceptions of relative advantage, compatibility, complexity, trialability, and observability. Each theme is interpreted through this theoretical lens to establish the connection between farmers’ lived realities and the broader diffusion process of agro-processing innovations.

##### 4.9.1. Socioeconomic Characteristics and the Diffusion Context

**Table 4.1** below presents the socio-economic characteristics of smallholder farmers who participated in the study conducted in uMshwathi Local Municipality. The variables include gender, marital status, educational level, farm size, main source of income, and cooperative membership, all of which are critical determinants of technology adoption and innovation participation according to the Innovation Diffusion Theory (IDT).

**Table 4.1:** Socioeconomic Demographics of Respondents

<b>Gender</b>		
	<b>Frequency</b>	<b>Percent (%)</b>
Male	7	23.3
Female	23	76.7
<b>Marital Status</b>		
Never Married	7	23.3
Married	16	53.3

Widowed	7	23.3
<b>Educational Level</b>		
Primary School	10	33.3
Secondary School	12	40.0
Vocational/Technical Training	3	10.0
Other	5	16.7
<b>Farm Size</b>		
Less than a Hectare	18	60.0
More than 1 Hectare	11	36.7
More than 2 Hectares	1	3.3
<b>Main Source of Income</b>		
Government grant	10	33.3
Salary (employed)	2	6.7
Farm Harvest	17	56.7
Non-farm business	1	3.3
<b>Cooperative Member</b>		
Yes	22	73.3
No	8	26.7
<b>Total</b>	<b>30</b>	<b>100.0</b>

The results presented in Table 4.1 provide critical insights into the socio-economic profile of smallholder farmers and how these characteristics influence their participation in agro-processing industries through the lens of the Innovation Diffusion Theory (IDT). IDT posits that the adoption of new technologies or innovations—such as engagement in agro-processing—is influenced by five major elements: relative advantage, compatibility, complexity, trialability, and observability. These elements are also shaped by individual and social characteristics such as education, gender, income, and social networks.

#### *a) Gender and Participation in Agro-processing*

The findings reveal that 76.7% of the respondents were female, while only 23.3% were male. This suggests that women play a dominant role in smallholder farming within the uMshwathi Local Municipality. From an IDT perspective, gender dynamics can influence innovation adoption through differences in access to resources, decision-making power, and information exposure. Women’s predominance may imply that agro-processing initiatives must be designed to accommodate their specific needs and constraints, such as time, access to credit, and training opportunities. Their strong representation in the sector also presents an opportunity for targeted empowerment programs aimed at enhancing participation and innovation adoption.

#### *b) Marital Status and Social Stability*

More than half of the respondents (53.3%) were married, while 23.3% were either widowed or never married. Marital status may affect a farmer's willingness or ability to engage in agro-processing due to variations in social capital and household responsibilities. Married individuals often benefit from shared labour and decision-making, enhancing their ability to adopt new practices. According to IDT, social systems play a pivotal role in shaping diffusion processes; thus, strong family and community ties can accelerate information exchange and reinforce adoption behaviour.

#### *c) Educational Level and Innovation Awareness*

Education is a crucial factor in determining an individual's ability to comprehend, evaluate, and adopt innovations. The results show that 73.3% of respondents had either a primary (33.3%) or a secondary (40%) education. Only 10% had vocational or technical training. This relatively modest educational attainment may limit farmers' ability to understand the technical complexity of agro-processing technologies, slowing the rate of adoption. Within the IDT framework, lower educational levels can reduce perceived relative advantage and increase perceived complexity, thereby influencing adoption negatively. Strengthening educational and extension support can therefore enhance farmers' capacity to evaluate and implement agro-processing innovations effectively.

#### *d) Farm Size and Resource Availability*

The majority of farmers (60%) operated on land less than one hectare, with only 3.3% having more than two hectares. Small landholdings constrain production volume, affecting both the economic feasibility and perceived advantage of investing in agro-processing activities. According to IDT, resource limitations increase the perceived complexity of innovation adoption, particularly for capital-intensive processes like agro-processing. Farmers with larger land sizes are more likely to adopt due to economies of scale and better resource endowment, which enhance innovation diffusion.

#### *d) Main Source of Income and Economic Motivation*

A significant proportion (56.7%) of respondents relied primarily on farm harvests for income, while 33.3% depended on government grants. This indicates limited economic diversification and financial vulnerability. From an IDT standpoint, economic capability influences adoption readiness—farmers with

stable income streams can better absorb the risks associated with innovation. Dependence on grants may also reflect a risk-averse behaviour, potentially slowing participation in agro-processing ventures that require financial investment.

#### *e) Cooperative Membership and Information Networks*

A large majority (73.3%) of the farmers were members of cooperatives. This finding is particularly relevant to the social system component of IDT, which emphasises that innovations diffuse more rapidly in cohesive social networks. Cooperatives provide platforms for information sharing, joint training, and collective marketing, which reduce perceived complexity and enhance observability of benefits associated with agro-processing. Cooperative membership thus appears to be a critical enabling factor for participation and diffusion of agro-processing innovations in the study area.

#### *4.9.2 Identifying the Agro-Processing Activities Carried Out by Smallholder Crop Farmers*

**Table 4.2.** shows that, based on the investigation conducted through focus group discussions (FGDs) with farmers, the study identified a diverse range of agro-processing activities undertaken by smallholder farmers in the uMshwathi local municipality, including mushroom drying, juice-making, baking, sun-drying fruits and vegetables, and dairy processing (e.g., cheese and maas production).

These activities are primarily home-based due to a lack of external processing facilities. The reliance on home-based processing highlights the farmers' adaptability and resourcefulness in value addition, despite facing significant infrastructural and financial constraints (Tamru and Minten, 2023). This finding aligns with broader literature, which suggests that smallholder farmers often turn to home-based processing due to the high costs and logistical challenges of accessing external facilities (Tibaingana et al., 2024; Mwinyiheri et al., 2023).

Despite the potential of agro-processing to improve farmers' income, the study revealed that these activities currently lack a positive economic impact. Farmers reported several economic barriers, including limited access to credit, high transportation costs, and inadequate infrastructure, such as poor roads and unreliable electricity.

These challenges restrict their ability to invest in necessary equipment and access markets, thereby hindering their capacity to fully engage in and benefit from agro-processing (McCoy et al., 2021; Nkwabi et al., 2019). The uniformity of these challenges across regions within the uMshwathi local municipality suggests that these issues are widespread and not confined to specific areas. According to IDT, innovations

are more likely to be adopted when they are seen as providing substantial benefits over existing practices (Mbatha, 2024). In this context, systemic barriers raise the perceived complexity and reduce farmers' confidence in investing in agro-processing. These challenges not only constrain initial adoption but also limit the trialability and scalability of innovation.

The lack of variation in agro-processing activities across different regions of the municipality indicates that the barriers faced by farmers are widespread. This uniformity points to systemic issues that require comprehensive policy interventions. The absence of local or national policies aimed at supporting agro-processing activities further exacerbates the situation, leaving farmers without the necessary support to overcome these barriers. This finding underscores the critical need for policy advocacy and the development of targeted support programmes to assist smallholder farmers in their agro-processing endeavours. Nkwabi et al. (2019) suggest that to address these challenges, it is imperative to develop and implement support programmes that provide access to credit, improve transportation infrastructure, and ensure a reliable electricity supply. Establishing community-based processing facilities can help farmers move beyond home-based processing and engage in more advanced value-adding activities. Additionally, capacity-building and training programmes focused on advanced agro-processing techniques and business management can enhance farmers' skills and improve the quality and marketability of their products.

The study's findings align with existing literature that underscores the importance of supportive infrastructure and policy frameworks in enabling smallholder farmers to scale up their agro-processing activities and achieve better economic outcomes (Khoza et al., 2019). While smallholder farmers in the uMshwathi local municipality engage in various agro-processing activities, significant economic and infrastructural barriers limit their effectiveness and benefits. By addressing these barriers through supportive policies and programmes, stakeholders can help smallholder farmers overcome challenges and fully realise the potential of agro-processing to enhance their economic stability and food security. The study enhances the understanding of agro-processing activities among smallholder farmers and provides a foundation for future research and policy development in this area.

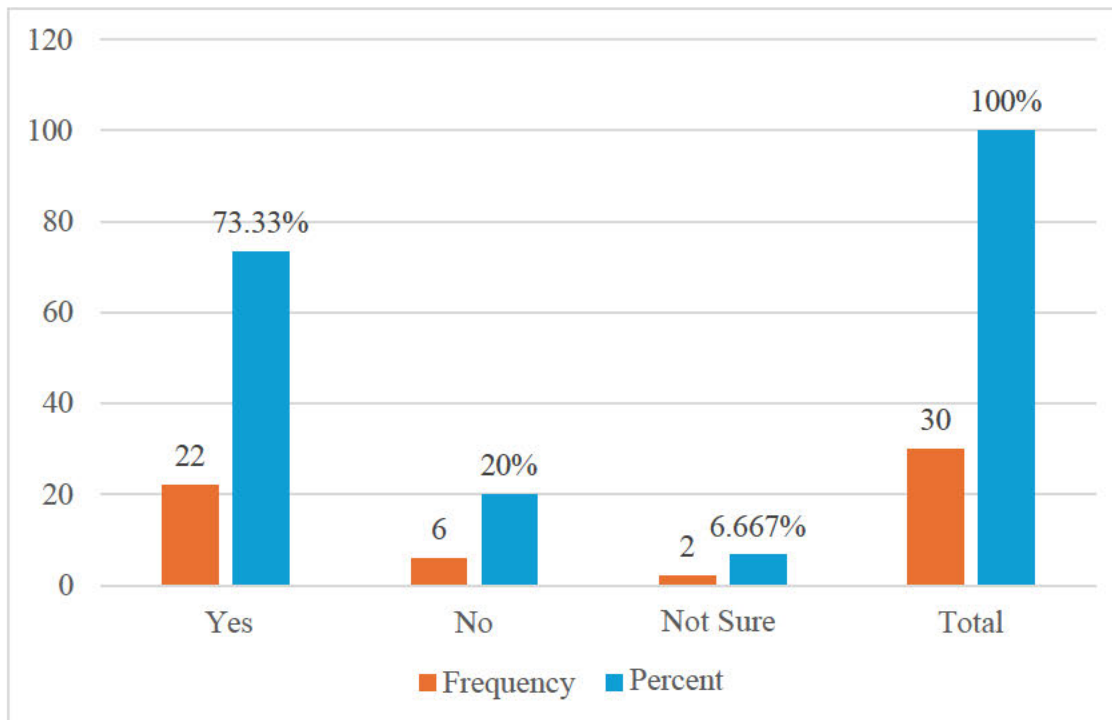
**Table 4.2:** Key Agro-Processing Activity Themes Emerging from FGD’s

Question Category	Codes	Theme	Brief Discussion
Agro-Processing Activities	<ul style="list-style-type: none"> <li>✓ Mushroom drying</li> <li>✓ Juice-making</li> <li>✓ Baking</li> <li>✓ Sun-drying fruits and vegetables</li> <li>✓ Dairy processing (e.g., cheese and maas production)</li> </ul>	<ul style="list-style-type: none"> <li>✓ Variety of agro-processing methods</li> <li>✓ Home-based processing activities</li> </ul>	Participants identified a variety of on-farm agro-processing activities, including mushroom drying, juice-making, baking, and dairy processing. These activities are predominantly conducted at home due to a lack of external facilities, emphasising the farmers’ resourcefulness despite limited support. These findings demonstrate the potential for agro-processing as a value-adding activity among smallholder farmers, albeit constrained by infrastructural and financial limitations.

*4.9.3. Home-based Agro-processing Activities Reported by Farmers*

The findings from the study, as illustrated in **Figure 4.1**, indicate that a significant majority of smallholder crop farmers (73.33%) are actively engaged in agro-processing activities, while 20% reported no involvement, and a small fraction (6.67%) were uncertain. This high level of participation suggests that agro-processing is becoming an integral component of smallholder farming systems in the area, reflecting broader national and regional trends aimed at strengthening rural livelihoods and enhancing food system resilience. Agro-processing, defined as the transformation of raw agricultural products into value-added goods, is increasingly promoted as a pathway for improving income generation, reducing post-harvest losses, and enhancing food security among smallholder farmers (FAO, 2017).

The strong participation rate in this study aligns with literature highlighting that farmers who engage in agro-processing are better positioned to stabilise incomes and improve household food availability, especially in times of market volatility or seasonal scarcity (Fanzo et al., 2020). In the South African context, policy instruments such as the Department of Trade and Industry’s Agro-Processing Support Scheme (DTI, 2017) and components of the National Development Plan (NDP 2030) have underscored the role of small-scale agro-processing in rural development, particularly for emerging farmers.



**Figure 4.1:** Home-based processing activities

The finding that 20% of respondents are not involved in agro-processing, however, highlights the persistence of structural and systemic barriers. These may include limited access to processing equipment, lack of start-up capital, insufficient market linkages, or gaps in technical knowledge and training. De Brauw et al. (2021) argue that smallholder farmers are often constrained by weak infrastructure and institutional support, which hampers their ability to participate in post-harvest value chains. Furthermore, low production volumes due to land constraints, input costs, and climate variability may discourage some farmers from processing their produce, especially if they are uncertain about returns on investment.

The 6.67% of respondents who were unsure about their involvement in agro-processing may reflect a conceptual misunderstanding of what constitutes agro-processing. Simple activities such as sun-drying, shelling, or sorting may not be recognised by farmers as formal agro-processing, although they fall within its broader scope (Asogwa et al., 2017). This finding suggests a need for clearer communication and education on the agro-processing value chain, perhaps through targeted extension programs and farmer workshops. Extension services play a critical role in facilitating knowledge transfer and helping smallholders appreciate the benefits of processing even at the micro or subsistence level (Moumenihelali and Amooghli-Tabari, 2025).

The implications of this high participation rate in agro-processing are multifaceted. Economically,

value addition through agro-processing can help farmers achieve higher margins, access diverse markets, and smooth incomes over time (Mmbengwa et al., 2019). In IDT terms, these outcomes strengthen the observability and relative advantage of agro-processing innovations, making them more appealing to other potential adopters (Mbatha, 2024). From a food security perspective, agro-processing improves food storage, shelf life, and availability, thereby contributing to food system stability and household dietary diversity. Socially, agro-processing can offer employment opportunities, particularly for women and youth, and support local enterprise development (Adeyeye, 2017). These outcomes are in line with the Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty) and SDG 2 (Zero Hunger), which advocate for inclusive agricultural development and rural industrialisation.

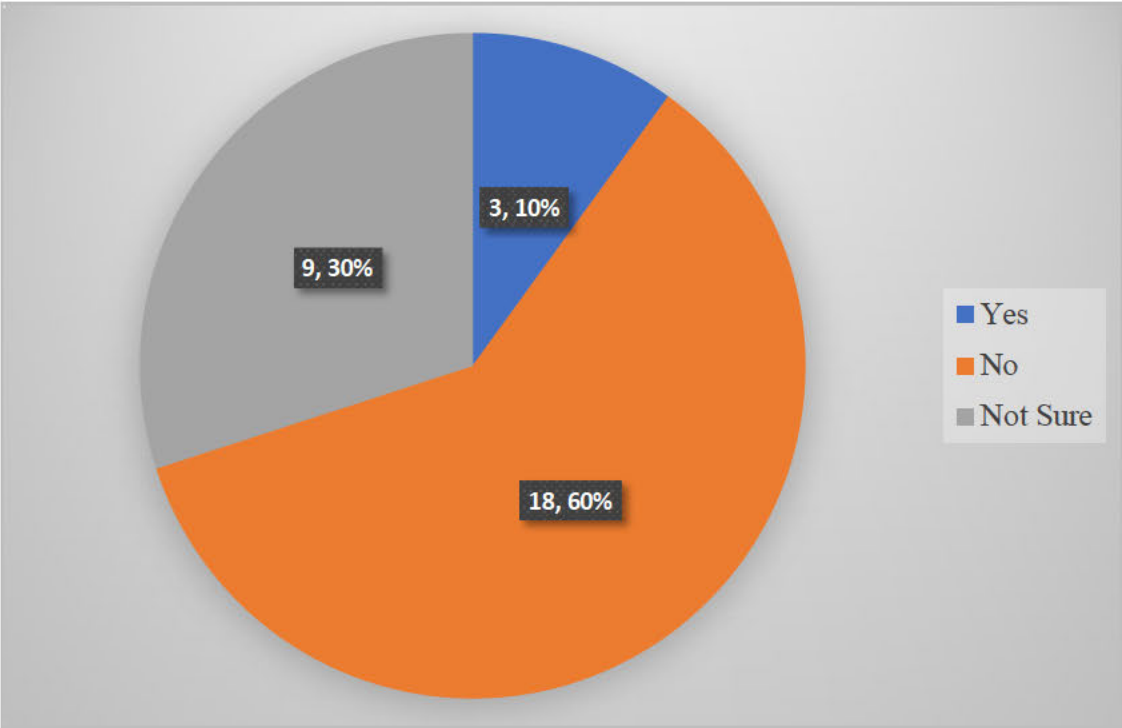
The study reveals a promising level of agro-processing participation among smallholder crop farmers in the study area, demonstrating its growing significance as a strategy for enhancing rural livelihoods and food system resilience. However, targeted interventions are needed to address the constraints faced by non-participating farmers and to clarify understanding among those unsure of their engagement. Strengthening access to training, infrastructure, and markets will be critical in enabling more farmers to transition into value-adding activities and realise the full potential of agro-processing.

#### *4.9.4. Equipment Used for Processing*

The chart in **Figure 4.2**, focusing on equipment use for processing, reveals that 60% of respondents do not use any equipment, 10% use equipment, and 30% are unsure. This finding highlights farmers' significant resource constraints, as the high cost of processing equipment and lack of financial resources are recurring themes in the demographic data and focus group discussions. The term “equipment” in this context refers to agro-processing tools such as grinders, shellers, oil pressers, dryers, milling machines, and basic packaging unit tools that are essential for improving processing efficiency, reducing post-harvest losses, and adding value to raw produce. The fact that many respondents do not use such equipment suggests heavy reliance on traditional manual methods like hand-pounding, sun-drying, or manual sorting, which are labour-intensive and limit productivity (Ntane et al., 2023). From an IDT perspective, this suggests that current agro-processing practices remain in early stages of diffusion, with innovations yet to be fully adopted due to low compatibility with farmers' economic realities (Ham, 2020).

Additionally, the 30% uncertainty rate points to a gap in awareness or training regarding the

availability and use of agro-processing equipment. According to Ndlovu and Masuku (2021), access to affordable and appropriate processing technologies is essential for smallholder farmers to scale operations and transition from subsistence to market-oriented production. The lack of equipment not only reflects financial and infrastructural limitations but also reinforces the position of smallholder farmers as resource-poor, underscoring the urgent need for targeted interventions in capacity building and capital investment to unlock their economic potential (Kapari et al., 2023).



**Figure 4.2:** Equipment Used for Processing

*4.9.5. Determining the Level of Knowledge and Awareness About Agro-Processing and Its Potential Benefits*

The data shown in **Table 4.3** reveals varying perceptions among respondents regarding the benefits of agro-processing, particularly its potential to increase income, add value to agricultural products, and enhance market access. Most respondents agree that agro-processing can improve income generation, as indicated by a mean response of 3.77 and a standard deviation of 0.971. This suggests moderate agreement but also some variability in understanding or experience. The strongest agreement was noted in the belief that agro-processing adds value to agricultural products, with a mean of 3.97 and a lower standard deviation of 0.809. This consistency highlights a widespread recognition of the value

addition potential of agro-processing. However, when it comes to enhancing market access, responses were more neutral, with a mean of 3.13 and a higher standard deviation of 0.973, reflecting a more diverse range of opinions. This suggests either limited understanding or mixed experiences regarding agro-processing’s role in improving market access for farmers.

**Table 4.3:** Descriptive Statistics on Awareness and Perceived Benefits of Agro-processing

Statements	N	Minimum	Maximum	Mean	Std. Deviation
I believe agro-processing can increase income.	30	1	5	3.77	.971
I believe agro-processing adds value to agricultural products.	30	2	5	3.97	.809
I believe agro-processing enhances market access for farmers.	30	1	5	3.13	.973
Valid N (listwise)	30				

*Note:* 5 strongly agree, 4 agree, 3 neutral, 2 disagree, 5 strongly disagree.

With the study's objective of determining smallholder farmers' knowledge and awareness of agro-processing, the findings suggest that while respondents are moderately aware of its benefits, there are gaps in understanding certain aspects, particularly regarding market access. The belief that agro-processing can increase income aligns with existing literature highlighting its role in diversifying income streams for smallholder farmers. Studies such as Ramandeep and Bhagawan (2019) emphasise how agro-processing helps reduce dependency on volatile raw product markets. The strong agreement on value addition also resonates with findings by Alam (2021), which illustrate how agro-processing increases the marketability and shelf life of agricultural products, thereby enhancing profitability. However, the neutral stance on market access may indicate limited exposure to structured markets facilitated by agro-processing. Literature such as Christian et al. (2024) highlights how farmers involved in agro-processing industries often gain access to broader markets, especially when linked to cooperatives or value chains. The variability in responses may point to challenges such as inadequate infrastructure, limited market information, or insufficient policy support.

These findings underscore the importance of capacity-building initiatives to enhance smallholder farmers’ understanding of the full range of benefits of agro-processing. Specifically, training programmes and extension services should focus on educating farmers about strategies to overcome

barriers to market access. According to the IDT, such gaps in perception can be addressed through improved communication channels and targeted knowledge-sharing platforms (García-Avilés, 2020). Such efforts could empower farmers in the uMshwathi municipality to better leverage agro-processing to improve their livelihoods. Supporting literature, including Manasoe et al. (2023) and Mthombeni et al. (2022), provides further evidence that these interventions can positively impact smallholder farmers. Addressing the identified challenges could significantly enhance participation in agro-processing industries and align with the study's overall objective of promoting agro-processing as a driver of rural development.

#### *4.9.6. Farmers' Familiarity and Knowledge About Agro-processing*

The findings on farmers' familiarity and knowledge of agro-processing, as shown in **Table 4.4**, indicate a basic understanding of the concept among participants but also reveal critical knowledge and capacity gaps that hinder their ability to fully benefit from agro-processing opportunities. A majority of respondents (56.7%) indicated that they were familiar with agro-processing, while 30% were unsure, and 13.3% reported no familiarity at all. Although this suggests a moderate level of awareness, only 33.3% could confidently name common agro-processing methods, with 36.7% stating they could not, and 30% remaining unsure. This disparity points to a superficial understanding of agro-processing, further echoed in focus group discussions (FGDs) where participants associated the practice primarily with “value addition” and “preservation,” citing basic techniques such as drying, juicing, pickling, and canning.

However, while some familiarity exists, there is a marked deficiency in technical expertise and deeper knowledge required for advanced agro-processing, which limits smallholder farmers' participation in high-value chains. These results align with Khoza et al. (2019), who highlight limited technical skills and knowledge gaps as significant barriers for smallholder farmers in rural South Africa. One of the contributing factors to this gap is the inconsistency and insufficiency of information sources. For instance, although 63.3% of respondents reported accessing information through workshops, a notable 36.7% had not.

**Table 4.4:** Familiarity, Knowledge, and Sources of Information about Agro-processing

<b>Familiar with agro-processing</b>		
	<b>Frequency</b>	<b>Percent (%)</b>
Yes	17	56.7
No	4	13.3
Not sure	9	30.0
<b>Can you name common agro-processing methods</b>		
Yes	10	33.3
No	11	36.7
Not sure	9	30.0
<b>Sources of information (workshops)</b>		
Yes	19	63.3
No	11	36.7
<b>Sources of information (extension services)</b>		
Yes	13	43.3
No	17	56.7
<b>Sources of information (online)</b>		
Yes	0	0.0
No	30	100.0
<b>Sources of information (other)</b>		
Yes	7	23.3
No	23	76.7
<b>Total</b>	<b>30</b>	<b>100.0</b>

Extension services reached only 43.3% of respondents, while a majority (56.7%) had no engagement through this channel. Alarming, none of the respondents (0%) reported using online platforms as a source of agro-processing information, and only 23.3% accessed knowledge through other informal sources. This underutilization of diverse knowledge systems is further reflected in the FGDs, where participants expressed frustration with sporadic training and the lack of regular follow-up support from agricultural development officers. These concerns resonate with Rusere et al. (2019), who point to under-resourced extension systems as a constraint to farmer advancement in agro-processing.

Furthermore, the inability to name common methods or access relevant information restricts farmers' capacity to scale up operations and adopt more efficient technologies. This challenge is compounded by limited access to affordable processing equipment, a theme reinforced by the survey data, where 60% of respondents indicated they do not use any equipment, and 30% were unsure about equipment use, further confirming the lack of awareness or training. This absence of exposure hinders trialability, a crucial innovation attribute under IDT, and highlights barriers to observability and scale (García-Avilés, 2020).

As Manasoe et al. (2023) observe, insufficient access to affordable technologies remains a major impediment to smallholder agro-enterprise growth in Southern Africa. Financial barriers and the absence of tailored support mechanisms, such as credit or subsidies, further hinder progress.

The implications are far-reaching: farmers are unable to reduce post-harvest losses or diversify their income streams, remaining confined to subsistence practices. This is especially pressing in areas like the uMshwathi local municipality, where agro-processing could catalyse rural economic development. Stathers and Mvumi (2020) highlight the severe impact of post-harvest losses on food security in sub-Saharan Africa, reinforcing the importance of efficient value addition strategies. To bridge these gaps, targeted interventions are critical. Regular, tailored training programs and consistent follow-up from extension services are essential to ensure not only knowledge transfer but also long-term application. Li et al. (2024) emphasise that such sustained capacity-building initiatives are vital for enabling smallholders to shift from subsistence farming to active participation in agro-processing value chains. Furthermore, improving access to affordable processing equipment through cooperatives, public-private partnerships, or subsidies could empower farmers to innovate, scale operations, and increase competitiveness. As noted in the demographics, farmers involved in cooperatives are better positioned to collectively acquire resources and technologies, underlining the importance of organisational structures in supporting agro-processing development.

#### *4.9.7. Perceived benefits of the underlying factors of agro-processing*

##### *a) Economic Benefits*

A primary perceived benefit of agro-processing lies in its economic potential to enhance income and improve financial resilience. Farmers noted that value addition through agro-processing could significantly increase the profitability of their produce by transforming raw agricultural products into higher-value goods. For example, dried or juiced fruits and pickled vegetables often fetch higher market prices than their fresh counterparts. This finding aligns with assertions by Christiana et al. (2021), who highlighted that agro-processing is a critical pathway for improving household incomes among smallholder farmers in developing countries. Additionally, farmers emphasised the role of agro-processing in reducing post-harvest losses, which directly contributes to improved food availability and reduced wastage. As pointed out by Mohamed et al. (2024), minimising post-harvest losses not only protects farmers' earnings but also strengthens food security at the household level.

### *b) Social Benefits*

The discussions also identified several social benefits of agro-processing, including its potential to empower women and strengthen community networks. Since many agro-processing activities, such as canning, drying, and pickling, are often led by women, the adoption of agro-processing creates opportunities for women's economic empowerment. Focus group participants noted that agro-processing initiatives could enhance their ability to contribute financially to their households and communities, fostering a sense of independence and pride. This aligns with findings from Mabe (2022), who argues that agro-processing supports gender equity by involving women in value addition activities that increase their economic influence. Furthermore, the cooperative model, already utilised by 73.3% of respondents sampled in the uMshwathi local municipality, fosters social cohesion by encouraging collective action, knowledge sharing, and resource pooling.

### *c) Market-Related Benefits*

Agro-processing also offers significant market-related advantages. Farmers perceive value addition as a strategy to improve market access and competitiveness by creating products that meet consumer preferences. For instance, processed goods such as dried fruits or packaged juices are more appealing to urban and formal market buyers than unprocessed produce. This enhances farmers' ability to participate in high-value markets and earn premium prices. Moreover, participants highlighted how processed goods have a longer shelf life, allowing farmers to overcome seasonal market fluctuations and sustain consistent income throughout the year. These findings align with Mapulanga (2020), who emphasises that agro-processing enables smallholders to enter diverse markets by increasing the marketability and durability of their products.

The benefits of agro-processing are multifaceted, as evident in **Table 4.5**, encompassing economic, social, and market-related dimensions. By enabling farmers to add value to their produce, agro-processing offers a viable pathway to enhanced income, reduced waste, community empowerment, and improved market access. However, these benefits can only be fully realised through targeted interventions that address the existing technical, financial, and institutional barriers. Literature emphasises the importance of integrating smallholder farmers into agro-processing value chains through capacity-building programs, cooperative structures,

and financial support mechanisms (Ros-Tonen, 2019). Thus, agro-processing represents a transformative opportunity for the uMshwathi Municipality if the right support systems are established. In line with the Innovation Diffusion Theory, strengthening communication channels, reducing perceived complexity, and enhancing the relative advantage of agro-processing will be essential to accelerating its adoption. These elements can foster wider acceptance and sustainable participation in agro-processing activities among smallholder farmers (Guo and Huang, 2024).

**Table 4.5:** Perceived Benefits of the Underlying Factors of Agro-processing

<b>Benefit</b>	<b>Codes</b>	<b>Theme</b>	<b>Brief Discussion</b>
Economic	<ul style="list-style-type: none"> <li>✓ Income generation</li> <li>✓ Value addition</li> <li>✓ Reduced post-harvest losses</li> <li>✓ Improved food security</li> </ul>	Financial resilience	Agro-processing increases profitability by converting raw products into higher-value goods. It also reduces post-harvest losses, preserving income and strengthening household food security
Social	<ul style="list-style-type: none"> <li>✓ Women empowerment</li> <li>✓ Community involvement</li> <li>✓ Cooperative participation</li> </ul>	Social empowerment	Activities like drying and pickling promote gender equity and enable women to contribute financially. Cooperative involvement fosters social cohesion, collective action, and shared learning
Market-related	<ul style="list-style-type: none"> <li>✓ Market access</li> <li>✓ Product shelf- life</li> <li>✓ Premium pricing</li> <li>✓ Urban market appeal</li> </ul>	Market competitiveness	Value-added products meet consumer demand and appeal to formal markets. Longer shelf life helps manage seasonal price fluctuations, supporting year-round income

#### 4.9.8. Integration of Findings and Theoretical Interpretation

The combined analysis reveals a dynamic interplay between socio-economic realities and the diffusion process. Farmers in uMshwathi perceive agro-processing as compatible and beneficial, yet institutional and infrastructural weaknesses heighten the perceived complexity and reduce trialability. Compatibility and observability promote initial adoption, but a lack of financial capital and training hinders scaling. This supports the theoretical expectation within IDT that innovations diffuse unevenly when external support mechanisms are inadequate. The findings, therefore, extend IDT’s application by illustrating how gender, institutional capacity, and resource constraints jointly mediate innovation diffusion in rural South Africa.

#### **4.10. Conclusion and Recommendations**

The findings of this chapter revealed that the adoption of agro-processing among smallholder farmers in uMshwathi is strongly shaped by social and structural conditions. Guided by the Innovation Diffusion Theory (IDT), the study established that adoption is largely driven by compatibility and observability, as processing activities fit existing household roles and visibly produce benefits such as reduced spoilage and improved food quality. However, the diffusion process remains constrained by high perceived complexity and low trialability, resulting from poor infrastructure, limited access to finance, and inadequate institutional support. Although farmers recognise the relative advantage of processing for income diversification and value addition, the benefits are curtailed by weak market access and inconsistent policy assistance. Overall, the study concludes that agro-processing diffusion in uMshwathi is socially embedded yet institutionally constrained, highlighting the need for systemic interventions to transform participation into sustainable enterprise growth.

This study recommends a coordinated and supportive policy environment that reduces institutional and infrastructural barriers to advance agro-processing adoption. Strengthening agricultural extension services should be a priority, enabling farmers to access practical, context-specific training that simplifies complex processing techniques and enhances market readiness. Access to affordable credit facilities through microfinance schemes or cooperative lending would further increase trialability by allowing smallholders to experiment without excessive financial risk. Investment in rural infrastructure, especially reliable electricity and better road networks, would reduce operational costs and improve supply-chain efficiency. Establishing community-based or cooperative processing centres would create shared learning environments, enhancing both compatibility and observability within the diffusion process. Finally, integrating digital information platforms and local knowledge hubs could expand communication channels, accelerate learning, and connect farmers to new technologies and markets, thereby supporting a broader and more sustainable diffusion of agro-processing innovations.

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## CHAPTER FIVE

### Exploring Resource Access and Decision-Making Drivers for Agro-Processing Among Smallholder Crop Farmers

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#### ABSTRACT

Smallholder farmers in South Africa face numerous challenges in engaging in agro-processing activities, which can significantly contribute to food security and rural development. This study aimed to identify factors influencing smallholder farmers' participation in agro-processing industries in the uMshwathi Local Municipality, KwaZulu-Natal. A mixed-methods approach was employed, combining structured surveys (n=30), semi-structured interviews (n=10), and focus group discussions (n=2) with purposively selected smallholder crop farmers. Quantitative data were analysed using descriptive statistics and non-parametric tests, while qualitative data underwent thematic analysis. The Sustainable Livelihoods Framework guided the interpretation of findings. Results revealed that resource access was severely constrained, with 90% of respondents lacking access to agro-processing equipment and 86.7% having no credit access. Infrastructure was rated as "fair" by 56.7% and "poor" by 23.3%. Training reach was relatively high (70%), but qualitative insights suggested it was often informal and inconsistent. Key factors influencing participation were institutional (government support and extension services, each cited by 56.7%), economic (income, market access, profitability, each over 50%), and social (gender, 40%; household size, 36.7%). Challenges included financial exclusion, technology deficits, and fragmented institutional structures. The study concludes that unlocking smallholder agro-processing potential requires interventions that synergistically strengthen multiple livelihood capitals, particularly through improved infrastructure, tailored financial products, and integrated support services. Policy recommendations include subsidising equipment access, investing in rural infrastructure, and designing gender-responsive programs. Future research should explore the impact of collective action and digital solutions on agro-processing participation.

**Keywords:** Smallholder Farmers, Agro-Processing, Food security, Decision-making, Resource Access, Sustainable Livelihoods

### **5.1. Introduction and Contextualisation**

Smallholder farming plays a crucial role in South Africa's agricultural sector, contributing significantly to food security and rural livelihoods. These farmers typically cultivate small plots of land, often less than two hectares, and rely primarily on family labour for production. Despite their importance, smallholder farmers in South Africa face numerous challenges, including limited access to resources, markets, and technology, which hinder their ability to engage in value-added activities such as agro-processing (Mazenda et al., 2022).

Muimba-Konkolongo (2018) states that smallholder farmers in South Africa also grapple with issues such as climate change, land tenure insecurity, and inadequate infrastructure, which further complicate their efforts to improve productivity and profitability. Despite these challenges, there is growing recognition of the potential for smallholder agriculture to drive rural development and reduce poverty, leading to various government initiatives and support programs aimed at empowering these farmers. The diversity of smallholder farming systems in South Africa reflects the country's varied agroecological zones and socio-economic conditions. While some smallholders focus on subsistence farming, others have managed to transition to semi-commercial or fully commercial operations, particularly in high-value crop sectors such as horticulture and viticulture. This highlights the need for tailored interventions and policies that address the specific needs and aspirations of different types of smallholder farmers across the country (Carelsen et al., 2021).

As per Lartey (2024), agro-processing plays a crucial role in enhancing food security for smallholder farmers in South Africa by adding value to their agricultural products and extending their shelf life. By transforming raw agricultural commodities into processed food items, smallholders can reduce post-harvest losses, increase their income potential, and create new market opportunities. Furthermore, the development of local agro-processing facilities can stimulate rural economies, create employment opportunities, and strengthen the link between agriculture and other sectors of the economy, contributing to overall food security and rural development (Habiyaremye and Mupela, 2019).

Developing agro-processing capabilities can also enhance smallholders' resilience to market fluctuations and climate-related challenges. By diversifying their product offerings and accessing new markets, farmers can reduce their vulnerability to price volatility and weather-dependent crop yields. Additionally, agro-processing can facilitate the integration of smallholder farmers into larger value chains, potentially leading to improved access to finance, technology, and knowledge transfer opportunities (Badiane et al., 2022). To fully harness the potential of agro-processing for food security, it is essential to address barriers such as limited access to infrastructure, technology, and skills training. Targeted investments in rural infrastructure, capacity-building programs, and supportive policies can help smallholder farmers overcome these challenges and participate more effectively in agro-processing activities (Mthombeni et al., 2022).

The uMshwathi local municipality, located in KwaZulu-Natal, South Africa, provides an interesting case study for examining the potential of agro-processing in rural areas. This municipality, characterised by its agricultural landscape and predominantly rural population, faces many of the challenges typical of smallholder farming communities. Exploring the implementation of agro-processing initiatives in uMshwathi could offer valuable insights into the practical application of these strategies for enhancing food security and rural development. The uMshwathi local municipality's agricultural sector presents unique opportunities for implementing agro-processing initiatives tailored to the needs of smallholder farmers. By focusing on locally relevant crops and traditional farming practices, these initiatives could create value-added products that reflect the region's cultural heritage while improving economic outcomes for rural communities (Ogwu, 2023). Collaboration between local government, agricultural extension services, and community organisations could be key to developing successful agro-processing programs in uMshwathi. Such partnerships could facilitate knowledge sharing, resource pooling, and the creation of inclusive value chains that benefit smallholder farmers and promote sustainable rural development in the region (Ngaka and Zwane, 2018).

Smallholder farmers in uMshwathi often face numerous challenges when attempting to engage in agro-processing activities. These obstacles may include limited access to processing facilities, inadequate technical knowledge, and insufficient financial resources to invest in necessary equipment (Mmbengwa et al., 2020). Additionally, smallholder farmers may struggle with meeting quality standards, packaging requirements, and market regulations, which can hinder their ability to effectively participate in and benefit from agro-processing initiatives (Touch et al., 2024).

The lack of comprehensive research on the specific factors influencing smallholder farmers' participation in agro-processing activities in uMshwathi presents a significant knowledge gap. Understanding these factors is crucial for developing targeted interventions and policies to support smallholder farmers' engagement in value-added activities. By identifying and addressing the key barriers and enablers, policymakers and stakeholders can design more effective strategies to enhance smallholder farmers' participation in agro-processing and improve their economic outcomes.

## **5.2. Theoretical Framework**

People's livelihoods, especially those in developing countries, may be understood and analysed using the Sustainable Livelihoods Framework (SLF). This framework is ideal for this study as it aims to assess the challenges faced by smallholder farmers in accessing resources required for agro-processing as well as to explore the factors that influence the decision-making process of smallholder farmers to engage in agro-processing activities in the uMshwathi local municipality. SLF aids in determining people's assets, resources, and methods of earning a living and the variables affecting their capacity to establish sustainable livelihoods (Serrat and Serrat, 2017). Applying SLF to this study allows for greater comprehension of the environmental, social, and economic factors influencing smallholder farmers' livelihoods. The creation of focused initiatives that promote sustainable agro-processing methods and enhance the welfare of rural communities may then be guided by this information.

### *5.2.1. Characteristics of the Innovation*

As per DFID (1999), the Sustainable Livelihoods Framework (SLF) emphasises the significance of understanding the assets, strategies, and contextual factors that influence livelihoods (Natarajan et al., 2022). In the current study, agro-processing activities are examined through the lens of the SLF to assess their impact on smallholder farmers' livelihoods and food security. The framework's core components, including livelihood assets, the vulnerability context, and institutional influences, are pivotal in analysing how agro-processing enhances farmers' resilience and income diversification in the uMshwathi local municipality. By focusing on the interplay between these elements, the SLF provides a comprehensive approach to evaluating the sustainability and effectiveness of agro-processing initiatives in improving rural livelihoods.

### *5.2.2. Livelihood Assets*

The SLF emphasises the importance of various livelihood assets in shaping the outcomes of agro-processing activities (Singh et al., 2021). In the current study, smallholder farmers' engagement in agro-processing can be influenced by their access to five types of assets: human, natural, financial, physical, and social capital. The framework allows for an analysis of how these assets enable or constrain farmers in adopting agro-processing activities. For instance, the availability of human capital, in terms of skills and training, may determine the level of involvement in value-addition processes, while access to financial capital influences investment in necessary infrastructure.

### *5.2.3. Vulnerability Context*

A crucial aspect of the SLF is the vulnerability context, which examines the external risks and stresses that impact livelihoods (Tambe, 2022). In this study, the vulnerability context allows for an exploration of how external factors such as market fluctuations, climate change, and policy shifts affect the feasibility and sustainability of agro-processing activities. By considering these contextual factors, the study aims to understand how agro-processing can serve as a strategy for mitigating risks and improving resilience to shocks, thereby enhancing food security in UMshwathi Local Municipality.

### *5.2.4. Transforming Structures and Processes*

The SLF also emphasises the role of transforming structures and processes, such as policies, institutions, and social networks, in shaping livelihood strategies (Natarajan et al., 2022). This framework enables an analysis of how government policies, institutional support, and social networks facilitate or hinder smallholder farmers' ability to engage in agro-processing. For example, the study explored how agricultural extension services, cooperative societies, and local markets influence decision-making processes regarding agro-processing participation.

### *5.2.5. Livelihood Strategies and Outcomes*

The SLF highlights that farmers adopt various livelihood strategies to achieve their goals, which may include agro-processing as a way to increase income and food security (Serrat and Serrat, 2017). By applying the SLF, this study will assess how smallholder farmers in uMshwathi use agro-processing as a strategy to diversify income sources and enhance their food security. The framework also allows for an examination of the outcomes of these strategies, such as improved income, better food access, and reduced vulnerability to economic or environmental shocks.

The Sustainable Livelihoods Framework provides a comprehensive and integrated approach to understanding the factors influencing smallholder farmers' participation in agro-processing activities in the uMshwathi local municipality. By incorporating key concepts from the SLF, this study aims to offer valuable insights into how livelihood assets, external vulnerabilities, and institutional processes intersect to shape the adoption of agro-processing and its impact on farmers' livelihoods and food security.

### **5.3. Methodology**

#### *5.3.1. Description of the Study Area*

Please refer to Chapter 3 for the detailed description of the study area.

### **5.4. Research Design**

#### *5.4.1. Mixed-methods approach*

This study adopts a mixed-methods research design, combining quantitative and qualitative approaches to assess the availability and accessibility of agro-processing resources and to explore the decision-making processes of smallholder crop farmers in the uMshwathi Local Municipality. This design allows for triangulation of findings, enhancing the validity and depth of the analysis (Ahmed et al., 2024).

#### *5.4.2. Sampling technique and sample size determination*

A purposive sampling technique was used to identify and recruit smallholder crop farmers who are actively engaged in agro-processing activities. Due to the limited number of such farmers within the study area, a total of 30 participants were identified and included in the study. While this sample size constrains the generalisability of the findings; it offers valuable, context-specific insights into a niche but critically important segment of the smallholder farming population (Lakens, 2022).

#### *5.4.3. Data collection methods (surveys, interviews, focus groups)*

Structured surveys were administered to all 30 participants to gather quantitative data on access to agro-processing resources, including land, finance, training, equipment, and market access. Semi-structured interviews were conducted with 10 purposively selected farmers from the survey sample to explore individual-level factors influencing their engagement in agro-processing, such as motivations,

institutional support, and perceived risks. Two focus group discussions (FGDs) were held, each comprising 5–7 participants, to capture collective perspectives and shared experiences that influence decision-making and participation in agro-processing at the community level.

## **5.5. Data analysis**

Given the study's mixed-methods design, data analysis was conducted using both quantitative and qualitative techniques to address the two research objectives in a complementary manner (Clark, 2017).

### *5.5.1. Quantitative Analysis*

Quantitative data obtained from the structured surveys were entered into IBM SPSS (Statistical Package for the Social Sciences) for analysis. Descriptive statistics (frequencies, means, and percentages) were used to summarise respondents' socio-demographic characteristics and the availability and accessibility of agro-processing resources such as finance, equipment, training, and market access. Given the small sample size ( $n=30$ ), non-parametric tests (e.g., Spearman's rank correlation) were applied to identify potential associations between key variables, such as the relationship between resource access and level of participation in agro-processing activities. The focus was on identifying patterns rather than statistical generalisations (Mustafy and Rahman, 2024).

### *5.5.2. Qualitative Analysis*

Qualitative data from semi-structured interviews and focus group discussions were transcribed verbatim and analysed using thematic analysis. An inductive coding approach was employed to identify recurring themes and patterns related to decision-making processes, perceived barriers, motivations, and institutional influences. Initial codes were generated manually and then categorised into broader themes using NVivo 15 software to ensure systematic organisation and traceability of themes across the dataset (Allsop et al., 2022). Triangulation between survey data, interviews, and FGDs was used to validate and enrich findings.

### *5.5.3. Integration of Data*

Findings from both strands were integrated during the interpretation phase using a convergent design, allowing for cross-validation of insights. Quantitative results provided an overview of resource access

and constraints, while qualitative findings contextualised and explained the underlying factors influencing participation in agro-processing.

## **5.6. Ethical Considerations**

The research adhered to ethical principles to ensure the protection and well-being of participants in line with the study's objectives. Informed consent was obtained from all smallholder farmers involved, ensuring they were fully informed about the purpose, procedures, and potential benefits of the study, particularly concerning the assessment of the challenges in accessing resources for agro-processing and the factors influencing their decision-making. Privacy and confidentiality were upheld, safeguarding participants' personal information. The study aimed to maximise the benefits by identifying practical strategies to address the challenges faced by farmers and explore factors that influence their decision to engage in agro-processing activities, while minimising any inconvenience or harm. Participants were selected through fair and equitable means, ensuring diverse representation. Data was collected and analysed with rigorous attention to accuracy and validity, ensuring that the findings truly reflect the challenges and decision-making processes of smallholder farmers in uMshwathi, KwaZulu-Natal. By maintaining these ethical considerations, the research will contribute valuable insights into improving agro-processing practices and informing interventions to enhance the livelihoods of smallholder farmers in the region.

## **5.7. Results and Discussions**

This chapter situates the study's findings within the Sustainable Livelihoods Framework (SLF) to explore how socio-economic characteristics, resource access, and institutional conditions shape smallholder farmers' engagement in agro-processing. The chapter deepens the analytical discussion by linking multiple livelihood capitals, financial, human, social, physical, and natural, to the observed adoption patterns. It also proposes policy and practical recommendations derived from the study's synthesis.

### *5.7.1. Socio-economic characteristics of smallholder farmers and implications for agro-processing participation*

Understanding the socio-economic characteristics of smallholder farmers, as shown in **Table 5.1**, is essential for identifying the constraints and opportunities that shape their participation in agro-processing industries (Khoza et al., 2019). These characteristics offer insight into farmers' access to

various forms of livelihood capital, particularly human, financial, social, and institutional, which are central to the Sustainable Livelihoods Framework (DFID, 1999).

**Table 5.1:** Socioeconomic Characteristics of Respondents

Category	Variable	Frequency (n)	Percent (%)
<b>Gender</b>	Male	7	23.3
	Female	23	76.7
<b>Educational Level</b>	Primary School	10	33.3
	Secondary School	12	40.0
	Vocational/Technical Training	3	10.0
	Other	5	16.7
<b>Farm Size</b>	Less than 1 Hectare	18	60.0
	More than 1 Hectare	11	36.7
	More than 2 Hectares	1	3.3
<b>Main Source of Income</b>	Government Grant	10	33.3
	Salary (employed)	2	6.7
	Farm Harvest	17	56.7
	Non-farm Business	1	3.3
<b>Access to Credit</b>	No	26	86.7
	Maybe	4	13.3
<b>Age</b>	Mean	56.43	-
	Median	58.00	-
	Mode	58	-
	Std. Deviation	7.210	-
	Range	26	-
<b>Family Size</b>	Mean	5.67	-
	Median	5.50	-
	Mode	2	-
	Std. Deviation	3.133	-
	Range	11	-
<b>Primary Crops Grown</b> <i>(Multiple Responses)</i>	Maize	20	66.7
	Cabbage	19	63.3
	Potatoes	18	60.0

	Spinach	17	56.7
	Dry Beans	17	56.7
	Taro	14	46.7
<b>Sources of Information</b> <i>(Multiple Responses)</i>	Workshops	19	63.3
	Extension Services	13	43.3
	Other	7	23.3

*a) Gender and Education: Human Capital Gaps*

The demographic profile shows a female-dominated respondent base (76.7%), indicating that women play a central role in smallholder agriculture in the study area. This aligns with broader trends across Sub-Saharan Africa where women comprise a significant proportion of the agricultural labour force, yet often face systemic barriers to resource access, training, and decision-making authority (Muzari, 2016; Rodgers and Akram-Lodhi, 2019). In the context of agro-processing, this gender imbalance could be both a constraint and an opportunity constraint due to gendered access to credit and land, and opportunities through the targeted design of gender-sensitive value addition programmes.

In terms of education, 40.0% had completed secondary school, while 33.3% had only primary education, and a further 10.0% had vocational or technical training. These figures suggest that while basic literacy is relatively widespread, technical training critical for the operation and maintenance of agro-processing equipment is lacking (Papier, 2021). Education is a vital dimension of human capital, and limited technical knowledge may inhibit innovation, mechanisation, and quality control in agro-processing systems (Gumbochuma, 2017).

*b) Age and Household Size: Labour Availability and Experience*

The mean age of respondents was 56.4 years, with a median and mode of 58, indicating an ageing farming population. While experience may confer advantages in terms of crop knowledge and traditional processing practices, older farmers may be less willing or able to adopt new technologies or to take on the entrepreneurial risks associated with agro-processing (Brown et al., 2019). This demographic ageing trend suggests that efforts to promote agro-processing should include capacity building that accommodates adult learning needs and intergenerational skill transfer. The average household size was 5.7, which may reflect the availability of family labour, a key input in both agricultural production and processing. In larger households, intra-family labour can be mobilised for value-adding activities, thus reducing operational costs and enhancing profitability. According to the

SLF, this labour constitutes social and human capital, both of which can be strategically leveraged if supported by enabling institutional conditions (Jiménez et al., 2022).

*c) Land Access and Farm Production: Physical and Financial Capital Constraints*

Regarding landholdings, 60.0% of farmers operated on less than 1 hectare, with only 3.3% farming more than 2 hectares. Such limited land access places significant constraints on economies of scale and the quantity of raw materials available for processing. Small-scale production may also limit investment in post-harvest handling and processing technologies. These findings point to constraints in physical capital, which can inhibit effective participation in value chains beyond the farm gate (Clark and Hobbs, 2018).

Crop production patterns reflect a diversity of staples and vegetables, with maize (66.7%), cabbage (63.3%), potatoes (60.0%), and spinach and dry beans (56.7%) being the most commonly cultivated. These crops are amenable to agro-processing through drying, canning, fermentation, and packaging, which presents untapped potential. However, without reliable infrastructure, training, and access to markets, this potential remains unrealised. A diversified crop base, as seen here, represents a strong foundation for agro-processing development, provided other capitals are mobilised effectively (Shaheen et al., 2019).

*d) Income Sources and Credit Access: Financial Capital Vulnerabilities*

The main source of income for most respondents (56.7%) was farm harvest, with one-third (33.3%) dependent on government grants, and only 6.7% earning a salary. This income structure reflects a heavy reliance on agriculture for livelihood security. While dependence on farm income suggests high exposure to agricultural shocks, it also means that improvements in agro-processing could directly enhance household income (Ogundeji et al., 2018). However, this requires enabling financial capital, which remains scarce: 86.7% of respondents reported no access to credit, a barrier that significantly impedes investment in value-adding equipment or market expansion. The lack of credit access further underscores the critical need for institutional mechanisms that can provide affordable finance tailored to the needs and cycles of smallholder agro-processors (McCoy et al., 2021). Without these, farmers remain locked in low-value primary production systems.

#### *e) Information Sources: Institutional Capital and Knowledge Flows*

In terms of knowledge access, 63.3% of respondents cited workshops, and 43.3% relied on extension services. This indicates that institutional capital is present but perhaps underutilised or insufficiently integrated. Strengthening the link between extension services and training in agro-processing could improve awareness, technical competence, and ultimately participation. These services are not just vehicles for knowledge; they represent institutional capital that can build trust, reduce risk, and enhance innovation in rural food systems (Mmbengwa et al., 2020; Manasoe et al., 2024).

#### *f) Implications for Agro-Processing Participation*

Taken together, the socio-economic profile reveals a population that is resource-constrained but holds latent potential for agro-processing engagement. Women dominate the sector but face gendered structural barriers; farmers are experienced but ageing; farms are small but diversified, and most depend on agriculture but lack access to financial instruments and formal training. In SLF terms, financial and physical capitals are weak, while human, social, and institutional capitals are unevenly distributed. Unlocking the potential of smallholder agro-processing requires holistic interventions that strengthen these capitals simultaneously, especially through inclusive finance, targeted technical training, and integrated extension systems (Thandisa and Urban, 2018; Khoza et al., 2018).

#### *5.7.2. Availability and accessibility of resources for agro-processing*

Sub-objective 1 of this study sought to assess the availability and accessibility of resources required for smallholder farmers to engage in agro-processing. The data from **Table 5.2** (survey responses) and **Table 5.3** (focus group insights) jointly highlight a constrained and uneven landscape in which resource-related barriers significantly limit smallholder participation in agro-processing value chains. These findings reinforce the broader assertion in the Sustainable Livelihoods Framework (DFID, 1999; Mumuni and Oladele, 2016) that access to livelihood capitals, particularly physical, financial, human, and institutional, is essential for enabling value-added rural enterprise.

**Table 5.2:** Availability and Accessibility of Resources for Agro-processing: Farmer Survey Responses

<b>Category</b>	<b>Response</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>Availability of Equipment</b>	Yes	3	10.0
	Not sure	27	90.0
	<b>Total</b>	<b>30</b>	<b>100.0</b>
<b>State of Infrastructure Support</b>	Good	6	20.0
	Fair	17	56.7
	Poor	7	23.3
	<b>Total</b>	<b>30</b>	<b>100.0</b>
<b>Agro-processing Training Received</b>	Yes	21	70.0
	No	7	23.3
	Not sure	2	6.7
	<b>Total</b>	<b>30</b>	<b>100.0</b>
<b>Market Access</b>	Easily Accessible	4	13.3
	Moderate Accessible	8	26.7
	Limited Access	12	40.0
	Not Access at All	6	20.0
	<b>Total</b>	<b>30</b>	<b>100.0</b>

The quantitative data in **Table 5.2** reveal that 90% of respondents were unsure whether agro-processing equipment was available, and only 10% confirmed access. This indicates an acute scarcity or invisibility of processing tools such as dryers, mills, sealers, or fermenters in local production systems. Such gaps in physical capital are corroborated by the focus group findings (**Table 5.3**), where farmers cited high equipment costs, dependency on manual processing, and gendered access to machinery as key deterrents to participation. These findings echo previous studies highlighting the prohibitive capital intensity of agro-processing for smallholders (Snyder and Sulle, 2022). Furthermore, while 56.7% of respondents described infrastructure support as "fair," only 20% considered it "good," and 23.3% rated it "poor." This suggests that while basic infrastructure may exist, it is not sufficient to support post-harvest handling, storage, or value addition at scale. Focus group participants also noted the lack of developed irrigation systems and the degradation of water sources, despite proximity to major dams such as Hazelmere and Albert Falls. These observations reflect broader challenges in rural Africa where weak infrastructure undermines productivity and discourages investment in downstream processing (Akinshipe and Aigbaybo, 2020).

**Table 5.3:** Constraints to Access and Availability of Agro-processing Resources: Themes, Codes, and Contextualised Descriptions

<b>Theme</b>	<b>Code</b>	<b>Contextualized Description</b>
<b>1. Uneven Access to Land and Water Resources</b>	Insecure access to arable land	Communal and tribal tenure systems limit land ownership, discouraging long-term investment in agro-processing.
	Fragmented landholding patterns	Small, scattered plots reduce the potential for economies of scale needed for processing.
	Limited irrigation infrastructure	Lack of developed irrigation despite proximity to major water sources (e.g., Albert Falls, Hazelmere Dams).
	Water insecurity due to climatic variability	Erratic rainfall and frequent droughts reduce water reliability for consistent agro-processing inputs.
	Ecological pressure on water sources	Overexploitation and poor conservation undermine the sustainability of rivers and dams.
<b>2. Constrained Access to Finance and Credit</b>	Exclusion from formal credit markets	Lack of collateral, documentation, and financial literacy hinders access to commercial finance.
	Dependence on social Grants	High reliance on government support does not enable capital investment in value addition.
	Limited awareness of financing mechanisms	Weak extension systems and language barriers (isiZulu dominance) restrict knowledge of funding opportunities.
	Barriers to complex loan processes	Existing loan procedures are inaccessible due to high interest rates and administrative demands.
	Use of informal saving mechanisms	Farmers rely on Stokvel's or family networks, which are insufficient for agro-processing investment.
	<b>3. Technology Deficits and Low Mechanisation</b>	Lack of agro-processing equipment
High cost of machinery		Capital-intensive technologies are unaffordable for most rural farmers.

	Low technical training and skills	Limited formal education and isiZulu language dominance reduce the uptake of agro-processing technology.
	Dependence on traditional/manual methods	Processing is predominantly manual, limiting productivity and scalability.
	Gendered access to equipment	Women who dominate subsistence agriculture face additional cultural and financial barriers to accessing technology.
<b>4. Weak Institutional and Support Structures</b>	Under-resourced extension services	Agricultural extension is sparse, irregular, and often not tailored to processing needs.
	Reliance on informal knowledge systems	Farmers primarily depend on traditional practices or peer learning rather than technical training.
	Lack of agro-processing policy guidance	Poor awareness of or alignment with national initiatives like the Agro-processing Master Plan.
	Fragmented stakeholder coordination	Poor coordination between the local government, tribal authorities, NGOs, and market actors.
	Barriers to accessing market information	Infrastructure, literacy, and language issues hinder access to market prices, demand data, and value chains.

*a) Human Capital: Training Access and Skills Gaps*

On a more positive note, 70% of farmers reported receiving agro-processing training, suggesting modest investment in building human capital. However, focus group narratives revealed that training was often informal or inconsistent, with a heavy reliance on peer learning and traditional knowledge systems. Moreover, the dominance of the isiZulu language and low technical education were cited as barriers to effective training uptake, especially regarding complex processing technologies. These findings are consistent with the literature, which emphasises that capacity-building efforts must be contextualised, linguistically accessible, and aligned with local value chains to be effective (Baiyegunhi, 2024). The disconnect between formal training and practical adoption suggests a gap between knowledge transmission and empowerment, pointing to a need for more robust, decentralised extension models.

*b) Financial Capital: Credit Inaccessibility and Grant Dependence*

Access to finance was a recurring barrier across both datasets. While **Table 5.2** does not explicitly address finance, earlier demographic results revealed that 86.7% of respondents lacked access to credit, and this was reinforced in **Table 5.3** under the theme “Constrained Access to Finance and Credit.” Focus group participants highlighted exclusion from formal credit markets due to lack of collateral, financial literacy, and documentation factors commonly identified in rural finance studies (Yeung et al., 2017). Many relied on government grants or informal savings groups, such as stokvels, which are insufficient for the capital demands of agro-processing. The SLF frames such barriers as weak financial capital, which inhibits households from converting available natural or human resources into sustainable livelihoods. Without access to affordable, farmer-friendly credit systems, smallholders remain locked in low-return production cycles and are unable to upgrade or scale operations (Serrat and Serrat, 2017; Tambe, 2022; Natarajan et al., 2022).

*c) Institutional Capital: Extension Gaps and Fragmented Governance*

Institutional barriers were evident in both the survey and qualitative results. While extension services were acknowledged as present (43.3%), focus group participants characterised them as under-resourced, irregular, and poorly targeted toward processing needs. The absence of a clear agro-processing policy framework or alignment with initiatives like the Agro-Processing Master Plan further diminishes the coherence and impact of institutional support. Participants also described fragmented coordination between stakeholders, including local municipalities, tribal authorities, NGOs, and market actors. This institutional fragmentation undermines trust, knowledge diffusion, and market integration, all of which are essential to effective value-chain participation (Kilelu et al., 2017). Moreover, barriers to market information driven by language, infrastructure, and literacy issues limit farmers’ ability to respond to demand patterns or pricing signals. These findings highlight weaknesses in institutional capital and echo the importance of designing inclusive governance systems for smallholder-driven agro-industrial development (Kayamo and Tebeka, 2021).

*d) Synthesis: Converging Quantitative and Qualitative Evidence*

Together, the findings from **Table 5.2** and the focus groups offer a coherent narrative: while there is interest and basic exposure to agro-processing, resource constraints across multiple livelihood capitals inhibit meaningful participation. Equipment is scarce, infrastructure is suboptimal, finance is inaccessible, and training is fragmented.

These constraints are mutually reinforcing, creating structural barriers that must be addressed through holistic, systems-level interventions (Thindisa and Urban, 2018; Khoza et al., 2018; Khoza et al., 2019). The alignment between quantitative and qualitative results strengthens the credibility of the findings and illustrates the value of mixed methods research in food systems analysis. Moreover, by applying the Sustainable Livelihoods Framework, the study provides a grounded understanding of why smallholder participation in agro-processing remains limited and offers a blueprint for targeting the most vulnerable entry points.

### 5.7.3. Factors influencing participation in agro-processing

To further understand the underlying dynamics influencing smallholder farmers' participation in agro-processing industries, a multiple-response analysis was conducted. This analysis provided insights into the frequency with which farmers identified various economic, social, and institutional factors as influencing their participation. The findings (which are shown in **Table 5.4**) were analysed through the lens of the Sustainable Livelihoods Framework (SLF), which highlights five key capitals: human, social, natural, financial, and physical, which shape livelihood strategies and outcomes (Jiménez et al., 2022).

**Table 5.4:** Factors Influencing Agro-processing Participation

Participation Frequencies		N	Responses Percent	Percent (%)
Factors influencing participation	Eco_income	16	10.7	53.3
	Eco_mktAccess	15	10.1	50.0
	Eco_Profitability	16	10.7	53.3
	Soc_Gender	12	8.1	40.0
	Soc_HHSize	11	7.4	36.7
	Soc_PostHarvest	16	10.7	53.3
	Instit_GovtSupport	17	11.4	56.7
	Instit_ExtnServ	17	11.4	56.7
	Instit_AccessToTraining	14	9.4	46.7
	Instit_Collaboration	15	10.1	50.0
Total		149	100.0	496.7

a. Dichotomy group tabulated at value 1.

#### *Institutional Capital as a Leading Enabler*

The most frequently cited factors influencing participation were institutional. *Government support* and *extension services* each accounted for 11.4% of total responses, being identified by 56.7% of the respondents.

This underscores the critical role that institutional capital plays in enabling or constraining engagement in agro-processing. The importance of extension services and government programmes is well-documented in rural development literature, with strong institutional support often cited as a prerequisite for transitioning smallholder farmers from subsistence production to more commercial and value-added activities (Chouhan et al., 2023; Mbatha, 2024). Closely linked to this was *access to training*, mentioned by 46.7% of respondents. Training represents an investment in human capital, equipping farmers with the knowledge and skills necessary to participate in more complex agro-processing chains (Amanah et al., 2021; Raidimi and Kabiti, 2019). These findings indicate that while institutional platforms exist, their effectiveness is significantly enhanced when they are coupled with relevant, context-specific training initiatives.

#### *a) Economic Factors as Foundational Drivers*

Three economic variables, *income*, *market access*, and *profitability*, were each cited by over 50% of respondents (53.3%, 50.0%, and 53.3%, respectively). These factors collectively represented 31.5% of total responses, highlighting the centrality of financial capital and economic viability in farmers' decisions to engage in agro-processing. This aligns with previous studies, which show that without sufficient income or clear profit incentives, smallholder farmers are unlikely to adopt risk-intensive strategies such as value addition (Mthombeni et al., 2021; Clark, 2020). Market access, while slightly less frequently cited, remains a crucial factor. Its role is closely linked with physical capital, particularly infrastructure such as roads, storage facilities, and processing units. Poor infrastructure in rural areas continues to impede farmers' ability to reach profitable markets or transport processed goods efficiently (Ndlovu and Masuku, 2021). The emphasis placed on profitability further underscores that agro-processing must be not only accessible but economically worthwhile for farmers to engage.

#### *b) Social Capital and Post-Harvest Considerations*

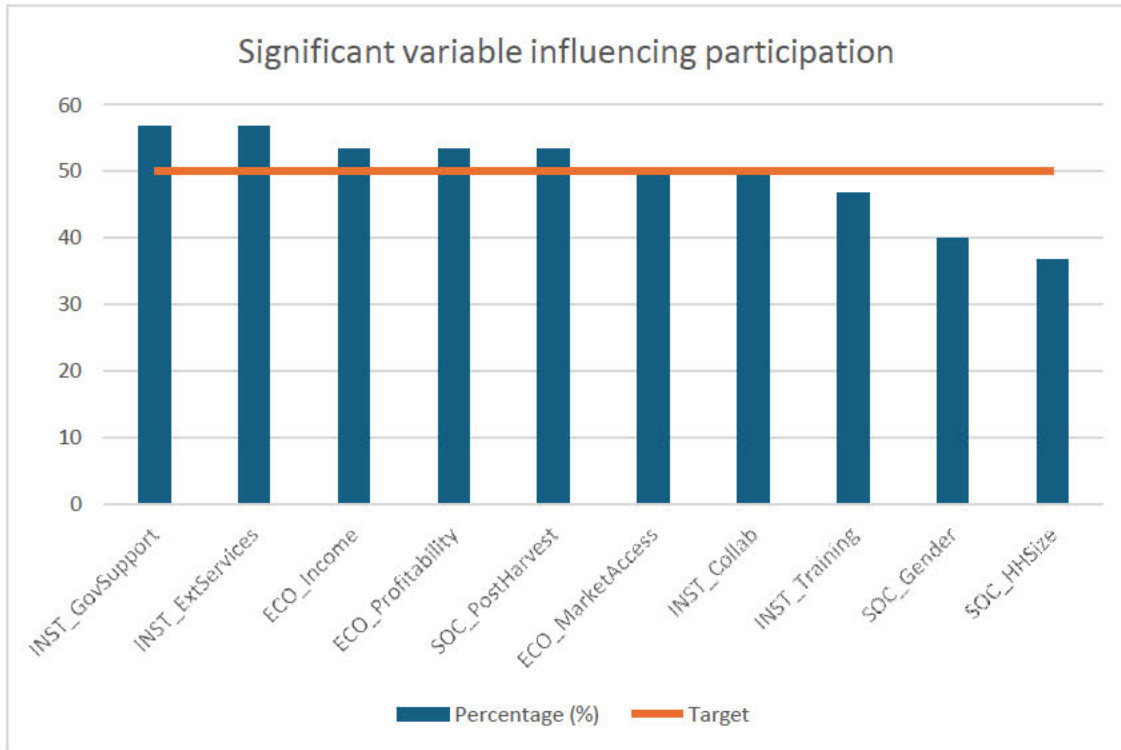
Among the social factors, *gender* and *household size* were identified by 40.0% and 36.7% of respondents, respectively. These findings suggest that social capital, in the form of gender roles and intra-household labour availability, significantly shapes participation. Previous research has shown that women often face constraints in accessing extension services and credit, limiting their involvement in value-added processing (Ugwu, 2019). Lusiba et al. (2017) add that household size can influence the availability of labour, which is particularly relevant for labour-intensive post-harvest and

processing activities. The prominence of post-harvest practices (identified by 53.3% of respondents) points to physical capital challenges related to storage, preservation, and transport. Inadequate post-harvest handling contributes to significant losses, reducing the quantity and quality of produce available for processing. These losses also disincentivise farmers from investing in processing equipment or partnerships. Thus, improving post-harvest infrastructure and techniques could serve as a direct lever to increase agro-processing engagement (Urugo et al., 2024; Mohamed et al., 2024).

*c) Emerging Themes: Interlinkages and the Need for Synergy*

A key theme emerging from the results is the interdependence of capitals: institutional support must be underpinned by appropriate training (human capital), financial incentives must be supported by market infrastructure (physical capital), and all of this must be accessed equitably across gender and household contexts (social capital). The Sustainable Livelihoods Framework highlights that the effectiveness of any one form of capital is contingent on access to and synergy with the others (Tambe, 2022). These findings underscore the need for multi-sectoral and integrated interventions. Policies that improve rural infrastructure, expand access to extension and training, and facilitate gender-responsive programming are likely to yield the greatest returns in terms of smallholder participation in agro-processing. Moreover, enabling farmer cooperatives or producer groups could strengthen social capital and promote collective engagement with markets and institutions (Raveena et al., 2024).

This section interprets the correlation results to the study's overall objective to identify factors influencing smallholder farmers' participation in agro-processing industries, and two sub-objectives, which are to assess the availability and accessibility of resources for agro-processing and to explore factors influencing the decision-making process for engagement.



**Figure 5.1:** Variables influencing agro-processing participation

**Figure 5.1** shows the variables that influence agro-processing participation amongst farmers, as per the study's findings. The analysis is framed using the Sustainable Livelihoods Framework (SLF), which conceptualises livelihoods as being shaped by access to five key types of capital: human, social, natural, physical, and financial (DFID, 1999). This framework provides a holistic lens through which to understand the structural and institutional constraints faced by rural farmers in leveraging agro-processing opportunities.

#### 5.7.4. General Correlation Trends in the Livelihood Context

The results in **Table 5.5** reveal a complex web of interactions between different livelihood capitals. Notably, a strong negative correlation was observed between farmer ID and both income ( $r = -0.56$ ) and post-harvest practices ( $r = -0.54$ ). These relationships suggest that farmers with lower financial capital (income) and poor post-harvest handling (indicative of weak physical capital) are less likely to identify with agro-processing activities. These findings reinforce existing literature suggesting that poverty and logistical constraints hinder value-chain upgrading for smallholders (Karatepe and Scherrer, 2024). The negative association between income and institutional collaboration ( $r = -0.40$ ),

as well as between training and collaboration ( $r = -0.40$ ), points to a concerning fragmentation within the social and institutional capital environment. This disconnect may limit access to collective action, joint investments, and shared knowledge, key facilitators of agro-processing participation (Ramoroka, 2019). The SLF emphasises that when institutional structures are poorly integrated, the ability of households to convert assets into viable livelihood strategies is severely weakened.

*a) Availability and Accessibility of Resources for Agro-Processing*

Sub-objective 1 focused on resource access, interpreted here as the availability of and access to the financial, institutional, and physical capital needed for agro-processing. The results indicate that economic income correlates modestly with household size ( $r = 0.16$ ) and gender ( $r = 0.22$ ), implying that financial capital accumulation is not uniform but varies across social dimensions. Larger households, often with surplus labour, may generate higher incomes or redistribute resources toward agro-enterprise investments (Toulmin, 2021). However, the weak correlation between market access and other enabling factors (e.g., extension services and training) suggests that even when markets exist, they may be inaccessible due to weak support systems or infrastructure, highlighting gaps in physical and institutional capital (Goodfellow, 2020).

Post-harvest practices, critical to agro-processing feasibility, exhibited a weak positive association with profitability ( $r = 0.06$ ) but were negatively correlated with government support ( $r = -0.28$ ) and extension services ( $r = -0.17$ ). This indicates a lack of coordinated efforts to reduce post-harvest losses, which are a major disincentive for smallholders considering agro-processing (Ogedengbe et al., 2022). The SLF suggests that without strengthening physical capital (storage, transport, processing technologies) and institutional capital (training, technical support), smallholders are unable to leverage surplus for value addition.

Additionally, gender exhibited positive correlations with institutional variables such as government support ( $r = 0.30$ ), extension services ( $r = 0.16$ ), and training ( $r = 0.05$ ), implying that gender dynamics mediate access to institutional capital.

While these correlations are not strong, they hint at emerging gender-responsive programming that may improve women's participation in agro-processing, a finding echoed in the literature on inclusive agricultural development (Quisumbing et al., 2021). However, more robust and intersectional approaches are needed to ensure equity and effectiveness.

### *b) Decision-Making Factors Influencing Agro-Processing Participation*

Sub-objective 2 examined the decision-making process, with findings interpreted through human, social, and financial capital lenses. A positive correlation between profitability and household size ( $r = 0.30$ ) suggests that larger households, possibly with more available labour and diversified income streams, may be more inclined to adopt agro-processing as a livelihood strategy. This aligns with broader findings by the Food and Agriculture Organisation (FAO, 2023), which reports that livelihood diversification, including income-earning activities both on and off the farm, is a common adaptive response to economic insecurity in sub-Saharan rural households. The FAO policy brief emphasises that households with greater labour capacity and resource diversity tend to generate higher income through value-added agricultural activities, supporting the theoretical proposition that agro-processing adoption is connected to household labour and income dynamics.

The negative correlations between institutional collaboration and both income and training reveal a fractured institutional environment where farmers may not be sufficiently engaged in knowledge-sharing platforms or cooperatives. According to the SLF, weak social capital constrains the flow of information and collective action, two critical drivers of effective agro-processing engagement (Serrat and Serrat, 2017). Furthermore, the minimal association between extension services and most economic or social variables suggests that these services are not well-integrated or targeted to support agro-processing transitions. Gender's positive correlations with institutional support reinforce its role as a cross-cutting variable influencing access to services that underpin informed decision-making. While women may have better access to some institutional programmes, the overall impact appears limited unless coupled with broader transformation of social norms and access to assets (Mudege et al., 2016).

### *c) Policy and Development Implications*

The findings underscore the need for multidimensional strategies to promote agro-processing participation. Interventions must address deficiencies in financial, physical, and institutional capital, especially through post-harvest infrastructure, inclusive training, and collaborative extension systems. Strengthening institutional synergies between government departments, NGOs, and farmer associations is crucial for converting livelihood assets into processing engagement. Moreover, recognising the gendered nature of asset access can help design more equitable and effective programmes.

Anchored in the Sustainable Livelihoods Framework, this study affirms that smallholder agro-processing participation is not solely a function of income or profitability, but an emergent outcome of well-aligned capitals: human, social, physical, financial, and institutional. Without such alignment, efforts to scale agro-processing among smallholders will likely fall short of desired food security and economic transformation outcomes.

**Table 5.5:** Correlation Trends amongst Economic, Social, and Institutional Factors Influencing SHFs' Participation in Agro-processing

<b>Variables</b>	<b>ID</b>	<b>ECO_Income</b>	<b>ECO_MarketAccess</b>	<b>ECO_Profitability</b>	<b>SOC_Gender</b>	<b>SOC_HHSize</b>	<b>SOC_PostHarvest</b>	<b>INST_GovSupport</b>	<b>INST_ExtServices</b>	<b>INST_Training</b>	<b>INST_Collab</b>
<b>ID</b>	1.00	-0.56	0.00	-0.19	-0.10	-0.25	-0.54	0.21	-0.14	-0.03	0.14
<b>ECO_Income</b>	-	1.00	-0.27	-0.07	0.22	0.16	0.20	-0.01	-0.14	0.21	-0.40
<b>ECO_MarketAccess</b>	-	-	1.00	0.00	0.14	0.07	0.13	-0.07	-0.07	-0.13	0.20
<b>ECO_Profitability</b>	-	-	-	1.00	-0.05	0.30	0.06	-0.14	-0.01	0.07	-0.13
<b>SOC_Gender</b>	-	-	-	-	1.00	-0.20	0.08	0.30	0.16	0.05	0.00
<b>SOC_HHSize</b>	-	-	-	-	-	1.00	0.16	-0.31	-0.17	0.12	-0.21
<b>SOC_PostHarvest</b>	-	-	-	-	-	-	1.00	-0.28	0.13	0.07	0.00
<b>INST_GovSupport</b>	-	-	-	-	-	-	-	1.00	0.05	-0.13	-0.20
<b>INST_ExtServices</b>	-	-	-	-	-	-	-	-	1.00	-0.26	0.07
<b>INST_Training</b>	-	-	-	-	-	-	-	-	-	1.00	-0.40
<b>INST_Collab</b>	-	-	-	-	-	-	-	-	-	-	1.00

### 5.7.5. Challenges and opportunities in agro-processing

The data depicted in **Table 5.6** emphasises significant systemic barriers that smallholder farmers face in accessing agro-processing opportunities, particularly regarding finance and equipment. Within the Sustainable Livelihoods Framework (SLF), this reflects deficits in financial capital, which includes credit, savings, and access to financial institutions (DFID, 1999). With 93.3% of respondents lacking access to credit or loans, farmers are unable to invest in essential agro-processing infrastructure or scale operations, perpetuating economic vulnerability. This absence of financial exclusion, according to von Loeper, Drimie and Blignaut (2018), directly limits the capacity of farmers to transition from subsistence to value-adding enterprises. In addition, Mthombeni et al. (2022) argue that smallholder farmers in South Africa face high costs and limited access to agro-processing technologies. Part of the physical capital domain of the SLF is severely constrained, with only 10% of respondents indicating any form of access. The absence of such assets hinders productivity and forces reliance on traditional methods that offer minimal return. These findings reflect structural deficits that restrict livelihood diversification and resilience, further entrenching poverty in rural contexts.

**Table 5.6: Barriers to Smallholder Farmers' Participation in Agro-Processing Activities**

<b>Access to financial resources</b>		
	<b>Frequency</b>	<b>Percent (%)</b>
Yes	0	0.0
No	28	93.3
Not sure	2	6.7
<b>Access to equipment</b>		
Yes	3	10.0
No	0	0.0
Not sure	27	90.0
<b>State of infrastructure</b>		
Good	6	20.0
Fair	17	56.7
Poor	7	23.3
<b>Support services available</b>		
Yes	0	0.0
No	16	53.3
Not Sure	14	46.7
<b>Total</b>	<b>30</b>	<b>100.0</b>

Infrastructure inadequacies compound these challenges, as only 20% of respondents rated their local infrastructure as “Good,” while the majority (56.7%) deemed it “Fair”, and 23.3% classified it as “Poor.” Poor roads, unreliable electricity, and limited water supply disrupt the ability to transport goods, sustain processing activities, and maintain market connections. Von Loeper et al. (2018) similarly note that infrastructure deficiencies in rural areas constrain smallholder farmers’ ability to engage with broader value chains and access profitable markets. The lack of support services further exacerbates these challenges. Within the SLF, these barriers point strongly to weaknesses in physical capital, specifically infrastructure and services necessary for supporting livelihoods. Inadequate physical infrastructure increases farmers’ vulnerability to external shocks and limits their ability to pursue alternative or improved livelihood strategies. Without reliable roads, power, and water, the viability and efficiency of agro-processing are severely compromised (Serrat and Serrat, 2017).

Over half of respondents (53.3%) reported no access to support services such as training or extension follow-ups, while 46.7% were unsure, indicating either a lack of awareness or an absence of available services. This finding reflects Pandey et al.'s (2024) observation that sustained support services are critical for equipping smallholder farmers with the technical knowledge and mentorship required to optimise agro-processing activities and overcome barriers to entry. This highlights a deficit in human capital within the SLF. Human capital encompasses education, training, and knowledge that enable individuals to pursue sustainable livelihoods. When extension services and technical support are lacking, farmers are deprived of the skills necessary to adopt new technologies or enhance production. This limits innovation and constrains long-term improvements in livelihood outcomes (Natarajan et al., 2022).

## **5.8. Conclusion and recommendations**

Using the Sustainable Livelihoods Framework (SLF), this chapter demonstrated that farmers’ engagement in agro-processing is determined by the interaction between socio-economic attributes and the availability of livelihood capitals. Gender, education, and cooperative membership were particularly influential, shaping both the nature and intensity of participation. Female farmers dominated less capital-intensive, home-based processing due to limited financial and physical capital, while better-educated and male farmers participated in semi-commercial ventures requiring more sophisticated management and equipment. The analysis confirmed that deficiencies in financial, institutional, and physical capital, such as poor infrastructure and minimal access to credit, restrict the transformative potential of agro-processing

as a livelihood diversification pathway. Conversely, farmers possessing multiple asset types and strong social networks displayed greater resilience and engagement, underscoring the interconnectedness of capitals within the SLF. The chapter concludes that enhancing these livelihood assets simultaneously is critical for building sustainable agro-processing enterprises and achieving inclusive rural development.

To promote inclusive and sustainable agro-processing participation, policy interventions must strengthen the multiple livelihood capitals that underpin farmers' resilience. Expanding access to financial capital through microcredit schemes and savings cooperatives would enable investment in processing equipment and inputs, while targeted training programs should enhance human capital by developing both technical and business management skills. Social capital can be strengthened through cooperative membership, mentorship networks, and producer associations that foster knowledge exchange and collective action. Investment in physical capital, electrification, transport infrastructure, and local processing hubs would lower production costs and create employment opportunities within rural communities. Furthermore, gender-responsive strategies must ensure that women have equal access to credit, training, and leadership opportunities, thus redressing structural inequalities. Improving market linkages through partnerships between processors, retailers, and government agencies will help secure stable outlets for processed goods and sustain economic viability. Finally, institutional coordination among local municipalities, NGOs, and agricultural departments should be enhanced to align support programs, reduce duplication, and ensure coherent implementation of agro-processing initiatives that contribute to food security and rural livelihoods.

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## CHAPTER SIX

### CONCLUSION AND RECOMMENDATIONS

#### 6.1. Conclusion

This study set out to investigate the factors influencing smallholder crop farmers' participation in agro-processing industries within the uMshwathi Local Municipality, KwaZulu-Natal. The research aimed to identify the types of agro-processing activities undertaken by smallholder farmers, evaluate their level of knowledge and awareness, assess their access to critical resources, and explore the decision-making factors shaping their participation in value-added agricultural practices.

Four central findings emerged from the study. Firstly, it was found that a majority (73.33%) of smallholder farmers in the study area were engaged in home-based agro-processing activities such as baking, juice-making, and mushroom drying. However, this engagement was predominantly informal and limited in scale. Secondly, while farmers exhibited moderate awareness of agro-processing and its potential benefits, their access to formal training and extension support remained inconsistent. Many relied heavily on informal knowledge systems, peer networks, and experiential learning due to a lack of structured support mechanisms.

Thirdly, the study revealed that access to essential resources such as credit, equipment, and infrastructure remains a critical barrier. An overwhelming 86.7% of respondents reported no access to credit facilities, and 90% lacked access to appropriate processing equipment. Poor infrastructure, including inadequate storage facilities, unreliable electricity, and limited transport options, further compounded the challenge of scaling up agro-processing activities. Lastly, despite these constraints, smallholder farmers demonstrated a strong understanding of the potential of agro-processing to generate income, improve food security, and reduce post-harvest losses. However, without sufficient institutional support, their capacity to transform awareness into sustainable action remains limited.

These findings confirm that the core problem is not a lack of motivation or interest among smallholder farmers, but rather structural and systemic barriers that hinder their participation in agro-processing industries. The study thus reinforces the need to shift from top-down, technocratic approaches toward farmer-centred development that acknowledges existing local innovations and strengthens the enabling environment for value chain participation.

Theoretically, this research contributes to the ongoing discourse on rural livelihoods and innovation diffusion by integrating the Sustainable Livelihoods Framework (SLF) and Innovation Diffusion Theory (IDT) in the analysis of smallholder participation in agro-processing. It provides empirical evidence of how different types of capital, particularly social, human, and financial, interact to influence innovation adoption in resource-constrained rural settings. Practically, the study offers a foundation for designing targeted interventions that support smallholders in overcoming participation barriers. These include improving access to finance, strengthening cooperative structures, expanding tailored training programs, and investing in rural infrastructure.

## **6.2. Study Limitations**

While the study successfully achieved its objectives, several limitations should be acknowledged as they define the scope and context of the findings. Firstly, the research was conducted within a single case study area, the uMshwathi Local Municipality, which, while representative of many rural communities in KwaZulu-Natal, limits the generalisability of the results to other provinces or national contexts. Secondly, the sample size of thirty participants, though suitable for an in-depth case study, restricted the ability to perform broader quantitative comparisons or statistical generalisations.

Data collection was also constrained by limited access to reliable records. Many farmers lacked formal documentation of production volumes, sales, or income, necessitating reliance on self-reported data, which may be subject to recall bias. Logistical challenges, including poor road conditions, long travel distances, and scheduling conflicts, occasionally hindered data collection and reduced the time available for follow-up interviews. Moreover, infrastructural issues such as electricity outages and weak internet connectivity posed additional obstacles to communication and fieldwork efficiency. Finally, due to time and financial limitations, the study did not include an in-depth value-chain analysis or long-term impact assessment of agro-processing activities. Future studies incorporating these dimensions could provide a more comprehensive understanding of how agro-processing influences household income, market integration, and community resilience over time.

## **6.3. Suggestions for Future Research**

Building on the insights and limitations of this study, several directions are proposed for future research. Firstly, future studies should adopt a comparative or multi-site approach, expanding beyond uMshwathi

to include other municipalities or provinces. This would enable cross-regional analysis and enhance understanding of how contextual differences as local governance structures, resource availability, and cultural practices, influence smallholder participation in agro-processing.

Secondly, researchers should consider longitudinal methodologies to examine how participation in agro-processing evolves over time and how changes in policy, infrastructure, or technology affect adoption rates and livelihood outcomes. This would provide valuable evidence on the sustainability and long-term impacts of agro-processing initiatives on income, employment, and food security. Thirdly, gender-focused research remains crucial, given that women constituted the majority of participants in this study. Future research should explore how gender dynamics, social norms, and intra-household decision-making processes shape the distribution of benefits from agro-processing and influence innovation adoption patterns.

Additionally, further research could investigate value-chain linkages and market integration, focusing on how smallholder farmers can be better connected to urban markets, retailers, and processors. Such analysis would deepen understanding of economic opportunities and identify entry points for policy and private-sector collaboration. Finally, the role of digital innovation and ICTs in supporting agro-processing development presents an emerging research frontier. Exploring how mobile technologies, digital training platforms, and e-commerce tools can enhance farmer participation and market access would add valuable insight to the discourse on modernising rural agro-processing systems.

#### **6.4. Recommendations**

To translate the study's insights into tangible change, a coordinated and inclusive approach among policymakers, smallholder communities, researchers, and development partners is essential. Policymakers should prioritise the development of agro-processing support policies that address the unique constraints faced by smallholders. This includes embedding smallholder-focused programs within municipal Integrated Development Plans (IDPs) and aligning them with national strategies such as the Agricultural and Agro-processing Master Plan (AAMP). Financial institutions should be encouraged to develop accessible, low-interest credit facilities tailored to the needs of rural processors.

At the community level, smallholder farmers should be encouraged to strengthen or form cooperatives that facilitate shared access to processing equipment, training, and markets. Such cooperative networks can promote economies of scale and collective bargaining power while creating platforms for peer-to-peer

learning. Academic and research institutions should expand participatory research partnerships with local farmers, exploring the long-term socio-economic and nutritional benefits of agro-processing participation.

Finally, NGOs and development partners can play a catalytic role by establishing rural agro-processing incubators and innovation hubs that provide technical support, mentorship, and seed funding for youth- and women-led enterprises. When supported through these collaborative efforts, smallholder farmers can move beyond subsistence and become central actors in driving rural industrialisation, enhancing food security, and strengthening South Africa's agricultural economy.

## APPENDICES

### Appendix A: Structured Questionnaire

#### Factors Influencing Participation of Smallholder Farmers in Agro-processing Industries: A Case Study of uMshwati Local Municipality

**OBJECTIVE 1: Identifying the agro-processing activities carried out by smallholder farmers in the area.**

#### 1. Demographic Information

Name and surname .....

##### 1.1. Age:

1	2	3	4	5
18-25	26-35	36-45	46-55	56 and above

##### 1.2. Gender:

1	2	3
Male	Female	Other (please specify)

##### 1.3. Ethnicity:

1	2	3	4
Black	White	Indian	Asian

##### 1.4. Marital status:

1	2	3	4
Never married	Married	Divorced	Widowed

**1.5. Location/ Ward:**

1

**1.6. Educational Background:**

1	2	3	4	5
Primary School	Secondary School	Vocational/Technical Training	College/University	Other (please specify)

**1.7. Occupation:**

1	2	3	4	5
Farmer	Student	Employee	Entrepreneur	Other (please specify)

**1.8. Family Size:**

1	2	3
1-3 members	4-6 members	7 or more members

**1.9. Farm Size:**

1	2	3
Small (less than 0.4047)	Medium (0.4047-2.0235)	Large (2.02.5 or more)

**1.10. Main income source:**

1	2	3	4	5	6
Government grant (any type)	Remittances (gift)	Salary (employed)	Farm harvest	Non-farm business	Other (Specify)

**1.11. Are you a member of an agricultural co-operation?**

1	2
Yes	No

1.12. If yes, please give its name(s):

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**2. General Information**

**2.1. Type of Crops Grown:**

2.1.1. Are the main crops that you cultivate in this area limited to specific types?

1	2	3
Yes	No	Not sure

2.1.2. Please specify the primary crops that you grow and their cultivation practices.

Crops	Practices

**2.2. On-Farm Processing Practices:**

2.2.1. Do you engage in on-farm processing activities?

1	2	3
Yes	No	Not sure

2.2. If any, please identify:

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**2.3. Off-Farm Processing Facilities:**

2.3.1. Are there external facilities that you use for crop processing?

1	2	3
Yes	No	Not sure

2.3.2. If any, please identify:

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**3. Processing Details**

**3.1. Processing Equipment:**

3.1.1. Do you use specific types of processing equipment, both on-farm and at external facilities?

1	2	3
Yes	No	Not sure

3.1.2. If any, please identify:

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**2. Volume of Processed Output:**

3.2.1. Is there data available on the annual quantities of crops that you process?

1	2	3
Yes	No	Not sure

3.2.2. If any, please identify:

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**3.3. Value-Added Products:**

3.3.1. Do value-added products result from the agro-processing activities that you participate in?

1	2	3
Yes	No	Not sure

3.3.2. If any, please identify:

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**4. Market and Challenges**

**4.1. Market Channels:**

4.1.1. Do you primarily use specific market channels for processed products?

1	2	3
Yes	No	Not sure

1.2. If any, please identify:

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**4.2. Challenges Faced:**

4.2.1. Do you encounter challenges in agro-processing?

1	2	3
Yes	No	Not sure

4.2.2. If any, please identify:

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**5. Support Services and Market Demand**

**5.1. Support Services:**

5.1.1. Are support services available to aid smallholder farmers in agro-processing?

1	2	3
Yes	No	Not sure

5.1.2. If any, please identify

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**2. Market Demand:**

5.2.1. Can you assess the trends and local market demand for processed agricultural products?

1	2	3
Yes	No	Not sure

5.2.2. If any, please identify:

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**OBJECTIVE 2: Determining the level of knowledge and awareness about agro-processing and its potential benefits.**

**1. Agro-processing familiarity:**

1.1 I am familiar with the term "agro-processing."

1	2	3
Yes	No	Not sure

**2. Knowledge of Common Agro-Processing Methods:**

2.1. I can name and describe common agro-processing methods.

1	2	3
Yes	No	Not sure

2.2.

2.3. If any, please name and describe.

Agro-processing method	Description

**3. Awareness, Perceived Benefits of Agro-Processing:**

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I believe agro-processing can increase income.					
I believe agro-processing adds value to agricultural products.					
I believe agro-processing enhances market access for farmers.					

**4. Sources of Information (please tick):**

1	2	3	4
Workshops and training sessions	Extension services	Online sources	Other (please specify)

**5. Barriers to Knowledge and Awareness:**

1	2	3	4
Limited access to information	Lack of awareness programs	Time constraints	Other (please specify)

**6. Perceived Economic Impact:**

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I believe engaging in agro-processing activities has a positive economic impact.					
I do not believe engaging in agroprocessing activities has a positive economic impact.					

**7. Level of Interest in Agro-Processing:**

1	2	3	4	5
Very interested	Somewhat interested	Neutral	Not very interested	Not interested at all

**8. Participation in Training Programs:**

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have participated in agro-processing training programs or workshops.					
I have not participated in any agroprocessing training programs or workshops.					

**8.1. I am currently involved in agro-processing activities.**

1	2	3
Yes	No	Not sure

8.2. If previously involved but no longer are, what are the reasons for non-participation?

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**9. Perceived Challenges (please tick):**

1	2	3	4
Limited access to resources (equipment, facilities, financial support)	Lack of technical knowledge	Market uncertainties	Other (please specify)

**OBJECTIVE 3: To assess the challenges faced by smallholder farmers in accessing resources required for agro-processing activities.**

**1. Access to Financial Resources:**

1.1. Do you have access to funds for purchasing agro-processing equipment or facilities?

1	2	3
Yes	No	Not sure

**2. Availability of Processing Equipment:**

2.1. Is there agro-processing equipment available to you?

1	2	3
Yes, in good condition	. Yes, in poor condition	No

### 3. State of Infrastructure and Support:

3.1. How would you rate the state of infrastructure, such as roads and transportation, affecting resource access for you?

1	2	3
Good	Fair	Poor

### 4. Level of Training and Skill Development:

4.1. Have you received any training related to agro-processing?

1	2	3
Yes	No	Not sure

4.2. To what extent have you received training in agro-processing?

1	2	3	4
High level	Moderate level	Low level	No training

### 5. Access to Markets:

5.1. How easily can you access markets for their processed products?

1	2	3	4
Very easily	Moderately easily	Not easily	Not at all

### 6. Challenges in Obtaining Raw Materials:

6.1. Do you face any challenge in obtaining the necessary raw materials for agro-processing?

1	2	3
Yes	No	Not sure

**7. Government Support Programs:**

7.1. Are there any government initiatives or support programs available to you for agroprocessing?

1	2	3
Yes	No	Not sure

7.2. If there are any, please name identify:

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**8. Existence and Effectiveness Cooperative or Community Support:**

8.1. Is there cooperative effort or community support in place to aid you in resource access for agro-processing?

1	2	3
Yes, and it is effective	Yes, but it is not effective	No

**9. Technological Challenges/ Barriers:**

9.1. Are there technological barriers hindering your access to resources for agro-processing?

1	2	3
Yes	No	Not sure

**10. Regulatory Barriers/constraints**

10.1. Do you face regulatory constraints or bureaucratic challenges in accessing resources for agro-processing?

1	2	3
Yes	No	Not sure

**OBJECTIVE 4: Exploring the factors that influence the decision-making process of smallholder farmers to engage in agro-processing activities**

**1. Types of crops cultivated (if any):**

1	2	3	4	5
Cereals (e.g., wheat, maize)	Pulses (e.g., lentils, chickpeas)	Fruits	Vegetables	Other (please specify)

**2. Scale of Agricultural Activities:**

1	2	3
Subsistence farming	Small-scale commercial farming	Large-scale commercial farming

**3. Economic Factors**

**3.1. Financial Resources:**

3.1.1. How would you describe your financial stability? (please tick)

1	2	3
Stable	Moderately stable	Unstable

**3.2. Access to Credit:**

3.2.1. Do you have access to credit for agricultural activities?

1	2	3
Yes	No	Not sure

#### 4. Market Access

##### 4.1. Market Opportunities:

4.1.1. What market opportunities exist for your agro-processed products?

1	2	3
Local markets	Regional markets	Export markets

#### 5. Technological Awareness:

5.1. Are you aware of and have access to relevant agro-processing technologies?

1	2	3
Yes	No	Not sure

#### 6. Support Services:

6.1. Are there support services available to you for agro-processing?

1	2	3
Yes	No	Not sure

6.2. If any, please identify:

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#### 7. Social and Cultural Factors:

7.1. How do social and cultural aspects influence your decisions regarding agro-processing?

1	2	3
Strongly influence	Moderately influence	Do not influence

**8. Barriers and Challenges:**

8.1. Are there any perceived barriers or challenges that may hinder or influence your decision to engage in agro-processing?

1	2	3
Yes	No	Not sure

8.2. If there are, please explain further.

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**Thank you for your participation!**

## **Appendix B: Focus Group Discussion Guide**

### **Focus Group Guide: Smallholder Agro-Processing Research**

#### **Objective 1: Identifying Agro-Processing Activities**

**1. Introduction (5 mins):**

- 1.1. Welcome participants and express gratitude.
- 1.2. Briefly explain the purpose of the focus group: to understand agro-processing activities among smallholder crop farmers.

**2. Icebreaker (3 mins):**

- 2.1. Ask participants to introduce themselves and briefly share their experiences in agriculture.

**3. Main Questions:**

- 3.1. What agro-processing activities do you currently engage in on your farm?
- 3.2. Can you describe any specific methods or techniques used in on-farm processing?
- 3.3. Are there external facilities, like mills or cooperatives, where you process your crops?

#### **Objective 2: Determining Knowledge and Awareness**

**1. Icebreaker (3 mins):**

- 1.1. Ask participants about their general understanding of agro-processing.

**2. Main Questions:**

- 2.1. How would you define agro-processing?
- 2.2. What common agro-processing methods do you know?
- 2.3. What benefits do you associate with agro-processing?

### **Objective 3: Assessing Resource Access Challenges**

#### **1. Icebreaker (3 mins):**

1.1 Ask participants to share any difficulties they encounter in agro-processing.

#### **2. Main Questions:**

2.1 How do you access financial resources for agro-processing equipment?

2.2 Are there challenges in obtaining necessary raw materials for agro-processing?

2.3 What external factors affect your access to processing facilities?

### **Objective 4: Exploring Decision-Making Factors**

#### **1. Icebreaker (3 mins):**

1.1. Ask participants to share their motivations for getting involved in agro-processing.

#### **2. Main Questions:**

2.1. How do economic factors, such as income and access to credit, influence your decision to engage in agro-processing?

2.2. What role do social and cultural factors play in your decision-making regarding agroprocessing?

2.3. Are there any barriers or challenges that affect your decision to engage in agro-processing?

#### **3. Closing (2 mins):**

Thank participants for their valuable input and insights.

**Appendix C: Key Informant Semi-Structured Questionnaire**

**Key Informant Semi-Structured Questionnaire: Smallholder Agro-Processing Research**

**Introduction:**

Thank you for participating in this key informant interview. Your insights are crucial for understanding smallholder agro-processing. Please feel free to provide detailed responses.

**Section 1: Background Information**

**1.1. Name and Position:**

1.1.1. Name: .....

1.1.2. Position/Role: .....

**1.2. Affiliation:**

1.2.1. Organization/Institution: .....

1.2.2. Role within the Organization: .....

**Section 2: Agro-Processing Landscape**

**2.1. Overview:**

2.1.1. Can you provide an overview of agro-processing activities in the area?

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2.1.2. What are the predominant crops processed by smallholder farmers?

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**2.2. On-Farm Practices:**

2.2.1. Do smallholder farmers commonly engage in on-farm processing activities?

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2.2.2. What on-farm processing practices are prevalent?

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**2.3. External Facilities:**

2.3.1. Are there off-farm processing facilities utilized by smallholder farmers?

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2.3.2. Can you identify key external processing facilities in the region?

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**Section 3: Challenges and Opportunities**

**3.1. Resource Access Challenges:**

3.1.1. In your experience, what challenges do smallholder farmers face in accessing resources for agro-processing?

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3.1.2. Are there specific financial or infrastructural challenges that impact resource access?

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**3.2. Market Dynamics:**

3.2.1. How do market dynamics influence smallholder agro-processing activities?

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3.2.2. Are there notable trends in market demand for processed agricultural products?

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**3.3. Support Services:**

3.3.1. What support services, if any, are available to aid smallholder farmers in agro-processing?

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3.3.3. How effective are these support services in addressing challenges?

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## **Section 4: Decision-Making Factors**

### **4.1. Economic Influences:**

4.1.1. How do economic factors, such as income and access to credit, influence smallholder farmers' decisions to engage in agro-processing?

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4.1.2. Are there financial incentives or barriers affecting decision-making?

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### **4.2. Social and Cultural Aspects:**

4.2.1. In your experience, how do social and cultural factors impact the decision-making process for smallholder farmers in agro-processing?

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4.2.2. Are there community-level influences on engagement in agro-processing?

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### **Conclusion:**

Thank you for sharing your valuable insights. Your contributions will greatly contribute to our understanding of smallholder agro-processing in this region. If there's anything else you would like to add, please feel free to do so.

## Appendix D: Informed Consent Form

### UKZN HUMANITIES AND SOCIAL SCIENCES RESEARCH ETHICS COMMITTEE (HSSREC)

APPLICATION FOR ETHICS APPROVAL  
For research with human participants

#### Information Sheet and Consent to Participate in Research

Date:

Greetings dear Participant.

I am Thalente Minenhle Khumalo from the School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal. Mobile Number: [REDACTED];  
Email: [223151665@stu.ukzn.ac.za](mailto:223151665@stu.ukzn.ac.za), [thalente.khumalo@ukzn.ac.za](mailto:thalente.khumalo@ukzn.ac.za).

You are being invited to consider participating in a study titled: Factors Influencing Participation of Smallholder Farmers in Agro-processing Industries: A Case Study of uMshwathi and uMsunduzi Local Municipalities. The study aims to figure out which factors are responsible for the participation of smallholder farmers in agro-processing industries in uMshwathi and uMsunduzi local municipalities. This will be achieved by administering questionnaires, focused group discussions, and key informative interviews. Agro-processing has great potential to increase the market for agricultural products, open new employment opportunities for smallholder farmers, especially in rural areas, and act as a bridge between primary agricultural products and industrialization. Thus, by acquiring what smallholder farmers understand about agro-processing, the limitations involved, and how concepts such as market dynamics and socio-economic factors affect the decision-making process of smallholder farmers' participation in agro-processing, we can conclude on the difference agro-processing can bring to smallholder farmers lives, bettering their livelihoods and improving their level of food security. I am interested in interviewing you to share your experiences and observations on the subject matter.

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number:.....).

In the event of any problems or concerns/questions you may contact the researcher at (Mobile Number: [REDACTED]01; Email: [REDACTED]) or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

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## APPENDIX E: Ethical clearance



29 July 2024

**Thalente Minenhle Khumalo (223151665)**  
School of Agri Earth & Env Sc  
Pietermaritzburg Campus

Dear TM Khumalo,

**Protocol reference number:** HSSREC/00006823/2024

**Project title:** Factors influencing participation of smallholder farmers in agro-processing industries: A case study of uMshwathi Municipality

**Degree:** Masters

### Approval Notification – Expedited Application

This letter serves to notify you that your application received on 10 April 2024 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

**Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.**

**PLEASE NOTE:** Research data should be securely stored in the discipline/department for a period of 5 years.

**Incidents of adverse events and serious adverse events (AEs and SAEs) should be reported in writing to HSSREC, the study sponsors, and any regulatory authority (where appropriate), within 7 working days of the occurrence for local sites and 14 days for all other South African sites.**

This approval is valid until 29 July 2025.

To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

HSSREC is registered with the South African National Health Research Ethics Council (REC-040414-040).

Yours sincerely,



**Professor Dipane Hialele (Chair)**  
/nng

### Humanities and Social Sciences Research Ethics Committee

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