The Exploration of Livelihoods and Food Security in Limpopo Province: Insights from Small-Scale Irrigation Schemes Users

by

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PREFACE

The research contained in this thesis was completed by the candidate while based in the Discipline of Food Security, School of Agricultural, Earth and Environmental Sciences of the College of Agriculture, Engineering and Science, University of KwaZulu-Natal, Pietermaritzburg Campus, South Africa. The research was financially supported by the National Research Foundation (Grant number: 77986) and the Water Research Commission (2082/1/15)

The contents of this work have not been submitted in any form to another university or publication and, except where the work of others is acknowledged in the text, the results reported are due to investigations by the candidate.

DECLARATION

I, Krishna Denver, declare that:

(i) the research reported in this thesis, except where otherwise indicated or acknowledged, is my original work;

(ii) this thesis has not been submitted in full or in part for any degree or examination to any other university;

(iii) this thesis does not contain other persons' data, pictures, graphs or other information unless specifically acknowledged as being sourced from other persons;

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a) their words have been rewritten but the general information attributed to them has been referenced;

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Krishna Denver Naidoo

As the candidate's supervisor, we agree to the submission of this thesis:

Prof Joyce Chitja (Supervisor)

Prof Hussein Shimelis (Co-Supervisor)

PUBLICATIONS AND DRAFTS EMANATING FROM THE THESIS

Chapter 4

1. Naidoo KD*, Thamaga-Chitja, J.M. and Shimelis, HA 2013. Toward Sustainable Livelihoods Through Water Use Security: Insights from Small-Scale Irrigation Schemes in Limpopo Province. Indilinga African Journal of Indigenous Knowledge Systems, Volume 12, Issue 2, p. 301-324.

Chapter 5

2. Naidoo, KD, Thamaga-Chitja, J.M. and Shimelis, HA. Analysis of the current household food security status of small-scale irrigation scheme women farmers Limpopo Province: implications for livelihoods. (Unpublished draft).

ABSTRACT

Three-quarters of the global population living in poverty, particularly in sub-Saharan Africa, depend on small-scale agriculture for their income and food security. This thesis addresses the pivotal role of smallholder farmers in the fight against global poverty and hunger, specifically aiming to explore and gain insight into the role of small-scale irrigation schemes on livelihoods and household food security in Limpopo Province. Despite using traditional and unimproved farming techniques, these farmers occupy a significant portion of global farmland, producing the majority of the world's food. However, they often find themselves trapped in a cycle of poverty, rendering them less productive compared to large-scale counterparts.

Access to water and land is fundamental to food security, defined as regular access to sufficient high-quality food for healthy living. Water scarcity can trigger famine and undernourishment, particularly in regions relying on local agriculture. Many of Africa's small-scale farmers are women who lack access to production resources. Despite African governments' commitment to allocate at least 10 percent of annual budgets to agriculture research and development, few have met this target. Collaboration with women farmers and their organizations is crucial to amplify their concerns globally as they often form the majority of farmers.

This study adopts the Sustainable Livelihoods Framework and people-centred development approaches to examine the livelihoods and food security of women smallholder farmers in three selected irrigation schemes in Limpopo Province. Specific objectives include: (i) to identify and describe the livelihood assets of small-scale irrigation scheme women farmers; (ii) to determine the current household food security status of small-scale irrigation scheme women farmers; and (iii) to analyse the current policies' impact on livelihoods and food security on smallholder irrigation scheme women farmers. A mixed-methods approach was employed, involving questionnaires, observations, and focus group discussions. Three irrigation schemes were chosen purposefully based on their relevance to the research criteria, long crop production histroy, and willingness to participate. Quantitative data was analyzed using Statistical Package for the Social Sciences (SPSS), while content analysis was applied to qualitative data. Logistic regression was employed to analyse determinants of household food security status.

The study revealed that livelihoods were constructed from assets, influenced by knowledge of agriculture, water management and marketing strategies. Escalating water costs, competition for water resources, and inadequate water management emerged as significant challenges. Using the Household Dietary Diversity Score (HDDS), the food security assessment indicated

that approximately one-third of the sampled farming households experienced food insecurity. The logistic regression model identified gender, age, education, income, and adult males as positive influences on household food security.

The study underscores the crucial role of women farmers in these irrigation schemes and highlights the need for proactive political leadership. South Africa's water legislation aligns with the Organisation for Economic Co-operation and Development (OECD) principles, emphasizing policy coherence and stakeholder engagement, but implementation issues persist, especially in transitioning responsibilities from national to catchment levels. Deteriorating monitoring systems and declining data quality control pose risks to local food security. Cross-sectoral consultation is imperative to establish coordinated efforts and ensure long-term, multi-sectoral water resource management, safeguarding local livelihoods and food security.

Keywords: Food Security, land use, water use, smallholder irrigation, gender, Limpopo Province

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A project of this nature, based on three research areas in the Limpopo Province, is only possible with the help of many people. They, too have played their part in this research.

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LIST OF ABBREVIATIONS

ABET: ADULT BASIC EDUCATION AND TRAINING

ANC: AFRICAN NATIONAL CONGRESS

AWARD: ASSOCIATION FOR WATER AND RURAL DEVELOPMENT

CMA: CATCHMENT MANAGEMENT AGENCY

CPA: COMMUNAL PROPERTY ASSOCIATION

DAFF: DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES

DBSA: DEVELOPMENT BANK OF SOUTHERN AFRICA

DFID: DEPARTMENT FOR INTERNATIONAL DEVELOPMENT

DLA: DEPARTMENT OF LAND AFFAIRS

DOA: DEPARTMENTS OF AGRICULTURE

DRDLR: DEPARTMENT OF RURAL DEVELOPMENT AND LAND REFORM

DWAF: DEPARTMENT OF WATER AFFAIRS AND FORESTRY

DWS: DEPARTMENT OF WATER AND SANITATION

EFF: ECONOMIC FREEDOM FIGHTERS

FAO: FOOD AND AGRICULTURE ORGANISATION

FBWP: FREE BASIC WATER POLICY

FGD: FOCUS GROUP DISCUSSIONS

GHS: GENERAL HOUSEHOLD SURVEY

HSRC: HUMAN SCIENCE AND RESEARCH COUNCIL

IDP: INTEGRATED DEVELOPMENT PLAN

IDS: INSTITUTE OF DEVELOPMENT STUDIES

IFAD: INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT

IGA: INCOME GENERATION ACTIVITY

IWMI: INTERNATIONAL WATER MANAGEMENT INSTITUTE

IWRM: INTEGRATED WATER RESOURCE MANAGEMENT

LRAD: LAND REDISTRIBUTION FOR AGRICULTURAL DEVELOPMENT

MDG: MILLENNIUM DEVELOPMENT GOALS

NDP: NATIONAL DEVELOPMENT PLAN

NGO: NON-GOVERNMENTAL ORGANISATION

NRF: NATIONAL RESEARCH FOUNDATION

NWA: NATIONAL WATER ACT

OECD: ORGANISATION FOR ECONOMIC OPERATION AND DEVELOPMENT

PLAAS: INSTITUTE FOR POVERTY, LAND AND AGRARIAN STUDIES

PTO: PERMISSION TO OCCUPY

RESIS: REVITALISATION OF SMALLHOLDER IRRIGATION SCHEMES

RRA: RAPID RURAL APPRAISAL

SADC: SOUTHERN AFRICAN DEVELOPMENT COMMUNITY

SEI: STOCKHOLM ENVIRONMENT INSTITUTE

SIS SMALL-SCALE IRRIGATION SCHEMES

SLA: SUSTAINABLE LIVELIHOOD APPROACH

SLAG: SETTLEMENT LAND ACQUISITION GRANT

STATSSA: STATISTICS SOUTH AFRICA

TA: TRADITIONAL AUTHORITY

UNDP: UNITED NATIONS DEVELOPMENT PROGRAMME

USAID: UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

WA: WATER ACT (WA) OF 1956

WRC: WATER RESEARCH COMMISSION

WSA: WATER SERVICE ACT NO. 108 OF 1997

WSA: WATER SERVICE AUTHORITY

WPP: WATER PARTNERSHIP PROGRAM

WUA: WATER USER ASSOCIATIONS

WWAP: WORLD WATER ASSESSMENT PROGRAMME

CHAPTER 1: THE PROBLEM AND IT'S SETTING

1.1 Introduction

Smallholder farming is an important livelihood and food security contributor for many rural households, even so for rural women. Exploring the livelihoods and food security status of women on small-scale irrigation schemes is fundamental since women are the backbone of agriculture and net providers of food at the household level. In addition, smallholder farmers play a key role in rural economies; however, rural women often experience greater constraints than men in accessing resources, services, and opportunities. True empowerment of women in rural areas will occur if water use security and land use security and knowledge generation are facilitated and realised through government policy, strategies, legislation and synthesis while underpinned by gender equity. While water is necessary for drinking, sanitation, and food production, billions of people lack access to and quality of water. The COVID-19 pandemic has exacerbated the impacts of these water inequities. The world is currently facing severe and growing challenges to meet the rapidly growing demand for water resources. At the global level, the average e amount of water per person has substantially dropped. The situation in South Africa is no different. The situation is getting desperate and water is very scarce. South Africa as a whole regularly faces water shortages making it a matter of national concern.

1.2 Background

The multifaceted issue of water scarcity poses a significant threat to economic development and poverty reduction, driven by escalating exploration costs and wasteful water use. Inequitable water access further compounds this problem, disproportionately affecting women, the poor, and other disadvantaged groups (Rosegrant et al., 2002). In many African countries, small-scale irrigation schemes are pivotal in efforts to combat poverty and enhance food security by reducing dependence on erratic rainfall patterns (Gebrehiwot, Mesfin & Nyseen, 2015). However, the vital role of water in agriculture often takes a backseat on the global stage, overshadowed by water supply and sanitation concerns. To elevate water's importance in agriculture, better communication between water engineers, farmers, economists, and policymakers is essential.

To address these intertwined challenges effectively, comprehensive water management policies are crucial. These policies must sustain agricultural growth, promote equitable water

allocation, reverse soil degradation, safeguard the rights of marginalized groups, and enhance water use efficiency. The urgency of these concerns has prompted water reforms in many countries (Rosegrant et al., 2002a).

Equally critical is the issue of land-use security. The post-apartheid government in South Africa initiated a land reform program to rectify historical land access imbalances (Cross & Hornby, 2002). However, traditional governance systems, deeply rooted in patriarchal norms, often favor male landownership. Women, who make up the majority of farmers in irrigation schemes, confront formidable barriers to land tenure, largely dependent on male relatives. Consequently, with high HIV/AIDS mortality rates, women face increased vulnerability to land loss (FAO, 1999; 2006).

Land use security is intricately tied to prevailing land property rights within communities, and the level of societal support for these rights is a crucial factor (Murugani et al., 2015). In rural South Africa, challenges persist regarding Permission to Occupy ("PTO") rights, which grant personal usage but not land ownership. These challenges are deeply rooted in the historical context of racially-based land distribution and ownership (Zimba, 2022). The issue of land ownership is closely tied to wealth inequality in South Africa, which is most evident in the land ownership patterns of historically disadvantaged communities (Kollamparambil, 2020).

In the context of irrigation schemes the determination of land use security in a community relies directly on the security provided to the right holders by society (Murugani et al., 2015, cited in Deininger & Jin, 2006; Chimhowu, 2019) delves into the importance of land tenure security in agricultural development, emphasizing the role of societal support in ensuring the effectiveness of irrigation schemes. The authors argue that secure land tenure rights are essential for promoting investment in land improvement and sustainable land use, which are critical components of successful irrigation schemes. Furthermore, they highlight the significance of societal recognition and support for these tenure rights in fostering a conducive environment for agricultural productivity. In irrigation schemes, the assurance of land use security is intricately tied to the level of support and security afforded to the right holders by the broader societal framework. The extent to which individuals or communities engaging in irrigation schemes can confidently utilize and manage land is fundamentally influenced by the security and recognition of their land rights within the larger social context.

This means that the success and sustainability of irrigation projects are closely linked to the legal, cultural, and institutional frameworks that underpin land ownership and use. In regions

where land rights are well-defined, legally protected, and culturally acknowledged, those participating in irrigation schemes are likely to experience greater stability and security in utilizing the land for agricultural purposes.

Conversely, in areas where land tenure is uncertain, contested, or lacks legal protection, the participants in irrigation schemes may face challenges related to the insecurity of their land use. Such uncertainties can impact the long-term viability of irrigation projects, as participants may be reluctant to invest time, resources, and effort in land-related activities without a clear and secure tenure arrangement

South Africa, like many Sub-Saharan African countries, operates with a dual land property rights system. The claim that under statutory law, women in South Africa can buy, sell, inherit, or manage land is significant in the context of the country's dual land property rights system. (Tekwa and Adesina, 2023). This assertion aligns with the broader discourse on gender equality and land rights in South Africa, particularly within the framework of the country's legal and policy landscape. Torkelsson & Tassew (2008) emphasize the importance of legal provisions that enable women to engage in land transactions and inheritance, thereby challenging traditional norms and practices that have marginalized women's access to and control over land resources. This aligns with the broader international discourse on women's rights, as enunciated in the UN International Covenant on the Elimination of all forms of Discrimination Against Women Claeys et al. (2022). Still, there are constitutional provisions prohibiting discrimination, although their implementation appears slow in certain countries such as South Africa, Uganda, and Mozambique (Odeny 2013).

The communal land law, administered by tribal and traditional authorities in rural Sub-Saharan Africa, constitutes the second component of the dual land property rights system. This system is often patriarchal, with land allocated to the male household head on behalf of his household.

Customary land tenure systems, often governed by traditional authorities, have historically favoured male household heads in the allocation and management of land resources (Mamdani, 1996). This has perpetuated gender disparities in land ownership and control, reinforcing traditional gender roles and power dynamics within rural communities. Under this system, women have limited access to land as secondary beneficiaries, with rights to cultivate and control their produce but not to own, inherit, or allocate land (Toulmin, 2008; Deininger & Jin, 2006; Gray & Kevane, 1999; Chimhowu, 2019). However, a shift toward a reformative trajectory is emerging across Sub-Saharan Africa, characterized by a new African customary

tenure regime that is more legible to local markets and economic globalization processes (Chimhowu 2019).

Land use security is crucial for agricultural production and other land-based livelihoods. Access to land is a key issue, vital for food production, shelter, and community development (White et al., 2012). Historically, land has been a primary source of wealth, social status, and power. However, due to the secondary nature of women's access to land and other resources, their access is often insecure (Odeny 2013; Chigbu et al., 2019; Gyau et al., 2017). The lack of access to land and other productive resources adversely affects women's enjoyment of various human rights (UN 2013). Inclusive growth requires equal access to opportunities and resources for all segments of society, including women. Barriers to women's access, control, and use of land often stem from inadequate legal standards, ineffective implementation, and discriminatory cultural attitudes at institutional and community levels. Even in countries with sound legal frameworks, women often struggle to enjoy their rights to access and control productive resources.

While statutory land laws in South Africa uphold gender equality in land rights, these provisions apply to only a fraction of Sub-Saharan Africa (Wily, 2011). The majority of land is held by tribal authorities or entities, denying private ownership rights to rural landowners. This leads to underdeveloped land exchange markets, hindering optimal land use and contributing to suboptimal agricultural productivity.

In summary, understanding the complex interplay of smallholder farming, water scarcity, and land-use security is paramount. Addressing these interconnected issues holds the key to alleviating poverty, enhancing food security, and advancing gender equality in rural communities, not only in South Africa but also in many other regions facing similar challenges.

1.3 Research Problem

Existing literature acknowledges the significance of small-scale irrigation schemes in enhancing livelihoods and household food security in various contexts. Studies indicate that such irrigations schemes can contribute positively to agricultural productivity, income generation, and food availability for rural households (Mhembwe et al., 2019, Shono & Kibret, 2020, and Muleta, 2021). Moreover, research underscores the importance of understanding the socio-economic dynamics and agricultural practices within specific regions to effectively assess the impact of irrigation schemes on livelihoods and food security (Panigrahi et al., 2021).

However, there is a notable gap in the literature concerning the role of small-scale irrigation schemes on livelihoods and household food security specifically within the context of Limpopo Province, South Africa. While studies conducted in other regions provide valuable insights, the unique socio-economic and environmental characteristics of Limpopo Province necessitate a localized investigation to comprehensively understand the challenges, opportunities, and outcomes associated with such schemes. There have been several studies over the past decades yet the problem persists.

This gap in the literature is problematic as it limits the development of targeted interventions and policies tailored to the needs of communities relying on small-scale irrigation in Limpopo Province. Without a nuanced understanding of the factors influencing the success or failure of these schemes, stakeholders, including policymakers, agricultural practitioners, and local communities, may struggle to implement sustainable strategies to improve livelihoods and enhance food security.

The absence of research addressing the role of small-scale irrigation schemes in Limpopo Province affects various stakeholders, including smallholder farmers, rural communities, governmental organizations, non-governmental organizations (NGOs), and researchers. These groups are directly or indirectly impacted by the effectiveness and sustainability of irrigation initiatives in the region.

The lack of empirical evidence and understanding regarding the role of small-scale irrigation schemes in Limpopo Province poses significant challenges to efforts aimed at alleviating poverty, enhancing agricultural productivity, and improving food security in the region. Failure to address this gap may result in suboptimal utilization of resources, missed opportunities for targeted interventions, and continued vulnerability of rural households to food insecurity and socio-economic instability

1.4 Aim

The overall aim of the study is to explore and gain insight into the role of small-scale irrigation schemes on livelihoods and household food security for their household in Limpopo Province.

1.4.1 Specific research objectives

The specific research objectives are to:

I. Identify and describe the livelihood assets of small-scale irrigation scheme women farmers.
II. Determine the current household food security status of small-scale irrigation scheme women farmers.
III. Analyse the current policies on livelihood and food security on small-scale irrigation scheme women farmers.

1.4.2 Research questions

I. What are the livelihood assets of women small-scale farmers in irrigation schemes, and how can they be described?
II. What is the prevailing food security status of households led by women in small-scale irrigation schemes?
III. How do existing policies impact women small-scale farmers' livelihoods and food security in irrigation schemes?

1.5 Importance and Significance of the Study

Women's participation in agriculture is of paramount importance, particularly in South Africa, where they have played a significant role in the sector's growth. Women accounted for a substantial portion of the new farm jobs created in the country, and studies have highlighted the outsized impact of their incomes on food security. For every Rand earned by women, it achieves an impact equivalent to R11 earned by men. This underscores the critical role women can play in addressing food insecurity (Stats SA 2018).

However, it is essential to recognize that women's contributions to agriculture often involve low-input, low-output farming or gardening activities that provide supplementary food for households. Moreover, a significant percentage of households engaged in such activities, approximately 56.5%, are headed by women. In rural areas, women bear the primary responsibility for various household needs, including childcare, clothing, housing, education, healthcare, water provision, and food supply. These responsibilities are compounded by the fact that a substantial portion of households in South Africa, approximately 52%, experience hunger, and a considerable majority, 59%, live below the monthly income poverty line of less than R 1 200. Therefore, addressing food insecurity is crucial for these vulnerable households (Stats SA 2018).

Furthermore, rural livelihoods in South Africa rely heavily on income from diverse sources, such as remittances from family members in urban areas, wages, pensions, and social grants. Rain-fed farming, which is subject to water availability, contributes significantly to rural incomes, further emphasizing the need for secure access to water resources (Water Research Commission (WRC) report on best management practices, 2013).

Despite constitutional provisions for gender equality, women in rural areas face challenges related to water use security and the knowledge required to achieve food security. Lack of food security implies inadequate access to sufficient food for a healthy life. Empowering women through secure access to water and land, along with knowledge and skills development, is imperative to address these challenges effectively.

Given the critical role of women in agriculture and the multifaceted issues surrounding food security, this study seeks to provide valuable insights into women farmer livelihoods and their contributions to household food security. By understanding the dynamics at play and the challenges women face, the study aims to stimulate action and ownership among women farmers to leverage water resources for improved food security and livelihoods (Stats SA 2018).

In summary, this study is justified by the pressing need to empower women in agriculture, address food insecurity, and promote sustainable livelihoods. It is imperative to prioritize secure access to water and land and enhance women's knowledge and skills to drive positive change in South Africa's rural communities (Water Research Commission (WRC) report on best management practices, 2013; Stats SA 2018

1.6 The Study Delineation and Limits

The study was carried out within the rural landscapes of Limpopo Province, specifically targeting respondents situated within three distinct irrigation schemes: Mashushu (located in the Capricorn district), Rambuda (situated in the Vhembe district), and Steelpoortdrift (positioned in the Sekhukhune district). It is noteworthy that this study specifically centered its investigation on small-scale farmers actively engaged in agricultural activities within these aforementioned schemes.

Furthermore, the research's primary focus was directed towards irrigation scheme communities that benefit from the presence of active extension support services and possess an extension officer stationed in close proximity. This deliberate selection criteria allowed for a more

comprehensive examination of the interplay between small-scale irrigation farming, livelihoods, and food security within the context of structured support systems.

It is essential to acknowledge the diversity and variability inherent within South African rural areas. As such, this study recognizes the importance of context specificity and the uniqueness of each rural community. Consequently, it is crucial to exercise caution when attempting to generalize findings or draw causal inferences based solely on the outcomes of this particular study. Each rural area in South Africa may possess distinct characteristics, challenges, and dynamics that influence the livelihoods and food security of its inhabitants. Therefore, while this study provides valuable insights and information, it does not claim to represent the entirety of rural South Africa, and findings should be applied judiciously, considering the local context and nuances of each specific community

1.7 The Study Parameters and General Assumptions

The study was conducted within the geographical boundaries of Limpopo Province in South Africa, serving as the overarching context within which all research activities transpired. Additionally, the study's specific scope was meticulously tailored to exclusively encompass small-scale irrigation farms as its focal point. This selection was guided by preliminary investigations, which compellingly indicated that women played the most prominent and active roles within irrigation schemes. As a result, the study primarily centered on the participation and insights of small-scale irrigation scheme women farmers, drawing from their valuable experiences and perspectives.

In terms of assumptions, the foundational premise underlying this research was that the participants engaged in the study would provide candid and truthful responses during the survey or interview processes. It was acknowledged that verifying the accuracy of every response on an individual basis would be an extensive and resource-intensive undertaking. Therefore, the researcher operated under the assumption that the participants would offer their insights with honesty and factual accuracy.

In tandem with this assumption, stringent measures were put in place to safeguard the identities and confidentiality of all study participants. The researcher assured each participant that their responses would remain confidential and secure throughout the research process, thus fostering an environment of trust and openness.

These parameters and assumptions were integral to the methodology and ethical considerations of the study, ensuring that it operated within a well-defined framework while upholding the principles of integrity, confidentiality, and respect for participants' privacy.

1.8 Definition of Terms

Food and nutrition security exists when all people at all times have physical, social and economic access to food, which is safe and consumed in sufficient quantity and quality to meet their dietary needs and food preferences, and is supported by an environment of adequate sanitation, health services and care, allowing for a healthy and active life (CFS, 2012).**Food Security** At community level is defined as the condition whereby the residents in a community can obtain safe, culturally accepted, nutritionally adequate diets through a sustainable system that maximizes community self-reliance.

Food Security At household level refers to the availability of food in one's home, which one has access. In this case, a household is regarded as food secure when the members of the family do not live in hunger or fear of starvation.

A **Livelihood** comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base. (Chambers & Conway, 1991).

Small-scale/Smallholder In general terms only refers to their limited resource endowment relative to other farmers in the sector. **Smallholder/Small-scale** farmers are also defined as those farmers owning small-based plots of land on which they grow subsistence crops, one or two cash crops and livestock without advanced and expensive technologies relying almost exclusively on family labour and in most cases, animal traction, limited use of agrochemicals throughout the thesis.

Small-scale irrigation schemes are multi-farmer irrigation projects larger than 5 ha in size that were either established in the former homelands or resource-poor areas by Black people or agencies assisting their development (Van Averbeke and Mohamed, 2006).

1.9 Structure of Thesis

Table 1.1 presents a summary of the chapter of the thesis. The table also outlines the manuscripts, contributing to this study results.

Table 1. 1: Structure of the thesis

Chapter		Overview	Objective	Publication
1.	Introduction, the problem and it's setting	Introduction		Not applicable
2.	Literature review			Not Applicable
3.	Methodology	A detailed discussion of study methods		Not applicable
4.	Research Manuscript 1	Toward sustainable livelihoods through indigenous knowledge and water use security: Insights from small-scale irrigation schemes in Limpopo Province	1	Published: Indilinga: African Journal of Indigenous Knowledge Systems. Vol 12, No 2 (2013)
5.	Research Manuscript 2	Analysis of current food security status of small-scale irrigation scheme women farmers in Limpopo: Implication for livelihoods	2	The manuscript is being revised
6.	Research Chapter	To assess the implications of current policies on livelihoods and food security of small-scale farmers in irrigation schemes	3	Not applicable
7.	Research Chapter	Present Conclusion and recommendations for future research:	4	Not applicable

1.10 Summary

Chapter 1 provides a comprehensive overview of the research context and objectives. It emphasizes the pivotal role of small-scale irrigation farming, particularly for women, in contributing to rural livelihoods and food security. The chapter underscores the significance of understanding the complex interplay of water scarcity, land-use security, and women's empowerment in agriculture, not only in South Africa but also in similar regions facing these challenges. The research problem is identified as the lack of reliable data specific to small-scale irrigation farming in South Africa, prompting the need for this study.

Furthermore, the chapter outlines the primary aim of the research: to explore the role of small-scale irrigation schemes in improving livelihoods and household food security in Limpopo Province. It delineates three sub-problems, guiding the investigation into livelihood assets, food security status, and policy impacts on women farmers in these schemes. The importance of this study lies in its potential to empower women in agriculture, address food insecurity, and promote sustainable livelihoods in South Africa's rural communities. The chapter concludes by highlighting the study's limitations and the need for context-specific solutions to the challenges faced by rural communities.

In summary, Chapter 1 serves as a foundational introduction to the research, outlining its objectives, significance, and scope. It sets the stage for the subsequent chapters, which delve into specific aspects of small-scale irrigation farming and its implications for livelihoods and food security, particularly for women.

REFERENCES

ADB (ASIAN DEVELOPMENT BANK). 2003. Water and Poverty- a collection of case studies: Experience from the Field. Available: https://www.adb.org/sites/default/files/publication/28450/water-05.pdf (Accessed 15 August 2018).

AGARWAL, B. 1998. Disinherited Peasants, Disadvantaged Workers: A Gender Perspective on Land and Livelihood. Economic and Political Weekly. 33(13): A2-A14.

BRADSTOCK, A. 2005. Changing Livelihoods and Land Reform: Evidence from the Northern Cape Province of South Africa. World Development 33 (11): 1979-1992. Available: https://www.sciencedirect.com/science/article/pii/S0305750X0500152X (Accessed 11 November 2015).

CHAMBERS, R. & CONWAY, G.R. 1991. Sustainable rural livelihoods: practical concepts for the 21st century. IDS Discussion paper 296. Available: http://publications.iwmi.org/pdf/H_32821.pdf (Accessed 24 November 2014).

CHIGBU, U. E., NTIHINYURWA, P. D., VRIES, W. T. D., & NGENZI, E. I. (2019). Why tenure responsive land-use planning matters: insights for land use consolidation for food security in Rwanda. International Journal of Environmental Research and Public Health, 16(8), 1354.

CHIKWENDU, D. O. & AROKOYO, J. O. 1997. Women and sustainable agricultural development in Nigeria. Journal of Sustainable Agriculture, 11(1), 53–69.

CHIMHOWU, A., 2019. The 'new 'African customary land tenure. Characteristic, features and policy implications of a new paradigm. Land use policy, 81, pp.897-903.

CLAEYS, P., LEMKE, S., & CAMACHO, J. (2022). Editorial: women's communal land rights. Frontiers in Sustainable Food Systems, 6. https://doi.org/10.3389/fsufs.2022.877545

CROSS, C. & HORNBY, D. 2002. 'Opportunities and obstacles to women's land access in South Africa'. A Research Report for the Promoting Women's Access to Land (PWAL) Programme, February.

DBSA (DEVELOPMENT BANK SOUTHERN AFRICA). 2009. Development information base. Midrand: Development Bank of Southern Africa Department of Agriculture Forestry and Fisheries.

DENISON, J. & MANONA, S. 2007a. Principles, approaches and guidelines for the participatory revitalisation of smallholder irrigation schemes. Volume 1 – A rough guide for irrigation development practitioners. WRC Report No. TT 308/07. Water Research Commission, Pretoria.

DENISON, J. & MANONA, S. 2007b. Principles, approaches and guidelines for the participatory revitalisation of smallholder irrigation scheme. Volume 2 – concepts and cases. WRC Report No. TT 308/07. Water Research Commission, Pretoria.

DEININGER, K. AND JIN, S., 2006. Tenure security and land-related investment: Evidence from Ethiopia. *European Economic Review*, *50*(5), pp.1245-1277.

DLA (DEPARTMENT OF LAND AFFAIRS). 2006. Implementation Plan for the Proactive Land Acquisition Strategy, Version 1. Pretoria: Department of Land Affairs.

FAO (FOOD AND AGRICULTURE ORGANISATION). 1999. Multilingual Land Tenure Thesaurus. Rome. Available: http://www.fao.org/3/a-y4307e.pdf (Accessed 25 November 2015).

GEBREHIWOT, N.T., MESFIN, K.A. & NYSEEN, J. 2015, 'Small-scale irrigation: The driver for promoting agricultural production and food security, the case of Tigray Region State, Northern Ethiopia', Irrigation and Drainage System Engineering 4(2), 141–150.

GOEBEL, A. 2007. We Are Working for Nothing": Livelihoods and Gender Relations in Rural Zimbabwe, 2000-06. Canadian Journal of African Studies. 41(2): 226.

GRAY L, KEVANE, M. 1999. Diminished Access, Diverted Exclusion: Women and Land Tenure in Sub-Saharan Africa. African Studies Association. 42(2): 15-39.

GYAU, A., FAITH, A. N., FONDJEM-TITA, D., NJI, A., & CATACUTAN, D. (2017). Small-holder farmers' access and rights to land: the case of Njombé in the littoral region of Cameroon. Afrika Focus, 27(3). https://doi.org/10.21825/af.v27i3.4905

HSRC (HUMAN SCIENCE RESEARCH COUNCIL). 2009. Food security in South Africa: Key Policy Issues for the medium term. Integrated Rural and Regional Development. Position paper.

IWMI (INTERNATIONAL WATER MANAGEMENT INSTITUTE). 2001. Water for rural development. Background paper on Water for Rural Development prepared for the World Bank. IWMI, Colombo.

KERR, R.B. 2005. Food Security in Northern Malawi: Gender, Kinship Relations and Entitlements in Historical Context. Journal of Southern African Studies. 31(1):53-74.

KOLLAMPARAMBIL, U. (2020). Non-income effect of land ownership and tenure on subjective wellbeing in South Africa. South African Journal of Economics, 89(2), 301-323. https://doi.org/10.1111/saje.12276

LI, X., DONG, Q., LIU, X., WU, J. 2008. Gender Inequality and Poverty in Asset Ownership. Chinese Sociology and Anthropology. 40(4):49–63.

MHEMBWE, S., CHIUNYA, N., & DUBE, E. (2019). The contribution of small-scale rural irrigation schemes towards food security of smallholder farmers in Zimbabwe. Jàmbá

Journal of Disaster Risk Studies, 11(1). https://doi.org/10.4102/jamba.v11i1.674MNKENI, P.N.S., CHIDUZA, C., MODI, A.T., STEVENS, J.B., MONDE, N., VAN DER STOEP, I. & DLADLA, R. 2010. Best management practices for smallholder farming on two irrigation schemes in the Eastern Cape and Kwazulu-Natal through participatory adaptive research. WRC Report No. TT 478/10. Water Research Commission, Pretoria

MULETA, G. (2021). Impact of small-scale irrigation on household food security in central highlands of Ethiopia: evidences from Walmara district. JESD. https://doi.org/10.7176/jesd/12-3-04

MUZERENGI, T. & MAPURANGA, D. 2017. 'Impact of small-scale irrigation schemes in addressing food shortages in semi-arid areas: A case of Ingwizi Irrigation scheme in Mangwe District, Zimbabwe', International Journal of Humanities and Social Studies 5(7): 298–312.

PANIGRAHI, A. K., MODAK, S., & PADHY, C. (2021). Willingness to adopt the recommended practices of organic turmeric among kandhamal farmers of odisha. Asian Journal of Agricultural Extension, Economics &Amp; Sociology, 80-87. https://doi.org/10.9734/ajaees/2021/v39i830628

ROSEGRANT, M.W., CAI, X. & CLINE, S.A. 2002. World Water and Food to 2025: Dealing with Scarcity. International Food Policy Research Institute, Washington, DC.

SHONO, H. AND KIBRET, S. (2020). Impact of small-scale irrigation on resettled household food security: the case of hora, Gorrea & Shenkora small scale irrigations in Sasiga district of Wollega, Ethiopia. International Journal of Ecotoxicology and Ecobiology, 5(4), 61. https://doi.org/10.11648/j.ijee.20200504.14

TEKWA, N., & ADESINA, J. O. (2023). Land, Water, and Gender Questions in South Africa: A Transformative Social Policy Perspective. Agrarian South: Journal of Political Economy, 12(1), 72-97. https://doi.org/10.1177/22779760231151517

TLOU, T., MOSAKA, D., PERRET, S., MULLINS, D. & WILLIAMS, C.J. 2006. Investigation of different farm tenure systems and support structures for establishing small-scale irrigation in long term viable conditions. WRC Report No. 1353/1/06. Water Research Commission, Pretoria.

TORKELSSON, A. & TASSEW, B. 2008. Quantifying women's and men's rural resource portfolios – empirical evidence from Western Shoa in Ethiopia. The European Journal of Development Research. 20(3): 462-481.

TOULMIN, C. 2008. Securing land and property rights in sub-Saharan Africa: The role of local institutions. Land Use Policy, 26, 10-19.

TOULMIN, C. & QUAN, J. 2000. Evolving Land Rights, Policy and Tenure in Africa. Available: http://pubs.iied.org/pdfs/7416IIED.pdf (Accessed 24 November 2014).

UNECA (UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA). 2004. Economic Report on Africa 2004: Unlocking Africa's Trade Potential. Available:

https://www.uneca.org/sites/default/files/PublicationFiles/era2004full.pdf (Accessed 25 November 2015).

VALENTE, C. 2009. The food (in) security impact of land redistribution in South Africa: Microeconometric evidence from national data. World Development, 37(9), 1540-1553.

VAN AVERBEKE, W. AND MOHAMED, S. 2006. 'Smallholder farming styles and development policy in South Africa: The case of Dzindzi Irrigation Scheme'. Agrekon, 45 (2): 136 – 157.

WEIDEMAN M (2006) Who shaped South Africa's land reform policy? Politikon: *South African Journal of Political Studies* 31 (2): 219-238.Widows Rights International (2006).

WHITE, B., BORRAS, S. M., JR, HALL, R., SCOONES, I., & WOLFORD, W. (2012). The new enclosures: Critical perspectives on corporate land deals. The Journal of Peasant Studies, 39(3-4), 619-647. doi:10.1080/03066150.2012.691879

WRC (WATER RESEARCH COMMISSION). 2013. Abridged Knowledge review 2012/2013. Water Research Commission. Pretoria, South Africa.

ZIMBA, Z. F. (2022). The racially-based land distribution and ownership in south africa: a challenging discourse for social work. Critical Social Work Studies in South Africa: Prospects and Challenges, 85-101.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The planet is currently grappling with increasingly dire challenges in meeting the surging global demand for water resources. This predicament is underscored by a striking reduction in the per capita volume of water available worldwide, a trend driven by the rapid expansion of the global population. Unfortunately, this population growth has not been met with a commensurate increase in the development of new water supply sources, rendering the capacity for expanding water availability increasingly limited. This crisis does not only concern developing countries, where water access and infrastructure remain deficient, but also the developed world, where burgeoning demand threatens to outstrip supply. These water shortages pose a formidable obstacle to sustainable development and the alleviation of poverty, exacerbated by escalating costs associated with exploring new water sources, inefficient utilization of existing resources, soil erosion in irrigated regions, groundwater depletion, water contamination, subsidies, and other complex challenges (Pacheco-Trevino et al., 2024).

The South African government has actively endorsed smallholder irrigation to create jobs, reduce poverty, and foster pro-poor agricultural and economic growth (NDP, 2023; DAFF, 2015; NPC, 2016;). This strategic push is particularly evident in the Department of Agriculture, Forestry, and Fisheries' efforts to revitalize pre-1994 smallholder schemes and establish new ones, particularly in former homelands. Concurrently, several smallholder canal irrigation schemes have been constructed, all featuring concrete lining

The primary water source for these schemes is rivers, with a substantial majority (96.7%) relying on river water for irrigation. This source is accessed through direct pumping, diversion via weirs, or reservoir storage. Groundwater serves a smaller portion of irrigated land, comprising 3.0%, while municipal and spring water contribute minimally at 0.2% and 0.1%, respectively. Irrigation methods encompass both pumping (48.5%) and gravity-based systems (34.6%), with a smaller portion (16.9%) employing a combination of gravity and pumping (van Koppen et al., 2017).

The Department of Agriculture, Forestry, and Fisheries (DAFF) manages public irrigation schemes where the total equipped irrigation area within Limpopo Province is estimated at

20,788 hectares. This statistic reveals that, out of the overall irrigated area spanning 97,471 hectares, approximately 79% primarily comprises informal irrigation by private investors, who are likely to be predominantly small-scale private investors. These investors may operate individually or in small groups, utilizing various methods such as gravity river diversions, manual or powered pumps, buckets, or even wetlands.

Particularly noteworthy, is that certain regions within Limpopo Province, such as Venda (46%) and Gazankulu (25%), exhibit remarkably high proportions of small-scale irrigated land. This dispels the common misconception that irrigation is confined to former white areas, as the percentage of crops irrigated in former homelands (15%) versus former white areas (17%) demonstrates little variation (van Koppen et al., 2017). This prevalence of irrigation in former homelands underscores its significant contribution to livelihoods, food security, and self-employment.

One of the paramount considerations within this study is the issue of equitable access to water and its associated benefits for marginalized groups, including women and the economically disadvantaged (Hamilton, 2020; Ezbakhe et al., 2019). The global focus on water supply and sanitation issues has often overshadowed the importance of water for agriculture and, consequently, food production. Bridging this gap necessitates enhanced communication and collaboration between water engineers, agriculturalists, economists, and policymakers to elevate the prominence of water for agriculture on the global agenda (Tzanakakis et al., 2020)

To address these multifaceted challenges, the implementation of water management policies is crucial. These policies must sustain agricultural production, facilitate efficient and equitable inter-sectoral water reallocation, reverse the ongoing depletion of water resources in irrigated lands and associated ecosystems, protect the rights of vulnerable communities, enhance their incomes, and optimize water use efficiency (Meinzen-Dick et al., 2019). These governance and policy imperatives have propelled water reforms in many nations.

Equally significant is the role of land in facilitating sustainable rural livelihoods, yet current efforts often fall short of achieving this goal (Munayi, 2018). The security of land use is fundamentally rooted in prevailing land rights within society (Hull & Whittal, 2021. South Africa, like many sub-Saharan African countries, operate under a dual land ownership rights framework (Mubecua & Nojiyeza, 2022). On one hand, statutory law enshrined in the constitution grants equal land rights to both women and men (Behr et al., 2023). Under this framework, women possess the capacity to purchase, sell, inherit, or manage land (Behr et al.,

2023). This approach underscores the importance of recognizing and upholding property rights as a fundamental aspect of land tenure systems, empowering individuals to engage in secure and beneficial land transactions while promoting economic development and social equity. However, this statutory law has limited coverage, extending to just 10% of Sub-Saharan Africa (Kobusingye et al., 2016).

Conversely, communal land law is governed by tribal and local authorities across rural Sub-Saharan Africa (Chikozho et al., 2019). This framework predominantly adheres to a patriarchal structure where land allocation falls under the purview of the male household head (Akinola, 2018. In this context, women access land as secondary beneficiaries through inheritance from their husbands, with rights primarily related to cultivation and produce control. Yet, they have limited opportunities to own, inherit, or allocate land unlike male counterparts. Most customary land laws are patrilineal in nature, ascribing primary rights over productive resources to men while relegating women to secondary beneficiary status (Masuku et al., 2023). Women's rights within this land ownership system are precarious and contingent upon their relationship with men (Tschirhart et al., 2018). Land use security is pivotal for agricultural production and various land-based livelihoods (Claudia et al., 2022). Thus, securing access to land is intrinsically linked to securing access to other natural resources, such as water (Bob, 2018). Despite the predominant secondary status of women's access to resources in South Africa's smallholder farming, uncertainties persist regarding their utilization, compounded by the gender question, as limited access to land for women extends to other productive resources (Tekwa & Adesina, 2023). In addition, Khuzwayo et al. (2019) stated that land remains an emotive issue in rural South Africa, especially among women who are side-lined by government intervention measures.

2.2 Smallholder Farming in South Africa

Agriculture in South Africa can be understood as a dual system comprising two distinct sectors. Firstly, there is the well-developed and capital-intensive commercial agriculture sector, which plays a substantial role in ensuring national food security. The second form of agriculture is less advanced and resource-intensive, primarily involving smallholder farmers and subsistence production within rural communities (Thamaga-Chitja & Pholoho, 2017).

The participation of households in agricultural activities, particularly subsistence farming, holds significant potential for reducing vulnerability to hunger among both rural and urban households in South Africa. Over the past decade, South Africa has seen a decline in household

participation in agriculture in six out of nine provinces, except for Limpopo, which showed a 5% increase. KwaZulu-Natal, Limpopo, and the Eastern Cape provinces consistently had the highest number of agricultural households.

As of 2022, 16.3% of South African households were engaged in agriculture. Provinces with larger rural areas, like Limpopo (35.2%) and Mpumalanga (33.4%), had higher agricultural participation, while urbanized provinces, such as Gauteng (5.9%) and Western Cape (3.3%), had lower involvement. Compared to 2021, the share of households in agriculture declined in most provinces, except the Northern Cape, North West, and Western Cape (Stats SA, 2023).

In 2017, with 16.2 million households, about 15.6% (2.5 million) were involved in agriculture. Provinces with rural majorities and high poverty rates, such as Limpopo (25%), the Eastern Cape (20%), and KwaZulu-Natal (20%), relied significantly on agriculture for nutritional needs. These trends highlight regional variations and economic shifts in South Africa's agricultural landscape (Stats SA, 2019).

In contrast, the commercial agriculture market is vibrant, well-integrated, and strongly capitalized. According to Stats SA (2017), the, country has approximately 40,122 commercial agricultural units, accounting for 90% of total agricultural production. However, smallholder farmers in former homelands, cultivate only 13% of agricultural land, have lacked adequate support from policymakers (Hall 2021). They operate under traditional tenure systems established during apartheid (Andrew, 2018, DAFF 2015).

Socio-economically, most smallholder farmers in South Africa are characterized by poverty, limited education, and residence in underdeveloped rural areas, placing them within what is often termed the "second economy" (Chitja & Morojele, 2014, cited in Jacobs, 2008). Smallholder agriculture has been identified as a means to achieve poverty reduction and rural development goals in South Africa (Pienaar & Traub, 2015). The National Development Plan (NDP) has specifically designated smallholder agriculture as a driver of rural development and improvement in the livelihoods of people in former homelands (Fan & Rue, 2020). One of the NDP milestones is to achieve a food trade surplus, with one-third produced by small-scale farmers or households, while ensuring household food and nutrition security by 2030

To realize these goals, the South African government has increased its budgetary allocation for smallholder support programs aligns with the global recognition of the importance of enhancing smallholders' capacity to mitigate the impacts of food insecurity, climate change and external shocks such as the COVID-19 pandemic (Harvey et al., 2018; Vignola et al., 2015).

While 1.6 million citizens (3% of the population) are involved in some form of farming, only 30,000 are commercial farmers supplying more than 80% of South Africa's food (van Loeper et al., 2018). The number of farmers in South Africa has been declining, particularly since the start of the Covid-19 pandemic. However, the COVID-19 pandemic has led to a surge in home food production, with a notable increase in gardening activities. Studies have shown that the pandemic has encouraged more individuals to engage in domestic food production, such as home food gardening (Music et al., 2022; Mullins et al., 2021; Cerda et al., 2022; Park & Shin, 2022; Perera et al., 2021; Wati et al., 2022)

Those who remain, especially small-scale South African farmers, face ongoing challenges. By 2007, approximately 240,000 Black farmers supported about a million household members and employed nearly half a million staff (Aliber & Hall, 2012). This indicates the significant role played by small-scale Black farmers in the South African agricultural sector. However, these farmers continue to face ongoing challenges that hinder their productivity and sustainability.

One of the key challenges y small-scale South African farmers face is access to resources. This includes limited access to land, water, and capital. Land reform in South Africa has been a contentious issue, and many Black farmers still struggle to secure land for agricultural purposes. Additionally, access to water for irrigation and other agricultural activities is often limited, particularly in rural areas. Furthermore, small-scale farmers often lack the necessary capital to invest in modern farming techniques, high-quality seeds, and machinery, which hinders their ability to improve productivity and compete in the market.

Another significant challenge is market access and pricing. Small-scale farmers often struggle to access formal markets and are forced to sell their produce at lower prices to middlemen (Ndlovu & Masuku, 2021). This limits their profitability and perpetuates a cycle of poverty. Additionally, the lack of infrastructure and transportation facilities in rural areas further hinders their ability to access markets and sell their produce at competitive prices.

The role of agriculture in South African households is multifaceted and crucial for livelihoods and food security. Small-scale agriculture plays a significant role in providing income generation and enhancing food security for rural communities (Mbatha & Masuku, 2018). Despite various livelihood strategies, agricultural activities remain essential. According to Stats SA (2023) in 2022, 16.3% of South African households engaged in agricultural activities. Provinces with substantial rural areas, like Limpopo (35.2%) and Mpumalanga (33.4%),

exhibited higher concentrations of households participating in agricultural production. Women make up the majority of smallholder farmers, contributing to food security and livelihoods.

The vast majority of South Africa's rural poor, residing in small-scale irrigation schemes (SISs), depend on small-scale agriculture, creating a gap in welfare. To ensure local water sufficiency, integrated water resource management (IWRM) policies and strategies have been established. Effective engagement is needed at the local level to align objectives between institutions, such as Water User Associations (WUAs), Irrigation Management Committees (IMCs), and the government, with the National Water Act (NWA) promoting a water licensing system facilitating access to adequate water.

Several studies have explored farmer perceptions of water security and water use efficiency (Feng et al., 2023; Meshesha et al., 2022; Sharaunga & Mudhara, 2016). However, managing common pool resources (CPRs), including canal irrigation water and hydraulic infrastructure, is critical for improving crop production and alleviating poverty in SISs, where poverty remains a persistent issue (Van Averbeke et al., 2011).

Women are actively involved in various aspects of crop production, including land preparation, planting, weeding, harvesting, and post-harvest activities. Studies have shown that women make up a significant portion of the agricultural labour force in many developing countries, and their contributions are essential for ensuring food security and agricultural productivity (Diiro et al., 2018). However, women in poor and marginalized agricultural communities face various constraints, including time poverty, limited access to resources, and gender discrimination in land ownership (Holvoet & Inberg, 2018). In South Africa, where subsistence agriculture is prevalent, women's productivity is hindered by these challenges (Qange & Mdoda, 2020).

Smallholder female farmers, particularly in Limpopo, face difficulties in making the most productive use of their time due to their multiple responsibilities (Chitja et al., 2016). Lower levels of resources allocated to women result in decreased agricultural productivity. A study by Doss et al. (2018) investigated the relationship between women's access to productive resources and agricultural productivity in developing countries. The findings revealed that increasing women's access to resources such as land, credit, and inputs improved agricultural productivity and food security. This underscores the significance of resource allocation in influencing women's production outcomes. Additionally, women often bear the primary

responsibility farming and childcare, as men frequently migrate to search for work (Peterman et al., 2020). Despite these obstacles, women are essential to agricultural production and household wellbeing. However, communal land ownership in rural South Africa diminishes the economic importance of land, especially in comparison to commercial farming regions (Kollamparambil, 2020).

Agriculture in South Africa encompasses a dual system, with commercial agriculture playing a crucial role in food security, while smallholder agriculture, primarily led by women, contributes to livelihoods and subsistence. While government initiatives aim to support smallholders and improve water resource management, challenges persist, including poverty, gender disparities, and limited resources. The Socio-Political Context of smallholder farmers' Food Insecurity in South Africa underscores that addressing these issues is essential for sustainable rural development, poverty reduction, and achieving equitable access to resources, including land rights.

2.3 The Socio-Political Context of smallholder farmers Food Insecurity in South Africa

According to the Stats SA (2019), the Integrated Food Security Strategy for South Africa (IFSS) defines food security as "the physical, social, and economic access to sufficient, safe, and nutritious food by all South Africans at all times to meet their dietary and food preferences for an active and healthy life. In spite of more than a decade of consistent economic growth in sub-Saharan Africa, the region confronts a myriad of challenges. These include rapid population growth, persistent economic inequality, threats posed by climate change and droughts, escalating youth unemployment, as well as widespread undernourishment and food insecurity (Dodo, 2020).

Highlighting the gravity of the situation, nations reveal that nearly 80% of individuals afflicted by hunger and chronic malnutrition reside in rural areas. Simultaneously, one in three people worldwide is affected by micronutrient malnutrition, commonly known as "hidden hunger." (Jha & Warkentin, 2020; Bjornlund et al., 2016). It is imperative to comprehend the state of food insecurity in South Africa and elevate it to a prominent position on the political agenda and leadership's priority list. Failing to do so would hinder South Africa's progress toward achieving the United Nations Sustainable Development Goals (SDGs 1 and SDGs 2). The SDG-2 aims to eradicate malnutrition and hidden hunger (Ofori et al., 2022). Improving the nutritional quality of diets for the poorest people is central to meeting the UN’s sustainable

development goals, particularly SDG-2, which aims to end hunger, achieve food security, and promote sustainable agriculture (Lowe, 2021).

In rural South Africa, smallholder farming households typically pursue diverse livelihood strategies based on their available natural, physical, human, and financial capital. Smallholder farming households are known for pursuing diverse livelihood strategies to sustain their families and generate income. This diversification is often a response to small-scale agriculture's various risks and uncertainties. Race et al. (2022) highlighted that while most smallholders still reported farming as their primary occupation, their families' livelihoods are diverse and mainly supported by non-farm enterprises. Ongoro et al. (2022) emphasized that smallholder farming, including animal husbandry, fishing, and non-farm activities, are the predominant livelihood systems in the developing world, characterized by high poverty levels and hunger. Furthermore, Habib et al. (2022) provided empirical evidence that smallholders' community adopts various proportions of livelihood strategies in the form of on-farm, off-farm, and non-farm activities, which can help facilitate resources and improve the overall livelihood of a household. Melketo et al. (2019) also suggested diversifying rural livelihood activities, underlining the fact that smallholder agriculture provides only a limited portion of household income.

In South Africa, gender disparities extend to land ownership and access. The Department of Rural Development and Land Reform's most recent Land Audit Report (DRDLR, 2017) reveals that men possess 73% of the agricultural land in South Africa's Northern Cape Province, with an even more unequal distribution of household plot ownership, where men own 98% of the plots. This data holds significant weight since 61.9% of agricultural activity in South Africa's Northern Cape Province takes place in residential backyards (Stats SA, 2016). This directly impacts women's access to finance, as they lack collateral for loans to invest in productive inputs (Ugwu, 2019; CARE, 2016).

South Africa face diverse livelihood vulnerabilities, influenced by sociodemographic, economic, and adaptation mechanisms (Maru et al., 2021). Approximately 20% of South African households, characterized by low food spending and limited energy availability, are classified as food-insecure (Stats SA, 2019). In 2017, despite a reduction from 13.5 million in 2002, 6.8 million South Africans still experienced hunger, affecting 1.7 million households across the country (Stats SA, 2019). Household food insecurity closely correlates with households' socioeconomic status in South Africa, reflecting factors such as wages,

employment status, and food expenditure (Maru et al., 2021; Pienaar & Traub, 2015; Chopra et al., 2009). Consequently, total household income plays a pivotal role in achieving food security (Ngema et al., 2018; Hendriks et al., 2016). Given the high levels of poverty, most South African households struggle to afford enough food to feed their entire families.

The issue of poverty is deeply intertwined with gender dynamics, particularly affecting women across the world. In South Africa, as is the case in many regions worldwide, deeply entrenched patriarchal norms and structures persist, marginalizing women despite their substantial contributions to both the economy and society (Nash, 2020). Despite the South African Constitution's commitment to gender equity and a non-discriminatory society, gender inequalities and the sexual exploitation of women persist and are not always easily addressed through legislation. In 2023, South Africa had an overall gender gap index score of 0.79, placing it 20th out of 146 countries across four main dimensions of inequality: political representation, economic inclusion, educational attainment, and health and survival (Cowling 2023; World Economic Forum, 2019).

South Africa is the only African nation among the top 20. However, the report acknowledges that no country has achieved complete gender equality across all aspects of life. Even in countries making significant progress, women are often predominant in the informal sector, rendering them more vulnerable to poverty. Although women's participation in South African society is progressing, gender equality faces challenges including rural-urban disparities, limited education, HIV/AIDS, gender-based violence, and unequal access to the labour market and land, which impact sustainable livelihoods. A study by Boudet et al. (2018) revealed substantial gender differences in poverty that are often overlooked when using household measures, underscoring the need for a gender-sensitive approach to poverty assessment.

2.4 Introduction to Sustainable Livelihood Framework and its relevance

The Sustainable Livelihoods Approach (SLA) is a framework developed by the Department for International Development (DFID) in the late 1990s to understand the various factors that affect people's livelihoods, particularly in the context of poverty. The SLA emphasizes the importance of considering the broader policy and institutional context in which livelihood strategies are pursued, and how these factors can either support or undermine these strategies.

Amartya Sen is commonly credited with shifting the food security debate from a sole focus on food availability to emphasizing households' ability to access food. This shift underscores the

importance of analyzing food security through the set "quantity, quality, and stability" (Adjimoti & Kwadzo, 2018). They highlighted the role of individual rights, particularly resources used for production, in ensuring food security for households. The concept of "livelihoods" has gained prominence in development discourse, with a growing emphasis on how human agency improves resilience King et al. (2021).

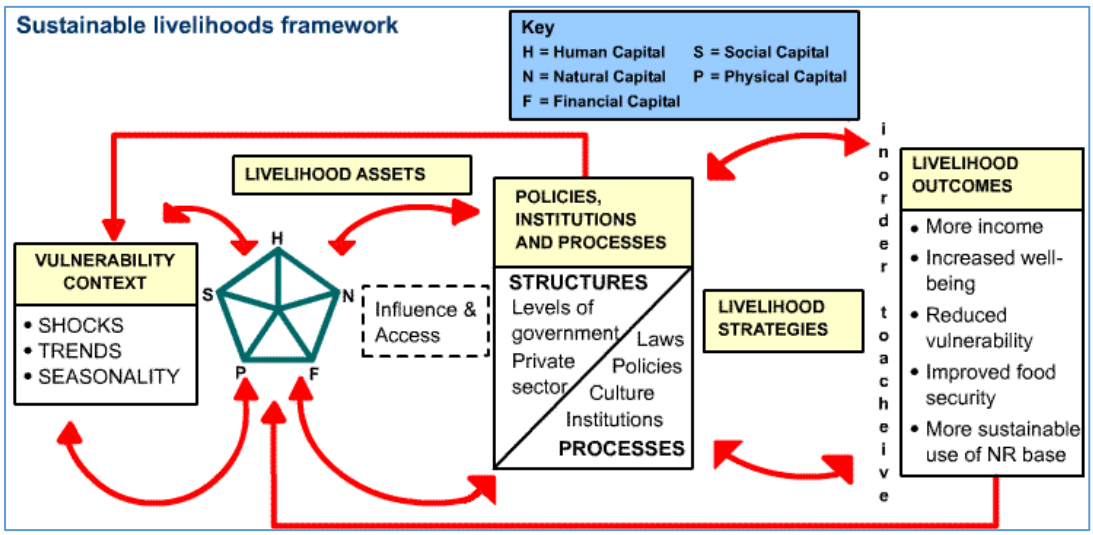

Figure 2. 1: The Sustainable Livelihood Framework

The Sustainable Livelihood Approach (SLA) (see Figure 2.1) is a valuable framework for examining the complex relationship between individuals' access to resources, their diverse livelihood practices, and the micro, intermediate, and macro-level influences at play. It also offers a means of assessing and prioritizing interventions (Su et al., 2018). The SLA directs attention to activities occurring within the broader policy and institutional context and how they either support or undermine livelihood strategies (Etana et al., 2021; Morse & McNamara, 2013; Ellis, 1998). For example, supportive policies and institutions can create an enabling environment for livelihood diversification, access to resources, and economic opportunities. On the other hand, policies and institutions that are poorly designed or implemented can hinder people's ability to improve their livelihoods and may perpetuate poverty and inequality.

To safeguard against hunger, households and communities must have access to and make use of livelihood resources. Smallholder agriculture serves as one of the primary sources of food for rural populations and generates income in many developing countries' rural areas, emphasizing the critical importance of smallholder agricultural productivity in poverty alleviation and hunger reduction (Moralles et al., 2021; Fan & Rue, 2020) Moreover, irrigation farming substantially contributes to wealth creation, particularly in rural settings. Improving

rural livelihoods is an important goal in South Africa, as reflected in the National Development Plan (NDP) strategy of reviving the rural economy through expanding irrigation farming. Smallholder irrigated farming is a crucial input into smallholder farming and, therefore, a potentially important poverty reduction strategy. Smallholder irrigation schemes in former homelands exemplify how irrigation significantly benefits livelihoods, food security, and self-employment. Irrigation already contributes significantly to the goals outlined in South Africa's NDP (NPC, 2012), which calls for an additional 500,000 hectares of irrigated agriculture nationwide. Smallholder irrigation farming, in particular, serves various roles in the livelihoods of agricultural communities, ranging from being one of the primary sources of income for smallholder irrigation farmers to supplementing livelihoods based on other industries (Water Research Commission, 2012; van Averbeke & Mohamed, 2006). Increasing the amount of irrigated land, South Africa can enhance agricultural productivity and resilience, thereby improving food security and creating more opportunities for self-employment. Smallholder irrigation schemes not only boost local economies but also provide a critical safety net for families, ensuring a steady food supply and income even during periods of drought or economic instability. This multifaceted role underscores the importance of irrigation in achieving sustainable development and poverty alleviation in rural communities

While opinions on irrigation farming are polarized, both perspectives recognize its positive impact on household welfare. Broadly, the availability of irrigation water facilitates the adoption of modern agricultural techniques, leading to heightened production, increased incomes, and diversified income streams, ultimately enhancing overall household welfare (Moyo, 2016). Empirical data indicates that regions with a higher percentage of irrigated land witness more substantial improvements in livelihoods compared to those relying solely on rainfall. In the context of South Africa's NDP, the envisioned smallholder irrigation schemes in former homelands hold promise for addressing food security, poverty alleviation, and rural development. (UNDP, 2017). The realization of smallholder irrigation schemes in South Africa's former homelands, as envisioned in the NDP, holds significant promise for advancing rural development and addressing historical inequalities. However, achieving this vision necessitates sustained commitment, effective governance, and meaningful engagement with local communities, drawing on lessons from past initiatives and international experiences in smallholder irrigation and community-based agricultural development.

The SLA recognizes that households require a range of assets, including human, natural, physical, financial, and social capital, to enhance their livelihood strategies. The adaptation of

households to their social, physical, economic, and political contexts through livelihood strategies is a multifaceted process influenced by various factors. Livelihood adaptation strategies involve the selection and combination of activities to maintain household well-being (Liu et al., 2022). When faced with livelihood risks, households adopt strategies to prevent, resolve, and adapt to these risks based on their resources and risk characteristics (Su et al., 2019). Livelihood diversification plays a crucial role in enhancing household well-being, as observed in rural Nepal (Gautam & Andersen, 2016). Additionally, the sensitivity of rural households' livelihood strategies to their livelihood capital status affects their ability to implement different strategies (Wang et al., 2019). By recognizing the need for a diverse range of assets, the SLA provides a comprehensive framework for understanding how households can adapt and thrive despite various challenges. Livelihood adaptation involves not only responding to immediate risks but also planning long-term strategies to improve well-being and resilience. This approach underscores the importance of resource availability and strategic decision-making in maintaining and improving livelihoods. For instance, in rural Nepal, households that diversified their income sources were better able to cope with economic shocks, illustrating the practical benefits of diversification. Moreover, the effectiveness of these strategies often depends on the existing capital status of households, indicating that improving access to various forms of capital can significantly enhance their adaptive capacities

Expanding the asset base of rural households is crucial for improving food security and livelihoods. Transforming systems and processes, involving government and private sector stakeholders, legislation, regulations, society, and organizations, influences the range of livelihood strategies that can lead to improved livelihood outcomes (Habib et al., 2022; Asfaw et al., 2017). The SLA is particularly relevant to this study because the well-being of rural populations is fundamentally tied, in various ways, to the condition of their livelihood assets. The framework provides a holistic approach to empower rural populations and understand the implications of asset access for communities. Smallholder irrigation farming in South Africa is instrumental in improving the lives of impoverished households and establishing pathways out of poverty. In this regard, human resources, including education and farming skills, have an impact on the effective utilization of other livelihood assets, subsequently affecting agricultural production and household welfare

2.5 Smallholder Irrigation Farming in South Africa

The adaptation of smallholder irrigation schemes in South Africa is crucial for addressing water scarcity and enhancing agricultural productivity. Smallholder farmers in Limpopo Province, South Africa, are facing increasing water security threats, necessitating agricultural resilience to ensure food security Kativhu et al. (2020). A prevailing consensus among agricultural researchers and stakeholders underscores the paramount importance of efficient water usage. The application of global satellite-based ET products for local-level irrigation management provides insights into irrigation performance assessment, contributing to sustainable water usage in the sugarbelt of Swaziland (Karimi et al., 2019). Reviewing the challenges and opportunities for revitalizing smallholder irrigation schemes in South Africa is essential for addressing water scarcity and enhancing livelihoods (Fanadzo & Ncube, 2018). Furthermore, understanding the interactions between irrigated agriculture and surface water quality, particularly regarding phosphate and nitrate, is crucial for sustainable water use in the Middle Olifants Catchment, South Africa (Mudaly & Laan, 2020).

Additionally, smallholder irrigation includes individual farms and organizations where farmers collectively manage water distribution among group members. Given that a majority of smallholder irrigation farms are situated in South Africa's former homelands, also known as Bantustans, which were areas set aside for black South Africans during the apartheid era. These areas were often characterized by poor infrastructure and limited access to resources, including water for agricultural purposes. However, in recent years, there has been a concerted effort to promote smallholder irrigation farming in these regions to improve food security and livelihoods for rural communities (Ncube, 2021; Plagerson et al., 2019; Averbeke et al., 2011). The collective management of water resources in smallholder irrigation systems enables farmers to optimize water usage, which is particularly crucial in areas with limited infrastructure and resources. By promoting smallholder irrigation in former homelands, recent initiatives aim to address historical inequalities and enhance the productivity and resilience of rural agricultural communities. These efforts not only contribute to better food security but also create economic opportunities, helping to uplift marginalized communities. The focus on improving irrigation infrastructure and resource access in these regions is a critical step towards sustainable development and poverty alleviation, reflecting a broader commitment to social and economic equity.

Collective activities at the scheme level in smallholder irrigation have been a subject of interest in recent research. Muchara et al. (2014) conducted a case study of the Mooi River Irrigation Scheme in KwaZulu-Natal Province, South Africa, focusing on collective action and participation in irrigation water management. The study emphasized the importance of understanding the level of participation in collective activities at the scheme level for effective smallholder irrigation management. This highlights the significance of collective action in ensuring the success of smallholder irrigation schemes. Therefore, determining the factors influencing farmers' participation in the management of smallholder irrigation schemes, for example, in Kwazulu-Natal Province provides valuable insights into improving irrigation management and water usage (Phali et al., 2021). Understanding the dynamics of collective action at the scheme level is crucial because it directly impacts the efficiency and sustainability of water management in smallholder irrigation systems. The success of these schemes depends on the active and effective participation of farmers in collective activities such as water distribution, maintenance of infrastructure, and decision-making processes. Identifying the factors that influence participation can help develop strategies to enhance engagement and cooperation among farmers, leading to better management practices and optimized water usage. This, in turn, contributes to increased agricultural productivity and improved livelihoods for smallholder farmers. Insights from studies like those conducted by Muchara et al. (2014) and Phali et al. (2022) are invaluable for policymakers and development practitioners aiming to strengthen smallholder irrigation schemes.

The South African government has prioritized and invested significantly in establishing, rehabilitating, and revitalising smallholder irrigation schemes to enhance food security and alleviate rural poverty Sinyolo et al. (2014). However, challenges such as low water-use efficiency and cost recovery of government investments have been identified in smallholder irrigation schemes in South Africa (Fanadzo & Ncube, 2018). Collective action and participation in irrigation water management have been studied, emphasizing the importance of understanding the level of participation for effective smallholder irrigation management (Muchara et al., 2014). The government's support for irrigation development, including providing subsidies to state irrigation schemes and irrigation board schemes, has been noted (Averbeke et al., 2011). Additionally, vast government investments have been made in smallholder irrigation establishment, rehabilitation, and revitalization in South Africa, particularly in the Limpopo Province (Kativhu et al., 2020).

The situation is somewhat different for canal schemes that have not undergone reengineering. The lack of reform in canal schemes in South Africa, as opposed to irrigation schemes, has been a concern. While there has been significant attention and investment in smallholder irrigation schemes, the focus on canal schemes has been relatively limited. The existing literature highlights the challenges and opportunities for revitalizing smallholder irrigation schemes in South Africa (Fanadzo & Ncube, 2018). It emphasizes the need for capacity building and the lack of adequately trained farmers and extension staff, particularly in irrigation water management, as a missing link in smallholder irrigation development. Additionally, the factors affecting the performance of irrigation schemes, such as the Tshiombo Irrigation Scheme in the Limpopo Province, have been studied, revealing issues such as limited participation of aging farmers in the value chain (Mwadzingeni et al., 2020).

Furthermore, the lack of reform in canal schemes is evident in the limited scholarly literature on factors affecting the performance of smallholder irrigation schemes in South Africa. This indicates a gap in understanding and addressing canal schemes' challenges and requirements. The need for collective action and participation in irrigation water management has been highlighted, emphasizing the high levels of dependence on government support among smallholder irrigation farmers and the recurrent problems in South Africa, including low participation and poor maintenance and performance when farmers are left to manage previously government-funded schemes (Fanadzo & Ncube, 2018). The lack of reform in canal schemes is further underscored by the limited utilization of some schemes, as evidenced by the findings that about one-third of the schemes in the Limpopo Province were not fully utilized (Koppen et al., 2017). This points to inefficiencies and underdevelopment in the management and utilization of canal schemes. The need for structural change and wider reform to address the challenges and limitations in smallholder irrigation schemes has been emphasized, indicating the necessity for similar attention to canal schemes (Fanadzo & Ncube, 2018).

2.6 Management of Smallholder irrigation Farming

South Africa has recognized the need to tackle its water-related challenges by implementing long-term irrigation schemes Adom & Simatele (2021). These initiatives have a dual purpose of improving the well-being of rural communities through sustainable agriculture, particularly emphasizing food security and poverty reduction (Kativhu et al., 2020). The impact of water-related challenges on rural communities' food security initiatives has been studied, highlighting the significance of addressing water scarcity for sustainable agricultural practices (Nephawe et

al., 2021). Focusing on long-term irrigation schemes, South Africa aims to mitigate the adverse effects of water scarcity on agriculture, which is crucial for the sustainability of rural livelihoods. These schemes are designed to ensure a reliable water supply for agricultural activities, thereby enhancing food security and reducing poverty among rural populations. Addressing water-related challenges is essential for enabling sustainable agricultural practices, which can lead to improved crop yields and stability in food production. Consequently, these efforts are expected to contribute significantly to the overall well-being of rural communities by providing them with the necessary resources to achieve food security and economic resilience.

Agricultural researchers and stakeholders widely agree on the critical importance of efficient water use Sinyolo et al. (2014). Smallholder irrigation encompasses individual farms and organizations where farmers are responsible regulating water distribution among group members (Dlangalala &Mudhara, 2020; Averbeke et al., 2011). This highlights the consensus among agricultural experts and stakeholders regarding the crucial role of efficient water utilization in addressing South Africa's water challenges. Furthermore, FAO's observations emphasize that smallholder irrigation involves both individual farms and collective organizations, with farmers taking on the responsibility of managing water distribution within these groups (Averbeke et al., 2011).

The majority of smallholder irrigation farms in South Africa are situated in former homelands and are predominantly owned by historically disadvantaged racial and ethnic groups Sinyolo et al. (2014). These systems are managed and run by residents who employ technology that they can efficiently operate and maintain (Dlangalala & Mudhara,2020; Averbeke et al., 2011). This underscores the socio-economic aspect of smallholder irrigation in South Africa, with a focus on historically marginalized racial and ethnic groups. Additionally, it highlights the localized and resident-driven nature of these irrigation systems, with an emphasis on their ability to effectively use technology suited to their capabilities.

Regardless of the scheme's size, farmers need to engage in collective activities at the scheme level to ensure effective smallholder irrigation management (Muchara et al., 2014). Training is probably one of the most important requirements for successfully developing and managing of smallholder irrigation schemes in South Africa (Fanadzo & Ncube 2018). A survey of 76 public smallholder irrigation schemes in the Limpopo Province was jointly conducted as part of the ‘Revitalization of Smallholder Irrigation in South Africa’ project, emphasizing the significance

of understanding the specific challenges and requirements of canal schemes (Koppen et al., 2017). Additionally, the diversity among smallholders farming 1.28 ha plots at Dzindi Irrigation Scheme in the Thulamela Local Municipality of Limpopo Province, South Africa, has been investigated, highlighting the need for tailored approaches to smallholder farming styles and development policy (Harvey et al., 2018). Furthermore, smallholder farmers in South Africa face increased pressure to manage water use due to growing scarcity and environmental water demand, emphasizing the need for resilience and adaptive strategies in smallholder farming (Kativhu et al., 2020).

In the 1980s, the South African government initiated an irrigation sector reform to enhance the performance of irrigation schemes. This reform had two distinct components. Firstly, it involved an irrigation management transfer exercise in which irrigation schemes were transferred to farmers, expecting this shift in responsibility to improve resource use efficiency (Zewdie et al., 2021; Nhemachena et al. 2020). This first component of the reform, known as irrigation management transfer, is the process through which the government transfers responsibility for managing, operating, and maintaining irrigation facilities to farmers. It encompasses various steps, including government withdrawal, the establishment of water users' associations, the development of local management institutions, and the transfer of ownership and management, as explained by Moyo et al. (2016).

Secondly, the reform introduced the concept of participatory irrigation management. The concept of participatory irrigation management (PIM) has been introduced as an attitudinal change, often accompanying the reforms introduced by Irrigation Management Transfer (IMT) (Playán et al., 2018). These reforms aim to achieve high crop productivity, economic efficiency, and equitable distribution of irrigation water among farmers (Ahmad et al., 2020). PIM involves the active involvement of water users, including farmers, in decision-making at various levels, and is implemented in many developing countries (Zulfiqar et al., 2021). The shift towards PIM signifies a transition from government-oriented to participatory irrigation management paradigms (Liu et al., 2021). This approach is advantageous as it increases irrigation water efficiency, strengthens construction and maintenance of irrigation facilities, and improves irrigation service and capacity building (Li, 2018). The findings from various studies have verified the effectiveness and usability of the participatory irrigation system in addressing the problem of inequitable water allocation between head-end and tail-end farmers (Kosanlawit et al., 2017).

The situation of non-reengineered canal schemes, typically over 40 years old and constituting approximately 25% of the smallholder irrigation command area, plays a significant role in the livelihoods of plot holders. Studies have shown that access to reliable irrigation water can enable farmers to adopt new technologies, intensify cultivation, and achieve increased productivity and higher returns from farming (Liu et al., 2021; Aseyehegu et al., 2012). However, challenges such as poor infrastructure, soil fertility, limited access to farm inputs, and inadequate market access have resulted in low yields, food insecurity, and negative farm income (Usman & Callo-Concha, 2021); Nwafor, 2020). Furthermore, issues such as watershed degradation, lack of sustainable funding, and management-related problems have been identified as major constraints affecting the performance of irrigation schemes (Moyo et al., 2016; Awulachew & Ayana, 2011).

In addition, poor management, infrastructural problems, water inadequacies, conflict, and theft have been highlighted as primary constraints in smallholder irrigation schemes (Belay et al., 2022). The governance focusses on repairing irrigation infrastructure while neglecting capacity building has been attributed to the failure of smallholder irrigation schemes in South Africa (Fanadzo & Ncube, 2018). The impact of small-scale irrigation on household income has been positively associated with irrigation participation, family labour force, livestock ownership, and access to market information and credit. However, the challenges faced by smallholder irrigation schemes, such as infrastructural decline, lack of funding, water shortage, and inefficient irrigation systems, have hindered their revitalization (Fanadzo & Ncube, 2018). Furthermore, the existence of informal land markets and the absence of formal rules and informal institutions have contributed to dysfunctional market environments in some irrigation schemes (Masasi & Ng'ombe, 2019). Non-reengineered canal schemes play a crucial role in smallholder irrigation, impacting household income and food security. While access to reliable irrigation water can enhance productivity, the challenges of poor infrastructure, management-related issues, and market constraints have hindered the performance and revitalization of smallholder irrigation schemes.

2.7 The role of Smallholder irrigation Farming in Livelihoods

Smallholder irrigation farming has been shown to play a crucial role in enhancing livelihoods and reducing poverty in rural communities (Zuma et al., 2018). Studies have demonstrated that the integration of smallholder irrigation systems has the potential to significantly reduce

malnourishment and poverty in low-income communities (Fandzo & Ncube, 2018; Sinyolo et al., 2014). However, it is important to note that smallholder irrigation schemes have faced challenges in achieving their objectives of improving rural livelihoods and sustainable crop production for food security and poverty alleviation (Fandzo & Ncube, 2018; Moyo et al., 2016). Nevertheless, the implementation of solar-powered drip irrigation has been found to enhance food security in the Sudano-Sahel, highlighting the potential of irrigation in poverty reduction (Gupta, 2019; FAO, 2018).

Institutions in smallholder irrigation schemes have the potential to contribute to building climate resilience and improving the livelihoods of smallholder irrigators (Mwadzingeni et al., 2022). Additionally, agroforestry systems have been identified as supporting sustainable livelihoods of smallholder farmers in mountainous areas, emphasizing the role of diversified agricultural systems in supporting rural livelihoods (Córdova et al., 2018). Furthermore, the adoption of irrigation technologies among smallholder farmers has been influenced by their awareness of the importance of irrigation farming, indicating the potential for technology adoption to enhance smallholder livelihoods (Muluki et al., 2022).

Vulnerability to drought across different livelihood typologies has been studied, highlighting the importance of understanding the specific challenges faced by smallholder farmers in different contexts (Maru et al., 2021). Moreover, access to water for irrigation has been reported to reduce poverty in smallholder farming communities, emphasizing the critical role of water access in improving livelihoods (Kamara et al., 2019). Introducing irrigation to smallholder farms in Sub-Saharan Africa has been recognized as a means to increase food security, improve nutrition, and reduce poverty (Zande et al., 2020). However, it is important to consider the economic implications of smallholder irrigation, as it has been found to create more income and wealth, thereby improving farmers' livelihoods (Agbugba et al., 2020). Smallholder irrigation farming has the potential to significantly impact rural livelihoods by reducing poverty, improving food security, and enhancing resilience to climate change. However, challenges exist, and it is essential to address these challenges through sustainable and context-specific interventions to maximize the potential benefits of smallholder irrigation for rural communities.

2.8 Women in Agriculture

Women play a crucial role in agriculture, particularly in smallholder farming communities, and their participation has significant implications for productivity, livelihoods, and household

well-being. Studies have highlighted the multifaceted contributions of women in agriculture, emphasizing the need to consider gendered responsibilities, resources, and constraints to enhance productivity and benefit both men and women smallholder farmers Doss (2017). Furthermore, the local gender contract in smallholder irrigation farming communities has shed light on the adaptive capacity of women and the negotiation of roles within these settings, underscoring the importance of understanding gender dynamics in agricultural contexts. Studies have shown that the feminization of agriculture, driven by male out-migration, has led to women taking on new agricultural responsibilities and increased household labour duties (Spangler & Christie, 2019).

Women's participation in agriculture extends beyond traditional subsistence farming, as evidenced by their involvement in urban agriculture, where they play a key role in food management at the household level, thereby influencing family economies (Niewoehner-Green et al., 2019). Additionally, the impact of irrigation on livelihoods in Western Africa has been shown to improve the incomes of women, leading to increased nutritional intake for their households, particularly when women are involved in marketing their farm produce (Akudugu et al., 2021). This underscores the economic and nutritional significance of women's engagement in irrigation farming.

Despite their crucial role, the contributions of women in agriculture are often undervalued, and they have limited access to productive capital and opportunities, leading to them earning considerably less than their male counterparts. Additionally, while women are integral to the agricultural sector, they are frequently marginalized when it comes to decision-making processes, both at the local level and concerning property rights (UN Women, 2019). In fact, women constitute 80% of farmers, supply 70% of the workforce, and produce 60-80% of the world's food supply. Their work is indispensable for ensuring food security (Doss 2011). Furthermore, women's empowerment in agriculture has gained significant attention in recent years, with the development of the Women's Empowerment in Agriculture Index (WEAI) by the International Food Policy Research Institute (IFPRI). The WEAI is a comprehensive tool designed to measure the empowerment of women in the agricultural sector, encompassing various dimensions such as decision-making power, access to and control over resources, and participation in agricultural activities (Addison et al., 2021). This index has been widely utilized in research to assess the extent of women's empowerment in agriculture and its implications for agricultural productivity, food security, and household well-being. In spite of their importance, women still faced disempowerment in agriculture.

It is impossible to overstate the significance of the gender component in agriculture. There is a need for transformative policies and processes in the engendering of agriculture in Southern Africa. In agrarian communities, gender and land ownership present a complex issue. Although conventionally perceived as a male entitlement, the reality is that women play a vital role in agricultural production yet often face marginalization in terms of land ownership and resource access. Rooted in social and power constructs, this phenomenon reflects societal norms regarding the roles of men and women (Chijta & Mkhize, 2019).

Women's contributions to agriculture cover the entire value chain, encompassing planting, harvesting, processing, and marketing. For instance, research has shown that women are actively engaged in high-value crop and livestock projects in Africa and Asia, where they have been able to increase their control over production, income, and assets, despite the persistence of gender-asset gaps (Diiro et al., 2018). Their active involvement is indispensable for the functioning of agriculture. Women participate in various roles, including managing their own land, providing unpaid labor on family farms, and working as paid or unpaid contributors on other agricultural ventures and plantations (Dedieu et al., 2022).

In addition, women's engagement in agricultural innovation and mechanization has been instrumental in unlocking the hidden potential of agricultural value chains, thereby impacting agricultural productivity and contributing to the development of value chains (Dijk et al., 2022; Kirui & Braun, 2018). Moreover, studies have emphasized the importance of measuring women's empowerment in various agricultural value chains, highlighting the need to address gender disparities and ensure that women benefit equitably from agricultural policies and programs (Deji, 2021; Sachs et al., 2020).

In Sub-Saharan Africa, women exhibit relatively high total labour force participation rates, and they have the highest average labour force participation rate in agriculture globally, standing at 63% in 2010 and 64% in 2014 compared to other regions (Nchake & Koatsa, 2017). Cultural traditions have historically empowered women to be economically self-reliant and have bestowed upon them significant responsibilities in agricultural production. Thus, women have played a crucial role in the conventional patriarchal agricultural sector (USAID, 2018). To truly harness the potential of agriculture for development, it is imperative that the development community fosters knowledge dissemination across all aspects of the agricultural sector, with a strong emphasis on gender mainstreaming in policy formulation, strategies and legislation to ensure the full and inclusive participation of women.

2.9 Water Policy, Strategies and Legislation

The water policy, strategies, and legislation in South Africa have been the subject of extensive research and analysis. The challenges facing sustainable and adaptive groundwater management in South Africa have been identified, including the need for effective implementation of current water legislation (Pienaar et al., 2021; Knüppe, 2011). Stakeholder engagement in sustainable water resource management has been highlighted as an area requiring improvement, despite existing legislation and policies (Adom & Simatele, 2022; Edokpayi et al., 2020). Post-apartheid South Africa has seen the initiation and adoption of various water policies and programs aimed at sustainable water development and improving water supply, particularly for the previously disadvantaged black population (Adom & Simatele, 2021). The National Water Act and National Water Resource Strategy have set ambitious visions for integrated water resources management, with a focus on redistributing water resources towards the poor and historically disadvantaged communities (Colvin et al., 2019).

In terms of water accessibility, South Africa's policy has been to provide a certain amount of free basic water per month to each household, aiming to meet the water needs of the population, including those living with HIV (Galvin & Masombuka, 2020). Legislative frameworks addressing mine waste and mine water management have been evaluated, with suggestions made for improving access to water for all in South Africa (Ledwaba & Nkomo, 2021). The existing public provision model continues to characterize much of the water infrastructure investment in South Africa, highlighting the importance of funding models for financing water infrastructure (Ruiters & Amadi-Echendu, 2022). The policy process followed by the South African Government in developing and implementing the White Paper on a National Water Policy has been outlined, providing an overview of the water policy process in the country (Coning, 2006).

The NWA also acknowledges the use of water for household food consumption, setting it apart from economic utilization. While this recognition is essential for meeting immediate sustenance needs, it poses a challenge to achieving livelihoods beyond subsistence agriculture, even though water is pivotal to breaking free from this cycle (Pawlak & Kolodziejczak, 2020). This particular dilemma necessitates a reconfiguration of the water sector and the alignment of the 1998 Act with poverty alleviation and sustainable agricultural development objectives. Although this legal framework is recognized globally as one of the most promising mechanisms

for addressing water management issues and promoting equity, the efforts of small-scale farmers, particularly women, appear to be faltering.

The financing of water infrastructure in South Africa is mainly undertaken by the central government, state-owned entities, and water boards existing in each province (Dithebe et al., 2019). The relevance of the right to water in sustainable water governance has been emphasized, with South Africa's constitution enshrining the right of access to water services (Adome & Simatele, 2021). Spatial planning initiatives, such as "Water Sensitive Urban Design for South Africa," have been introduced to guide settlements in becoming more water-sensitive (Rohr, 2015). The role of archives and records management legislation in South Africa has been examined, highlighting the availability of effective legislation but the lack of policy on appraisal and disposal of records (Netshakhuma, 2019).

2.9.1 Equity and Water

Water, universally acknowledged as a fundamental human right, is enshrined in South Africa's constitution, emphasizing everyone's entitlement to sufficient food and water (Section 27 1b). The focus extends beyond mere access to equitable water management, ensuring reliable, clean water for basic needs and installations, with a particular emphasis on enhancing the quality of life for vulnerable populations, especially women. Discussions about equity often concentrate on water access, necessitating a shift towards considering the quality of water allocation for genuine equity in access.

Equity priorities in water management are grounded in equal allocation principles, guided by economically diversified organizations (DWAF 2012). The National Water Act (NWA) and Free Basic Water Policy (FBWP) aim to provide free basic water (Water Alternatives, 2022), but challenges arise in translating this provision into poverty alleviation, particularly through food gardening, a critical aspect of poverty mitigation that relies on water availability (Doss 2011).

Research highlights that approximately 2.11 million people in South Africa lack access to safe water infrastructure (Edokpayi et al., 2018), emphasizing the urgent need to address water accessibility and quality. Legal reforms and policies, including a free basic water allowance, demonstrate South Africa's commitment to the human right to water. However, challenges persist, prompting calls for an independent water regulator to enhance governance capacity and

address issues of equity, especially for emerging farmers who face artificial water scarcity despite legislative focus on equity in the National Water Act (Chikozho et al., 2020).

The National Water and Sanitation Master Plan underscores challenges in water services delivery, emphasizing the need for both accessibility and equity (Loubser et al., 2021). Challenges in water infrastructure investment and financing, coupled with the impact of market incentives on water resource management, further complicate the multifaceted issue of equity and water in South Africa (Ruiters & Amadi-Echendu, 2022). While efforts have been made to address these challenges, sustained focus and action are crucial to ensure equitable access to safe and sustainable water resources for all South Africans (Yates & Harris, 2018).

Effective water resource management has far-reaching implications for people's lives, livelihoods, economic development, and social stability. The cornerstone principles underlining the strategy framework for water management in South Africa are Equity, Optimal Use, Sustainable Use, Responsibility, and Accountability, as outlined in the National Water Act (36 of 1998) and the Water Services Act (108 of 1997) (Tanner et al., 2022). These principles are essential for ensuring the fair and just distribution of water resources, efficient utilization of water, and the sustainable management of water resources to meet the needs of current and future generations. Additionally, Responsibility and Accountability are crucial aspects of this framework, emphasizing the obligation of water users to use water resources in a sustainable and equitable manner, while also being answerable for their actions and decisions in water management.

The implementation of these principles is vital for addressing the challenges of water scarcity, water quality degradation, and the provision of water services to all citizens in South Africa. Furthermore, the principles align with international best practices for water management, contributing to South Africa's commitment to achieving the United Nations Sustainable Development Goal 6 of ensuring availability and sustainable management of water and sanitation for all.

The cornerstone principles of Equity, Optimal Use, Sustainable Use, Responsibility, and Accountability, derived from the National Water Act and the Water Services Act, form the basis of the strategy framework for water management in South Africa. These principles are essential for addressing water-related challenges and ensuring the sustainable and equitable use of water resources in the country.

2.9.2 Equity in water services

Access to adequate water is not only vital for sustaining human life but is also considered one of the most significant socio-economic rights. This right is inseparable from other legal, political, and socio-economic rights. The United Nations and various countries have recognized access to safe drinking water as a fundamental human right, essential for improving living standards (Dinka, 2018). Furthermore, the importance of water, Section 27(1b) of the South African Constitution affirms the right of all citizens to access "appropriate water."

The rights enshrined in the Bill of Rights, including the right to access water, are explicitly justified, and the State is obligated to "respect, protect, promote, and fulfill" all these rights (Constitution, Section 7[2]). Like many socio-economic rights in the Constitution, the right to access adequate water places an obligation on the State to take reasonable legislative and other measures to progressively realize this right within its available resources (Constitution S 27, ii). This means that the Constitution of South Africa acknowledges the importance of various rights, including access to water, and imposes a duty on the State to not only recognize these rights but also to actively work towards ensuring that they are progressively realized, considering the available resources. In the case of the right to access adequate water, the State is obligated to take appropriate actions to make this right a reality for its citizens over time, within the constraints of its financial and logistical capacities.

Government programs must evolve to cater to the needs of the most vulnerable and ensure that social and economic rights become more accessible to a broader spectrum of individuals over time. To give practical effect to the constitutional right, national legislation in South Africa provides for the right to water. For example, Section 3 of the Water Services Act 108 of 1997 states that everyone has the right to access basic water and basic sanitation, and water service providers must take appropriate measures to enforce these rights (Algotsson and Murombo 2009). However, mere physical access to water resources near households is insufficient if water remains unaffordable and continues to perpetuate gender-based disparities. International treaties and agreements, such as the United Nations Convention on the Rights of the Child (1989) and the African Charter on the Rights and Welfare of the Child (1990), explicitly reference water-related rights.

The issue of equity in water services in South Africa, particularly concerning smallholder women irrigation farmers, is a pressing concern that necessitates comprehensive attention. Approximately 2.11 million people in the country grapple with inadequate access to safe water

infrastructure, underscoring the widespread challenge of water scarcity (Kayser et al., 2013). For smallholder women irrigation farmers, this translates into difficulties in securing reliable and sustainable water sources for agricultural purposes, impacting their livelihoods and food security.

Equity in water services for these farmers spans various dimensions, encompassing access to water infrastructure, water rights, and participation in water governance. Distributive equity, a key facet of social equity, assumes heightened significance in ensuring universal water access. Gender disparities further compound the challenges, limiting women farmers' ability to effectively utilize water resources for agricultural activities.

Research highlights the failure of smallholder irrigation schemes in southern Africa, emphasizing the need to address barriers and opportunities to enhance productivity and economic well-being (Moyo et al., 2016). Operationalizing equity in multipurpose water systems is pivotal, involving the consistent provision of a minimum quality and quantity of water services to all end-users (Yang et al., 2023). Understanding the policies and strategies that effectively promote equity is essential for policymakers and researchers (Fuente & Bartram, 2018).

Examining the impact of cost-recovery policies on low-income communities in townships is crucial for achieving distributional and procedural equity in service delivery (Smith & Hanson, 2003). Assessing infrastructure and water governance in smallholder irrigation contexts, based on farmers' and key informants' perceptions, provides valuable insights (Mugejo et al., 2022).

To address equity in water service for smallholder women irrigation farmers in South Africa, a comprehensive approach is necessary. This involves gender-sensitive water allocation policies, technical support for sustainable irrigation practices, and inclusive participation of women in water governance. By addressing the specific challenges faced by women farmers, South Africa can progress toward more equitable and sustainable water management practices, contributing to the empowerment of smallholder women irrigation farmers.

Considering the role of district municipalities and local municipalities in bulk water supply is integral to ensuring equity in water service for smallholder women irrigation farmers. Challenges related to water access and management necessitate attention, with improvements in irrigation infrastructure proving beneficial (Zewdie et al., 2021). Support for women smallholders positively influences their willingness to pay for irrigation water (Chipfupa &

Wale, 2019). Institutional challenges, such as inadequate participation and poorly organized irrigation water user associations, must be addressed (Kanda & Lutta, 2022).

Efficient water resource use and participatory data acquisition are critical for enhancing water productivity in small-scale irrigation schemes (Habtu et al., 2018). Assessment of irrigation water availability, infrastructure performance, and water governance systems is essential for equitable water allocation and inclusive water and food policies (Mugejo et al., 2022; Magidi et al., 2021). Cooperative approaches to intra-metropolitan water supply policies are emphasized for sustainable and resilient hydro-economies (Rushforth & Ruddell, 2015).

Addressing the challenges faced by smallholder women irrigation farmers requires a multifaceted approach. Improving irrigation infrastructure, enhancing water productivity, addressing institutional challenges, and promoting cooperative approaches to water supply policies are essential. District municipalities and local municipalities play a crucial role in ensuring equitable water service, and their involvement in bulk water supply is vital for addressing water access and management challenges faced by smallholder farmers.

2.10 Guidelines for Water Allocation Reforms in South Africa

The South African DWAF proposed in 2005 that the water allocation process should:

i) First of all, correct past imbalances in the distribution of water to economically marginalized people. this suggests that priority should incline to the vulnerable and also the less fortunate within the distribution of the water supplies available.

ii) Have capacity-building programs that promote water usage to enhance livelihoods and encourage the efficient and safe use of water. This implies that both the goals of equity and economic development may be discussed concurrently within the water allocation process.

(iii) Contribute to broad-based Black economic empowerment and gender equality by promoting access to water for Black and women-owned businesses.

(iv) Respond to local, provincial and national planning initiatives, and South Africa's international obligations and regional Southern African Development Community (SADC) initiatives. The Republic of South Africa is a vast country with huge differences in regional water availability. It also has shared rivers. These regional

differences and commitments to international obligations in allocating water resources must be taken into consideration in water resource management.

v) Be undertaken in an exceedingly fair, reasonable and consistent manner, such the existing lawful uses will not be arbitrarily curtailed.

vi) Give effect and support to the protection of water resources as outlined in the National Water Act, by promoting the phased attainment of both developmental and environmental objectives.

vii) Introduce innovative mechanisms which will reduce the executive burden of authorising water use, while still supporting its productive uses, and therefore the effective management and protection of water resources (DWAF 2005).

The complexities of water allocation in South Africa demand a multifaceted approach that integrates various critical aspects, including wastewater management, water quality standards, human rights principles, legislative reforms, governance models, and strategies to address water scarcity. This discussion explores the comprehensive guidelines for water allocation and emphasizes the imperative of redressing historical disparities to ensure equitable access to water resources.

The guidelines for water allocation in South Africa encompass wastewater management, maintaining water quality standards, and utilizing insights from the water footprint assessment (WFA) for informed decision-making. Wastewater treatment facilities are mandated to manage effluent quality to protect surrounding environments, emphasizing the importance of water quality standards in preserving water sources (Okeyo et al., 2018; Pahlow et al., 2015).

Human rights principles, particularly the right to adequate and sustainable water supply, are crucial in the water allocation reform process. The South African Constitution recognizes water access as a fundamental human right, highlighting the significance of incorporating these principles into water allocation guidelines for equitable access (Adom & Simatele, 2021).

Legislative frameworks, such as the National Water Act of 1998, play a pivotal role in shaping water resource management, emphasizing equity, efficiency, and sustainability. Institutional reforms and governance models are equally vital, underscoring the need for effective

coordination and governance in water management (Backeberg, 2005).

Water scarcity considerations are critical in optimizing water allocation regimes, especially in water-scarce regions. The experiences in regions like the Middle Olifants sub-basin underscore the necessity of efficient water use under worsening scarcity conditions.

The National Water Act of 1998 serves as a legislative framework addressing historical disparities in water access. It prioritizes historically disadvantaged individuals and communities, providing a legal basis for redressing imbalances (Jegede & Shikwambane, 2021).

The SAHRC plays a crucial role in advocating for equitable water access as a fundamental human right. By monitoring and evaluating water access, particularly for historically disadvantaged individuals, the SAHRC provides recommendations for policy interventions to address existing inequalities (Dube, 2020).

The South African government's commitment to affirmative action policies, as exemplified in the Reconstruction and Development Programme (RDP), aims to redress historical imbalances. Community-based approaches and participatory decision-making processes are crucial in prioritizing redress and ensuring marginalized communities have equitable access to essential services, including water.

The comprehensive approach to water allocation in South Africa involves integrating guidelines for water management and addressing historical disparities. By combining legislative frameworks, human rights advocacy, affirmative action policies, community engagement, and participatory decision-making processes, sustainable and equitable water access can be achieved. This approach ensures not only the preservation of water resources but also redresses historical injustices, contributing to a more just and sustainable water allocation system in the country.

2.11 Gender dynamic and its effects on land and water Use Security

The concept of gender means a set of social, psychological and cultural characteristics that society ascribes in different ways to men and women. Those characteristics change over time and relation to social context. Integrating gender issues in land tenure and water resources matters and are key for the sustainability and security of livelihoods for all men and women, more importantly, women. This section will discuss land and gender equity, land right and

constraints, land rights and statutory constraints, land rights and customary constraints and water use security dynamics.

2.11.1 The Current Reality of Poor Women's Access to Water

Despite the democratic human rights system governing water facilities in South Africa, a significant portion of vulnerable South Africans still struggle to access adequate water and essential services. Access to these basic facilities hinges on factors such as availability, affordability, and quantity. These factors are heavily influenced by socio-economic and gender disparities, which, in turn, profoundly affect women's ability to lead secure and dignified lives (UN Women, 2019). Among the most adversely affected are rural African women, who represent the poorest class of women and grapple with multiple challenges related to water resources (UN Women, 2019) These challenges continue to erode their access to basic services, undermining their quality of life and socio-economic progress.

One of the primary challenges faced by rural communities, particularly in impoverished areas, is the substantial distance that many individuals, often women and children, must traverse to access water in the absence of basic facilities (UN Women, 2019). Although the post-1994 government's rural water supply program has made significant strides in improving water access, a concerning reality persists. As of 1999, 10% of non-urban African households still resided more than 1 kilometre away from the nearest water source, while 25.4% were situated between 200 meters and 1 kilometre from their water source (UN Women, 2019) This situation highlights the immense difficulty smallholder producers face in accessing irrigation water, even on a small-scale home garden level.

In cases where water sources are distant from households, it is typically women who bear the burden of dedicating more time and resources to collecting and transporting water for their families' needs (UN Women, 2019). For example, when the water source is 1 kilometre or more from the home, female household members are nearly three times more likely than their male counterparts to be responsible for water collection. They spend an average of 71 minutes daily on this arduous task (UN Women, 2019) and face potential risks during these journeys. Consequently, in South Africa, as in many other nations, women disproportionately shoulder the impact of water-related challenges, reinforcing the urgent need for improved access and gender-sensitive solutions.

2.11.2 Land and Gender Equity

The multifaceted issue of land and gender equity in South Africa encompasses economic, social, and political dimensions, prompting increased pressure on the government to address disparities in land ownership and equitable representation in employment (Tekwa & Adesina, 2023). Persistent structural inequalities, particularly in the land-water nexus, intersect with gender, as highlighted in debates around Section 25 of the South African Constitution and the principle of "expropriation of land without compensation." Despite progressive policies, challenges persist due to inconsistent interpretations of gender equity and uncertainties in identifying women as beneficiaries of land reform (Davis et al., 2004). Studies have shown that the distribution of land among land reform beneficiaries has been relatively uneven, leading to differentiated access to farming services and infrastructure among different groups of beneficiaries (Moyo, 2011). The challenges in achieving gender equity through land reform programs have been attributed to the lack of clarity in identifying women as beneficiaries and addressing the specific needs and rights of women in the context of land redistribution (Davis et al., 2004)

Female entrepreneurs in Africa, including South Africa, are significantly influenced by land ownership, emphasizing the importance of favorable land tenure and financial institutions (Baliyan et al., 2020). The comparison of land reform and gender equity issues in South Africa to other African countries, like Zimbabwe, reveals similar challenges for women in terms of land ownership and allocation. The literature underscores the gap between high-level commitments to gender equity and actual practices in South Africa's land reform program, advocating for redistributive reforms that integrate gender equity to address discrimination and alleviate women's poverty.

The disjuncture between commitments and practices is evident in the comparison to Zimbabwe, where women face similar challenges in land ownership. Efforts to secure land tenure should consider potential negative outcomes for women. The existence of millions of unrecorded land rights in sub-Saharan Africa, particularly for women, further exacerbates gender disparities in land ownership and access (Koeva et al., 2017).

Gender equity in land ownership involves complex cultural, legal, and economic factors (Agarwal et al., 2021). Multiple measures are needed to assess inter-gender gaps effectively (Kieran et al., 2015). Despite legal rights, cultural objections and patrilineal inheritance

practices limit women's practical land rights (Ajala, 2017). Addressing gender discrimination requires a redistributive land reform integrating equity considerations (Ajala, 2017).

Changing gender roles in land ownership and decision-making influence land use, emphasizing the importance of women's inclusion (Blare & Useche, 2019). Regional perspectives, such as in Zimbabwe, recommend changing cultural perceptions to achieve gender balance in land ownership (Makwanise & Masuku, 2016). Legal capacities may be limited in addressing gender inequality within land grab contexts (Nwapi, 2016). Improving women's access to credit, land ownership, and training opportunities is crucial for gender equity in the agricultural sector (Hordofa & Badore, 2023).

The intersection of gender, traditional authority, and rural reform in South Africa reinforces gender biases, hindering radical transformation (Rangan & Gilmartin, 2002). Policy initiatives in Zimbabwe aim to ensure women's representation in land ownership (Landman & Shumba, 2020). In conclusion, achieving gender equity in land ownership requires a comprehensive approach involving redistributive reforms, cultural shifts, and policy initiatives promoting women's representation.

2.11.3 Land Rights and Constraints

Exploring gender equity within South Africa's land reform reveals a complex landscape with recent literature offering valuable insights. The examination of challenges and opportunities underscores the interconnected dynamics between gender equity, land reform, and broader societal policies.

Adewumi (2022) scrutinizes employment equity in South Africa, spotlighting the interplay between employment opportunities and land ownership—a key aspect in understanding gender equity in a larger societal context. Tekwa & Adesina (2023) advocate for a transformative social policy perspective, emphasizing the need to address structural inequalities, the land-water nexus, and gender disparities within the framework of social policy and land reform. Harris-Fry et al. (2020) uncover the pivotal link between gender equity in agriculture, ensuring land and livestock equity, and the consequential impact on household food security. Vyas & Jansen (2018) delve into the intricate dynamics of gender, land ownership, and power relations, specifically examining the association between women's sole ownership of land and instances of partner violence. Sihlangu & Odeku (2021) critically analyze transformative interventions,

emphasizing the importance of inclusivity and equity in redressing historical injustices stemming from apartheid land discrimination.

South Africa's land reform program reveals a disjuncture between policy and practice (Walker, 2003). Institutionalized practices inherited from apartheid persist, reinforcing gender biases and hindering radical transformation efforts (Rangan & Gilmartin, 2002). Structures and processes designed to achieve gender equity warrant scrutiny, revealing a gap between progressive policies and actual outcomes (Davis et al., 2004). The need to re-strategize the employment equity policy and ensure diverse representation highlights persisting challenges (Adewumi, 2022).

Limited gains in the land reform process exacerbate inequality, poverty, and conflicts, particularly with the inclusion of market mechanisms hindering access for the landless majority (Lekunze & Luvhengo, 2019). Constitutional safeguards for women's land tenure rights coexist with information gaps (Sauti & Thiam, 2018).

Effectively navigating gender equity challenges in South Africa's land reform necessitates addressing the disjuncture between policy and practice, dismantling gender biases, and reassessing the limited gains of the reform process. These strategic steps are crucial for establishing genuine gender equity and inclusivity in land ownership, paving the way for a more equitable and sustainable future.

2.11.4 Land Rights and Statutory Constraints

The issue of land rights and statutory constraints in post-apartheid South Africa is a multifaceted challenge, intricately woven into the historical, social, and political fabric of the country. This complexity is manifested in various dimensions, including the dual land tenure system, corruption in land administration, and the delicate balance between private and communal land ownership. Scholars like Kollamparambil (2020), Lekunze and Luvhengo (2019), and Mathiba (2021) have highlighted the formidable hurdles faced in rectifying historical injustices and addressing socio-economic exclusion, particularly in urban areas affected by forced removals.

In tandem with these challenges, the evolving post-apartheid planning system grapples with issues of discrimination, inequality, and environmental fragility, as underscored by the work of Wyk and Oranje (2013). The deregulation of the agricultural sector further complicates the

landscape, impacting social relations on commercial farms and affecting the land access of farm dwellers, thereby influencing their livelihoods and well-being (Spierenburg, 2019).

Corruption emerges as a deeply entrenched issue, impeding development and exacerbating inequalities in land ownership—a legacy of apartheid (Mathiba, 2021). Legal complexities, such as the disconnect between customary and statutory land rights and the expansion of treed areas in smallholder land use systems, pose challenges to carbon sequestration initiatives (Unruh, 2008).

In response to these challenges, the South African government has implemented land reform programs, with legislative instruments like the Extension of Security of Tenure Act (ESTA) and the Communal Land Rights Act (CLaRA) playing pivotal roles. Enacted in 1997, ESTA aims to protect the rights of farm dwellers, addressing historical injustices related to evictions and unfair labor practices (Pillay & Singh, 2017). CLaRA, passed in 2004, recognizes and protects the land rights of those in communal areas, promoting security of tenure and sustainable land use (Walker, 2005).

While these acts are significant in rectifying apartheid-era land dispossession, challenges persist in their effective implementation. Pillay & Singh (2017) highlight issues related to the interpretation of legal terms, particularly concerning children's land rights. Moreover, the enforcement of anti-money laundering measures is crucial to prevent illicit financial activities connected to land rights (Chitimira & Munedzi, 2023).

The historical context of opposition and support for land-related legislation, exemplified by the South African Natives' Land Act of 1913 (Walker, 2005), underscores the contentious nature of land rights. Evaluating policies like the Know Your Customer policy (Jaarsveld, 2022) and the business judgment rule (Kennedy-Good & Coetzee, 2022) within South Africa's legal framework is essential for understanding their impact on land tenure and security.

The interplay of flow and clarity reveals the intricate dynamics of land rights and statutory constraints in South Africa. Navigating these complexities demands a comprehensive understanding of historical legacies, legal nuances, and the challenges of post-apartheid planning. The legislative instruments of ESTA and CLaRA offer a pathway to address historical injustices, but their effective implementation requires careful consideration of legal, financial, and social dimensions to ensure equitable and sustainable land rights for all citizens.

2.11.5 Land Rights and Customary/Cultural Constraints

Across Sub-Saharan Africa and Asia, data starkly illuminates gender disparities in land ownership and secure tenure, disadvantaging women compared to men (Doss et al., 2015; Kieran et al., 2015). Women's claims to land under customary law often contrast sharply with their insecure documented land rights, impacting their role in land restoration efforts.

Empirical evidence from Ghana illustrates that women with more secure land tenure are more inclined to invest in land restoration, while those with unstable tenure show reduced tendencies for soil fertility restoration (Goldstein & Udry, 2008). However, African customary traditions have historically confined women's land rights to family status and usage rather than ownership, contributing to their vulnerability, especially in cases of widowhood (Akinola, 2018; Budlender et al., 2011). The struggles for land rights by rural women in sub-Saharan Africa have been attributed to the significant barrier posed by customary tenure systems, limiting women's realization of their land rights (Massay, 2019).

This pattern extends to South Africa, where despite women's crucial roles in agriculture, patriarchal societal structures limit their access to land ownership and financial agency (The Advisory Panel on Land Reform and Agriculture, 2019). Customary norms further hinder women from owning land and managing property, often leading to societal disapproval and accusations of defiance when they attempt to do so. The legacy of colonial practices and deeply ingrained societal attitudes perpetuates the deprivation of land rights for women in South Africa (Njieassam, 2019). Widows, in particular, face challenges in inheritance, frequently dispossessed of their lands and homes, subject to the whims of male relatives (Widows Rights International, 2006). These disparities transcend individual households and impact wider communities, with traditional laws and socio-cultural norms impeding women's access to and retention of land rights (World Bank, 2012). Despite legal mandates for equity, entrenched customs often obstruct women and girls from claiming their rightful inheritance. Institutional transformation is vital for ensuring equity, with institutions playing a pivotal role in either granting or withholding power from men over women.

However, addressing pervasive patriarchy remains a complex process, often perpetuated by women themselves through adherence to cultural norms. Continental commitments to human rights and women's rights exist, but their enforcement encounters obstacles, limiting women's access to land despite legal provisions allowing for it. One study by Kabeer (2005) emphasizes the importance of institutional transformation in challenging gender inequalities, highlighting

the need to address the underlying power structures that perpetuate gender disparities. Kabeer argues that institutions, including legal and political systems, can either reinforce or challenge gender norms and power dynamics, underscoring the significance of institutional change in promoting gender equity Candia (2021).

In Sub-Saharan Africa and South Africa, customary land tenure systems heavily influence land rights and resource access, yet the translation of legal rights into secure tenure faces challenges (Mawere et al., 2021). In South Africa, the recognition of customary law has been under scrutiny, with discrepancies between constructed customary law and women's de facto land rights posing challenges (Ngubane, 2019).

Moreover, gendered outcomes persist in Nigeria, highlighting the marginalization of women in land access and utilization despite their significant engagement in agriculture (Oshikoya & Ifediora, 2022). Challenges in administering customary land, including lack of skills by traditional leaders and corruption in land acquisition, have significant implications for land users. The interconnectivity of land and water rights within customary systems further complicates matters, emphasizing the intricate nature of these tenure systems (Schreiner & Koppen, 2020). Overall, these findings emphasize the pressing need for comprehensive approaches to address these multifaceted issues.

2.11.6 Water use security dynamics

Water security, defined as "the reliable availability of an acceptable quantity and quality of water for health, livelihoods, and production, coupled with an acceptable level of water-related risks" (World Bank, 2019), is fundamental to human well-being. The South African Constitution reinforces the right to access sufficient food and water (RS, 1996), a principle further emphasized by the United Nations General Assembly's General Comment 15 (United Nations, 2010). This foundational understanding sets the stage for exploring the intricate relationship between water security, women's access to land and resources, and the broader dynamics shaping South Africa's water use security.

Water rights, integral to the broader framework, encompass access to various water sources. However, the link between access to water and women's rights is closely tied to land rights, often controlled by men. Women, despite contributing significantly to food production, face challenges in securing both land and water rights (Claey et al., 2022; Dube, 2020; Hall et al., 2013; Fonjong, 2012). Cultural norms and inadequate legal education compound these

challenges, limiting women's ability to exercise their rights (Ajadi et al., 2015). In many rural contexts, women's reliance on land for providing food for their families contrasts with their limited land ownership (Villa, 2017). Women's access to water, crucial for domestic and subsistence production, is often overshadowed by male-dominated practices (Oladele & Mudhara, 2016).

Women's substantial contributions to food production, estimated at 60-80% in developing countries, are pivotal for food security (Clement et al., 2019). Secure land tenure and access to water are key to enhancing agricultural productivity and improving livelihoods for women (Meinzen-Dick & Zwarteveen, 2020; Quisumbing & Pandolfelli, 2010). However, the scarcity of water resources directly impacts women who rely on agriculture for their livelihoods (Hope et al., 2008). Initiatives related to water for rural livelihoods often overlook gender considerations, perpetuating gender inequality (Parker et al., 2016).

South Africa's water security dynamics are influenced by agricultural resilience, climate change, and policy impacts. Challenges in maintaining water security for food production and household needs persist, especially with increasing pressure on arable land and water resources (Daniell & Tonder, 2023; Adom & Simatele, 2021). Comprehensive policies face hindrances due to structural factors, impacting smallholder farmers and water security in regions like Limpopo Province (Sinyolo et al., 2014). Empirical evidence from the uMzinyathi district in South Africa demonstrates the interconnection between water security and rural household food security, emphasizing the importance of addressing water availability for food production (Hosea & Khalema, 2020).

The nexus between climate change and water security in rural South Africa reveals coping and planning mechanisms adopted by communities facing water insecurity (Rockström et al., 2009). The potential of green water for resilience is highlighted, emphasizing the need for efficient water management practices to ensure food security (Mathivha et al., 2012). The impact of climate change on food security underscores the necessity of sustainable water management practices (Coning, 2006).

Efforts to secure water rights and enhance rural livelihoods must acknowledge the unique challenges and needs of women, encompassing both land and water resources. Addressing these challenges through gender-inclusive policies and initiatives is crucial for improving the well-being of rural women and their communities. In South Africa, the complex interplay of

water security, women's rights, and sustainable development requires holistic approaches, considering both local and systemic factors.

2.12 Summary

The extensive literature review on South Africa's agricultural landscape provides comprehensive insights into the challenges and opportunities across various dimensions. Smallholder farming, recognized for its pivotal role in ensuring food security and rural livelihoods, encounters obstacles related to resource accessibility, market participation, and environmental pressures. Addressing these challenges is imperative for bolstering the sustainability and productivity of smallholder farming initiatives.

Food insecurity among South African smallholder farmers is revealed to be a complex issue influenced by socio-political factors. Local contexts, particularly in the Limpopo province, and systemic challenges nationwide contribute to persistent food insecurity rates. Despite political advancements, resilience among smallholder livestock farmers and coping strategies in the face of climate-related food insecurity highlight the socio-political implications of this pressing issue.

The Sustainable Livelihood Framework emerges as a valuable tool for understanding and promoting sustainable livelihoods, particularly among smallholder women irrigation farmers. Its comprehensive approach, encompassing various forms of capital and livelihood strategies, positions it as a versatile framework for addressing multifaceted challenges, spanning rural development, poverty alleviation, environmental conservation, and entrepreneurship.

Smallholder irrigation farming in South Africa is recognized as essential for improving food security, rural livelihoods, and sustainable crop production. Nevertheless, challenges such as low productivity, limited market access, and underutilization of irrigation systems necessitate targeted interventions and support from diverse stakeholders to enhance its overall effectiveness.

Effective management of smallholder irrigation farming requires a holistic approach encompassing factors like water management, governance, training, technical support, and the development of sustainable business models. Additionally, the adoption of appropriate irrigation technologies and the revitalization of smallholder irrigation schemes are deemed essential for enhancing agricultural productivity, livelihoods, and food security in sub-Saharan Africa.

Gender dynamics are acknowledged as critical in shaping land and water use security in South Africa. Addressing gender disparities in access to land, water, and related resources is identified as an essential step towards achieving sustainable and equitable land and water use security in the country.

The review also sheds light on the multifaceted nature of water policy, strategies, and legislation in South Africa. Influenced by historical, economic, and social perspectives, these policies aim at sustainable water development, integrated resource management, and water quality control.

Equity in water access is identified as a complex issue involving historical, political, economic, and social dimensions. Achieving equitable water distribution and management requires comprehensive and inclusive policy frameworks.

Water allocation reforms, deemed crucial for sustainable and equitable water resource access, involve legislative frameworks, governance models, water rights, pricing mechanisms, and investment analyses for the water infrastructure value chain. Striking a balance between macro and micro considerations in policy interventions is considered pivotal.

The intricate relationship between gender dynamics and land and water use security underscores the importance of addressing disparities in access to resources for achieving equitable outcomes. The current reality of poor women's access to water is influenced by a multitude of factors, including water quality, information dissemination, COVID-19 impacts, land and water reforms, and social engagement, necessitating comprehensive and gender-sensitive interventions.

The literature review concludes with a focus on land rights and constraints, emphasizing the need to address gender equity in the context of land reform and expropriation. The challenges in translating policy commitments into tangible, gender-inclusive practices are highlighted, calling for transformative approaches to achieve gender equity in land rights.

REFERENCES

ADEWUMI, S. (2022). Employment equity realisation: assessing the bridges and barriers in the eThekwini municipality of South Africa. Academic Journal of Interdisciplinary Studies, 11(4), 70. https://doi.org/10.36941/ajis-2022-0099

ADOM, R. & SIMATELE, M. (2022). The role of stakeholder engagement in sustainable water resource management in South Africa. Natural Resources Forum, 46(4), 410-427. https://doi.org/10.1111/1477-8947.12264

ADOM, R. & SIMATELE, M. (2021). Analysis of public policies and programmes towards water security in post-apartheid South Africa. Water Policy, 23(3), 503-520. https://doi.org/10.2166/wp.2021.017

AGARWAL, B., ANTHWAL, P., & MAHESH, M. (2021). How many and which women own land in India? inter-gender and intra-gender gaps. The Journal of Development Studies, 57(11), 1807-1829. https://doi.org/10.1080/00220388.2021.1887478

AGBUGBA, I., CHRISTIAN, M., & OBI, A. (2020). Economic analysis of smallholder maize farmers: implications for public extension services in eastern cape. South African Journal of Agricultural Extension (Sajae), 48(2). https://doi.org/10.17159/2413-3221/2020/v48n2a537

AHMAD, B., PHAM, H., ASHFAQ, M., MEMON, J., BANO, R., DAHRI, Z.& NASEER, M. (2020). Impact of institutional features on the overall performance assessment of participatory irrigation management: farmers' response from Pakistan. Water, 12(2), 497. https://doi.org/10.3390/w12020497

AJADI, A.A., OLADELE, O.I., IKEGAMI, K. & TSURUTA, T. (2015). Rural women's farmers access to productive resources: the moderating effect of culture among Nupe and Yoruba in Nigeria.

AJALA, T. (2017). Gender discrimination in land ownership and the alleviation of women's poverty in Nigeria. International Journal of Discrimination and the Law, 17(1), 51-66. https://doi.org/10.1177/1358229117700028

AKINOLA, A. (2018). Women, culture and Africa's land reform agenda. Frontiers in Psychology, 9. https://doi.org/10.3389/fpsyg.2018.02234

AKUDUGU, M., MILLAR, K., & AKURIBA, M. (2021). The livelihoods impact of irrigation in western Africa: the Ghana experience. Sustainability, 13(10), 5677. https://doi.org/10.3390/su13105677

ALGOTSSON, E. & MURAMBO, M. (2009). Water Supply and Sanitation in South Africa Environmental Rights and Municipal Accountability LHR Publication Series (1/2009). Available at: https://cer.org.za/wp-content/uploads/2011/11/LHR-DBSA_Water_Report.pdf

ALIBER, M. & HALL, R. (2012). Support for smallholder farmers in South Africa: Challenges of scale and strategy. Development Southern Africa, 29 (4): 548-562. Available: https://doi.org/10.1080/0376835X.2012.715441 (Accessed 11 May 2018).

ADDISON, L., SCHNURR, M., GORE, C., BAWA, S., & MUJABI-MUJUZI, S. (2021). Women's empowerment in Africa: critical reflections on the abbreviated women's empowerment in agriculture index (a-weai). African Studies Review, 64(2), 276-291. https://doi.org/10.1017/asr.2021.33

AJALA, T. (2017). Gender discrimination in land ownership and the alleviation of women's poverty in Nigeria. International journal of discrimination and the law, 17(1), 51-66. Https://doi.org/10.1177/1358229117700028

ANDREW, N. (2020). South Africa's Land Ownership System as a Barrier to Social Transformation: Land Conflict and the Forced Displacement of Black Farm Dweller Families. *Revue Internationale des études du Développement*, 243, 233-261. https://doi.org/10.3917/ried.243.0233

ASEYEHEGU, K., YIRGA, C., & RAJAN, S. (2012). Effect of small-scale irrigation on the income of rural farm households: the case of Laelay Maichew district, central Tigray, Ethiopia. Journal of Agricultural Sciences – Sri Lanka, 7(1), 43-57. https://doi.org/10.4038/jas.v7i1.4066

ASFAW, A., SIMANE, B., HASSEN, A., & BANTIDER, A. (2017). Determinants of non-farm livelihood diversification: evidence from rainfed-dependent smallholder farmers in northcentral Ethiopia (Woleka sub-basin). Development Studies Research, 4(1), 22-36. https://doi.org/10.1080/21665095.2017.1413411

AWULACHEW, S. & AYANA, M. (2011). Performance of irrigation: an assessment at different scales in Ethiopia. Experimental Agriculture, 47(S1), 57-69. https://doi.org/10.1017/s0014479710000955

BACKEBERG, G. (2005). Water institutional reforms in South Africa. Water Policy, 7(1), 107-123. https://doi.org/10.2166/wp.2005.0007

BALIYAN, S., MOSIA, P., & BALIYAN, P. (2020). Gender differences in entrepreneurial attitudes and constraints: do the constraints predict university agriculture graduates' attitudes towards entrepreneurship? International Journal of Higher Education, 9(5), 259. https://doi.org/10.5430/ijhe.v9n5p259

BEHR, D.M., GROUSSARD, H., KHAITINA, V. & SHEN, L. (2023). Women's Land Rights in Sub-Saharan Africa: Where do we Stand in Practice? World Bank Group: Development Economics Global Indicators. https://documents1.worldbank.org/curated/en/099432211092367495/pdf/IDU0afeba6800588804d2a0ad290368a53e64004.pdf

BELAY, A., ASSEFA, T., BELAY, S., & YIMAM, A. (2022). Evaluating the performance of small-scale irrigation schemes in sub humid Ethiopian highlands. Irrigation and Drainage, 72(1), 224-239. https://doi.org/10.1002/ird.2753

BEYERS, C. (2013). Urban land restitution and the struggle for social citizenship in South Africa. Development and Change, 44(4), 965-989. https://doi.org/10.1111/dech.12041

BLARE, T. AND USECHE, P. (2019). Differences in women's and men's conservation of cacao agroforests in coastal Ecuador. Environmental Conservation, 46(4), 302-309. https://doi.org/10.1017/s0376892919000237

BOB, U. (2018). Rural women's relations to land resources in KwaZulu-Natal: issues of access and control. Alternation, 15(1): 110–134. Available at: https://hdl.handle.net/10520/AJA10231757_46

BOUDET, A.M.M., BUITRAGO, P., DE LA BRIERE B.L., NEWHOUSE, D., MATULEVICH, E.R., SOCTT, K. & SURAEZ-BECERRA, P. (2018). Gender Differences in Poverty and Household Composition through the Life-cycle: A Global Perspective. https://documents1.worldbank.org/curated/en/135731520343670750/pdf/WPS8360.pdf

BRADSTOCK, A. (2005). Changing Livelihoods and Land Reform: Evidence from the Northern Cape Province of South Africa. World Development 33 (11): 1979-1992. Available: https://www.sciencedirect.com/science/article/pii/S0305750X0500152X (Accessed 11 November 2015).

BUDLENDER, D., MGWEBA, S., MOTSEPE, K. & WILLAIMS, L. (2011). Women, Land and Customary Law. Available: http://www.cls.uct.ac.za/usr/lrg/downloads/Women_and_Land.pdf (Accessed 30 November 2020).

CANDIA, D. (2021). Factors associated with land ownership by women in Uganda: a cross-sectional study. Asian Journal of Agricultural Extension Economics & Sociology, 256-264. https://doi.org/10.9734/ajaees/2021/v39i1030689

CARE (2016) Enhancing resilience through gender equality. Gender equality and women's voice in Asia-pacific resilience programming. Research report. Available from: https://careclimatechange.org/wp-content/uploads/2016/08/enhancing-resilience.pdf (Accessed 14 June 2020).

CERDA, C., GUENAT, S., EGERER, M., & FISCHER, L. (2022). Home food gardening: benefits and barriers during the covid-19 pandemic in Santiago, Chile. Frontiers in Sustainable Food Systems, 6. https://doi.org/10.3389/fsufs.2022.841386

CHARTER ON THE RIGHTS AND WELFARE OF THE CHILD. (1990). African Charter on the Rights and Welfare of the Child. Available:
http://www.achpr.org/files/instruments/child/achpr_instr_charterchild_eng.pdf (Accessed 24 November 2014).

CHIKOZHO, C., MANAGA, R., & DABATA, T. (2020). Ensuring access to water for food production by emerging farmers in South Africa: what are the missing ingredients? Water Sa, 46(2 April). https://doi.org/10.17159/wsa/2020.v46.i2.8237

CHIKOZHO, C., MAKOMBE, G., & MILONDZO, K. S. (2019). Difficult roads leading to beautiful destinations? articulating land reform's contribution to rural livelihoods in the Limpopo province, South Africa. Physics and Chemistry of the Earth, Parts a/B/C, 111, 13-19. https://doi.org/10.1016/j.pce.2018.11.003

CHIKWENDU, D. O. & AROKOYO, J. O. (1997). Women and sustainable agricultural development in Nigeria. Journal of Sustainable Agriculture, 11(1), 53–69.

CHIPFUPA, U. & WALE, E. (2019). Smallholder willingness to pay and preferences in the way irrigation water should be managed: a choice experiment application in KwaZulu-Natal, South Africa. Water Sa, 45(3 July). https://doi.org/10.17159/wsa/2019.v45.i3.6735

CHITIMIRA, H. & MUNEDZI, S. (2023). Historical aspects of customer due diligence and related anti-money laundering measures in South Africa. Journal of Money Laundering Control, 26(7), 138-154. https://doi.org/10.1108/jmlc-01-2023-0016

CHITJA, J.M., MTHIYANE, C.C.N., MARIGA, I.K., SHIMELIS, H., MURUGANI, V.G., MOROJELE, P.J., NAIDOO, K. & APHANE, O.D. (2016). Empowerment of Women Through Water Use Security, Land Use Security and Knowledge Generation for Improved Household Food Security and Sustainable Rural Livelihoods in Selected Areas in Limpopo. Water Research Commission, 2082/1/15. Available: http://www.wrc.org.za/wp-content/uploads/mdocs/2082-1-15.pdf (Accessed May 2016).

CHITJA, J., & MKHIZE, G. (2019). 25 Engendering Agricultural Transformation. In: *Transforming Agriculture in Southern Africa: Constraints, Technologies, Policies and Processes*.

CHOPRA, M., DAVIAUD, E. PATTINSON, R., FONN, S. & LAWN, J.E. (2009). Saving the lives of South Africa's mothers, babies, and children: Can the health system deliver?

CLAEYS, P., LEMKE, S., & CAMACHO, J. (2022). Editorial: women's communal land rights. Frontiers in Sustainable Food Systems, 6. https://doi.org/10.3389/fsufs.2022.877545

CLÁUDIA M. VIANA, DULCE FREIRE, PATRÍCIA ABRANTES, JORGE ROCHA, PAULO PEREIRA. (2022). Agricultural land systems importance for supporting food security and sustainable development goals: A systematic review, Science of The Total Environment, 806 (3) 2022. https://doi.org/10.1016/j.scitotenv.2021.150718.

CLEMENT, F., BUISSON, M., LEDER, S., BALASUBRAMANYA, S., SAIKIA, P., BASTAKOTI, R., & KOPPEN, B. (2019). From women's empowerment to food security: revisiting global discourses through a cross-country analysis. Global Food Security, 23, 160-172. https://doi.org/10.1016/j.gfs.2019.05.003

COLVIN, J., BALLIM, F., CHIMBUYA, S., EVERARD, M., GOSS, J., KLARENBERG, G. WESTON, D. (2019). Building capacity for co-operative governance as a basis for

integrated water resource managing in the Inkomati and Mvoti catchments, South Africa. Water Sa, 34(6), 681. https://doi.org/10.4314/wsa.v34i6.183669

CONING, C. (2006). Overview of the water policy process in South Africa. Water Policy, 8(6), 505-528. https://doi.org/10.2166/wp.2006.039

CÓRDOVA, R., HOGARTH, N., & KANNINEN, M. (2018). Sustainability of smallholder livelihoods in the Ecuadorian highlands: a comparison of agroforestry and conventional agriculture systems in the indigenous territory of Kayambi people. Land, 7(2), 45. https://doi.org/10.3390/land7020045

COWLING, N. (2023). Gender Gap Index in South Africa 2016-2023. Statista. Available at: https://www.statista.com/statistics/1253971/gender-gap-index-in-South-africa/#:~:text=In%202023%2C%20South%20Africa%20had,th%20out%20of%20146%20countries. (Accessed September 2023).

CROSS, C. & HORNBY, D. (2002). 'Opportunities and obstacles to women's land access in South Africa'. A Research Report for the Promoting Women's Access to Land (PWAL) Programme, February.

DAFF. (2015). National irrigation strategy for South Africa. Pretoria: Department of Agriculture, Forestry and Fisheries (DAFF).

DANIELL, A. & TONDER, D. (2023). Opportunity for increasing the soil quality of non-arable and depleted soils in South Africa: a review. Journal of Soil Science and Plant Nutrition, 23(2), 2476-2487. https://doi.org/10.1007/s42729-023-01205-7

DAVIS, N., HORN, A., & WYK, S. (2004). Invisible women" making the case for supply-led, class-based, gender targeted land redistribution in South Africa. Geojournal, 61(3), 273-279. https://doi.org/10.1007/s10708-004-3687-2

DEDIEU, B., NETTLE, R., SCHIAVI, S., SRAÏRI, M., & MALANSKI, P. (2022). Which perspectives for work in agriculture? food for thought for a research agenda. Frontiers in Sustainable Food Systems, 6. https://doi.org/10.3389/fsufs.2022.857887

DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES (DAFF) (2012). Pocket guide to South Africa 2011/12.

DEPARTMENT OF LAND AFFAIRS (DLA). (1997). South Africa Land Policy White Paper. Available: www.pmg.org.za/files/docs/090617whitepaper.doc (Accessed 25 June 2011).

DIIRO, G., SEYMOUR, G., KASSIE, M., MURICHO, G., & MURIITHI, B. (2018). Women's empowerment in agriculture and agricultural productivity: evidence from rural maize farmer households in western Kenya. Plos One, 13(5), e0197995. https://doi.org/10.1371/journal.pone.0197995

DIJK, M., LIMPENS, G., KARIUKI, J., & BOER, D. (2022). Telephone farmers and an emerging ecosystem are unlocking the hidden middle of agricultural value chains in Kenya through innovation. Journal of Agribusiness in Developing and Emerging Economies, 13(3), 452-467. https://doi.org/10.1108/jadee-03-2021-0059

DINKA, M. (2018). Safe Drinking Water: Concepts, Benefits, Principles and Standards. HTTPS://DOI.ORG/10.5772/INTECHOPEN.71352

DITHEBE, K., AIGBAVBOA, C., & THWALA, W. (2019). An appraisal of water infrastructure projects' financing challenges in South Africa., 103-110. https://doi.org/10.1108/s2516-285320190000002022

DLANGALALA, S. AND MUDHARA, M. (2020). Determinants of farmer awareness of water governance across gender dimensions in smallholder irrigation schemes in KwaZulu-Natal province, South Africa. Water Sa, 46(2 April). https://doi.org/10.17159/wsa/2020.v46.i2.8238

DODO, M.K. (2020). Understanding Africa's Food Security Challenge. Available: https://www.intechopen.com/online-first/understanding-africa-s-food-security-challenges (Accessed 26 November 2019).

DOSS, C., MEINZEN-DICK, R., & BOMPART, C. (2018). Analyzing the impact of interventions on gender outcomes, asset ownership, and agricultural productivity. Agricultural Economics, 49(3), 281-291. https://doi.org/10.1111/agec.12410

DOSS, C. (2017). Women and agricultural productivity: reframing the issues. Development Policy Review, 36(1), 35-50. https://doi.org/10.1111/dpr.12243

DOSS, C., KOVARIK, C., PETERMAN, A., QUISUMBING, A. & VAN DEN BOLD, M. (2015). Gender inequalities in ownership and control of land in Africa: myth and reality. Agric. Econ., 46 (2015): 403-434. Available: https://doi.org/10.1111/agec.12171 (Accessed 20 November 2020).

DOSS, C. (2011). The role of Women in Agriculture. ESA Working Paper. Agricultural Development Economics Division. Available: http://www.fao.org/docrep/013/am307e/am307e00.pdf (Accessed 24 November 2014).

DRDLR (Department of Rural Development and Land Reform). (2017) Land Audit Report. Phase II: Private Land Ownership by Race, Gender and Nationality. Version 2. Pretoria: South Africa.

DUBE, B. (2020). Deficit thinking in South Africa's water allocation reform discourses: a cultural discourse perspective. Journal of Multicultural Discourses, 16(4), 293-312. https://doi.org/10.1080/17447143.2020.1835926

DWAF. (2012). Proposed National Water Resource Strategy 2. Managing Water for an Equitable and Sustainable Future. Available: https://static.pmg.org.za/docs/120911proposed_0.pdf (Accessed 11 November 2016).

DWAF (2005) The Water Allocation Reform. Pretoria: Department of Water Affairs and Forestry, South Africa.

EDOKPAYI, J.N., ENITAN-FOLAMI, A. M., ADEEYO, A. O., DUROWOJU, O. S., JEGEDE, A. O., & ODIYO, J. O. (2020). Recent trends and national policies for water provision and wastewater treatment in South Africa. In *Water conservation and wastewater treatment in BRICS nations* (pp. 187-211). Elsevier.

EDOKPAYI, J., ROGAWSKI, E., KAHLER, D., HILL, C., REYNOLDS, C., NYATHI, E.& DILLINGHAM, R. (2018). Challenges to sustainable safe drinking water: a case study of water quality and use across seasons in rural communities in Limpopo province, South Africa. Water, 10(2), 159. https://doi.org/10.3390/w10020159

ELLIS, F. (1998). Household strategies and rural livelihood diversification. The Journal of Development Studies, 35(1), 1-38. https://doi.org/10.1080/00220389808422553

EZBAKHE, F., GINÉ-GARRIGA, R., & FOGUET, A. (2019). Leaving no one behind: evaluating access to water, sanitation and hygiene for vulnerable and marginalized groups. The Science of the Total Environment, 683, 537-546. tps://doi.org/10.1016/j.scitotenv.2019.05.207

FAN, S. & RUE, C., 2020. The role of smallholder farms in a changing world. The role of smallholder farms in food and nutrition security, pp.13-28.

FANADZO, M., & NCUBE, B. (2018). Challenges and opportunities for revitalising smallholder irrigation schemes in South Africa, 44 (3), https://doi.org/10.4314/wsa.v44i3.11

FAO. (2018). The benefits and risks of solar-powered irrigation - a global overview. https://www.un-igrac.org/sites/default/files/resources/files/The%20benefits%20and%20risks%20of%20solar-powered%20irrigation%20-%20a%20global%20overview.pdf

FAO. (2006). Land Tenure Studies: Gender and Access to Land. Available: http://www.fao.org/3/a-y4308e.pdf (Accessed 24 November 2014).

FARAGHER, T. & CARDEN, K. (2023). Groundwater governance for improving city water resilience in cape town, South Africa. Frontiers in Sustainable Cities, 5. https://doi.org/10.3389/frsc.2023.1062661

FENG, Y., CHANG, M., LUO, E., & LIU, J. (2023). Has property rights reform of china's farmland water facilities improved farmers' irrigation efficiency? —evidence from a typical reform pilot in china's Yunnan province. Agriculture, 13(2), 275. https://doi.org/10.3390/agriculture13020275

FONJONG, L., FOMBE, L. & SAMA-LANG, I. (2012). The paradox of gender discrimination in land ownership and women's contribution to poverty reduction in Anglophone

Cameroon. GeoJournal, 78: 575-589. Available: https://link.springer.com/article/10.1007/s10708-012-9452-z (Accessed 20 November 2020).

FUENTE, D. & BARTRAM, J. (2018). Pro-poor governance in water and sanitation service delivery: evidence from global analysis and assessment of sanitation and drinking water surveys. Perspectives in Public Health, 138(5), 261-269. https://doi.org/10.1177/1757913918788109

GALVIN, M. & MASOMBUKA, N. (2020). Failed intentions? meeting the water needs of people living with HIV in South Africa. Water Sa, 46(2 April). https://doi.org/10.17159/wsa/2020.v46.i2.8239

GAUTAM, Y. & ANDERSEN, P. (2016). Rural livelihood diversification and household well-being: insights from Humla, Nepal. Journal of Rural Studies, 44, 239-249. https://doi.org/10.1016/j.jrurstud.2016.02.001

GOLDSTEIN, M. & UDRY, C. (2008). The Profits of Power: Land Rights and Agricultural Investment in Ghana. Journal of Political Economy, 116 (6). Available: https://doi.org/10.1086/595561 (Accessed 12 November 2020).

GUPTA, E. (2019). The impact of solar water pumps on energy-water-food nexus: Evidence from Rajasthan India. Energy Policy, 129, 598-609. https://doi.org/10.1016/j.enpol.2019.02.008.

HABIB, N., RANKIN, P., ALAUDDIN, M., & CRAMB, R. (2022). Determinants of livelihood diversification in rural rain-fed region of Pakistan: evidence from fractional multinomial logit (fmlogit) estimation. Environmental Science and Pollution Research, 30(5), 13185-13196. https://doi.org/10.1007/s11356-022-23040-6

HABTU, S., ERKOSSA, T., FROEBRICH, J., TQUABO, F., FISSEHAYE, D., KIDANEMARIAM, T.& CAI, X. (2018). Integrating participatory data acquisition and modelling of irrigation strategies to enhance water productivity in a small-scale irrigation scheme in Tigray, Ethiopia. Irrigation and Drainage, 69(S1), 23-37. https://doi.org/10.1002/ird.2235

HALL, R., KOPPEN, B., & HOUWELING, E. (2013). The human right to water: the importance of domestic and productive water rights. Science and Engineering Ethics, 20(4), 849-868. https://doi.org/10.1007/s11948-013-9499-3

HAMILTON, S., MERRITT, W., DAS, M., RAHMAN, M., BHUIYA, S., CARTER, L. & SYME, G. (2020). Integrated assessment—how does it help unpack water access by marginalized farmers? Water, 12(12), 3444.

HARRIS-FRY, H., NUR, H., SHANKAR, B., ZANELLO, G., SRINIVASAN, C., & KADIYALA, S. (2020). The impact of gender equity in agriculture on nutritional status, diets, and household food security: a mixed-methods systematic review. *BMJ global health*, *5*(3), e002173. https://doi.org/10.1136/bmjgh-2019-002173

HARVEY, C., SABORÍO-RODRÍGUEZ, M., MARTÍNEZ-RODRÍGUEZ, M., VIGUERA, B., CHAIN-GUADARRAMA, A., VIGNOLA, R.& ALPÍZAR, F. (2018). Climate change impacts and adaptation among smallholder farmers in central America. Agriculture & Food Security, 7(1). https://doi.org/10.1186/s40066-018-0209-x

HENDRIKS, S.L.; VAN DER MERWE, C.; NGIDI, M.S.; MANYAMBA, C.; MBELE, M.; MCINTYRE, M.; MKANDAWIRE, E.; MOLEFE, Q.; MPHEPHU, M.Q.; NGWANE, L. (2016). What are we measuring? A comparison of household food security indicators from a sample of households in the Eastern Cape Province, South Africa. Ecol. Food Nutr. 2016, 55,141–162. [CrossRef] [PubMed] Accessed on 20 November 2021).

HOLVOET, N., & INBERG, L. (2018). Women's land rights as a pathway to poverty reduction: Framework and review of available evidence. World Development, 112, 75-87.

HOPE, R.A., GOWING, J.W. & JEWITT, G.P.W. (2008). The contested future of irrigation in African rural livelihoods: Analysis from a water-scarce catchment in South Africa. *Water Policy* 10: 173-192.

HORDOFA, D. AND BADORE, M. (2023). Assessing the impact of social, demographic, and economic factors on the economic empowerment of rural women in agricultural activities: a partial proportional odds model analysis in dire Dawa administration, Ethiopia. https://doi.org/10.21203/rs.3.rs-2687187/v1

HOSEA, P. & KHALEMA, E. (2020). Scoping the nexus between climate change and water-security realities in rural South Africa. Town and Regional Planning, 77. https://doi.org/10.18820/2415-0495/trp77i1.2

HULL, S. AND WHITTAL, J. (2021). Do design science research and design thinking processes improve the 'fit' of the fit-for-purpose approach to securing land tenure for all in South Africa? Land, 10(5), 484. https://doi.org/10.3390/land10050484

JAARSVELD, I. (2022). Mimicking sisyphus? an evaluation of the know your customer policy. Obiter, 27(2). https://doi.org/10.17159/obiter.v27i2.14384

JACOBS, P. (2008). Market Development and Smallholder Farmers-A Selective Literature Survey. HSRC: Durban

JEGEDE, A. & SHIKWAMBANE, P. (2021). Water 'apartheid' and the significance of human rights principles of affirmative action in South Africa. Water, 13(8), 1104. https://doi.org/10.3390/w13081104

JHA, A. & WARKENTIN, T. (2020). Biofortification of pulse crops: status and future perspectives. Plants, 9(1), 73. https://doi.org/10.3390/plants9010073

KABIR, M., MARKOVIC, M., & RADULOVIĆ, D. (2019). The determinants of income of rural women in Bangladesh. Sustainability, 11(20), 5842. https://doi.org/10.3390/su11205842

KAMARA, A., CONTEH, A. R., RHODES, E. R., & COOKE, R. A. (2019). The relevance of smallholder farming to African agricultural growth and development. African Journal of Food, Agriculture, Nutrition and Development, 19(01), 14043-14065. https://doi.org/10.18697/ajfand.84.blfb1010

KANDA, E. & LUTTA, V. (2022). The status and challenges of a modern irrigation system in Kenya: a systematic review. Irrigation and Drainage, 71(S1), 27-38. https://doi.org/10.1002/ird.2700

KATIVHU, S., MWALE, M., & ZUWARIMWE, J. (2020). Agricultural resilience under increasing water security threats: insights for smallholder farming in Limpopo province, South Africa. Water Practice & Technology, 15(4), 849-862. https://doi.org/10.2166/wpt.2020.068

KARIMI P, BONGANI B, BLATCHFORD M, & DE FRAITURE, C. (2019). Global Satellite-Based ET Products for the Local Level Irrigation Management: An Application of Irrigation Performance Assessment in the Sugarbelt of Swaziland. *Remote Sensing*. 11(6):705. https://doi.org/10.3390/rs11060705

KAYSER, G., MORIARTY, P., FONSECA, C., & BARTRAM, J. (2013). Domestic water service delivery indicators and frameworks for monitoring, evaluation, policy and planning: a review. International Journal of Environmental Research and Public Health, 10(10), 4812-4835. https://doi.org/10.3390/ijerph10104812

KEPE, T. & ELLIS, W. (2005). Land reform and biodiversity conservation in South Africa: complementary or in conflict? The International Journal of Biodiversity Science and Management, 1(1), 3-16. https://doi.org/10.1080/17451590509618075

KENNEDY-GOOD, N. & COETZEE, L. (2022). The business judgment rule (part 2). Obiter, 27(2). https://doi.org/10.17159/obiter.v27i2.14387

KIERAN, C., SPROULE, K., QUISUMBING, A.R. & DOSS, C.R. (2015) Gender gaps in landownership across and within households in four Asian countries. Land Econ., 93 (2): 342-370. Available: http://le.uwpress.org/content/93/2/342 (Accessed 20 November 2020).

KING, C., IBA, W., & CLIFTON, J. (2021). Reimagining resilience: covid-19 and marine tourism in Indonesia. Current Issues in Tourism, 24(19), 2784-2800. https://doi.org/10.1080/13683500.2021.1873920

KIRUI, O. & BRAUN, J. (2018). Mechanization in African agriculture: a continental overview on patterns and dynamics. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3194466

KNÜPPE, K., 2011. (2011). The challenges facing sustainable and adaptive groundwater management in South Africa. Water Sa, 37(1). https://doi.org/10.4314/wsa.v37i1.64110

KOBUSINGYE, D.N., VAN LEEUWEN, M. & VAN DIJK, H. (2016). Where do I report my land dispute? The impact of institutional proliferation on land governance in post-conflict Northern Uganda. The Journal of Legal Pluralism and Unofficial Law 48 (2): 238-255.

KOEVA, M., BENNETT, R., GERKE, M., CROMMELINCK, S., STÖCKER, C., CROMPVOETS, J. & KUNDERT, K. (2017). Towards innovative geospatial tools for fit-for-purpose land rights mapping. The International Archives of the Photogrammetry Remote Sensing and Spatial Information Sciences, XLII-2/W7, 37-43. https://doi.org/10.5194/isprs-archives-xlii-2-w7-37-2017

KOLLAMPARAMBIL, U. (2020). Non-income effect of land ownership and tenure on subjective wellbeing in South Africa. South African Journal of Economics, 89(2), 301-323. https://doi.org/10.1111/saje.12276

KOMATSU, H., MALAPIT, H., & BALAGAMWALA, M. (2019). Gender effects of agricultural cropping work and nutrition status in Tanzania. Plos one, 14(9), e0222090. Https://doi.org/10.1371/journal.pone.0222090

KOPPEN, B., NHAMO, L., CAI, X., GABRIEL, M., SEKGALA, M., SHIKWAMBANA, S.& MANYAMA, D. (2017). Smallholder irrigation schemes in the Limpopo province, South Africa. https://doi.org/10.5337/2017.206

KOSANLAWIT, S., SONI, P., & SHIVAKOTI, G. (2017). The relationship between effective and equitable water allocation, local rice farmer participation and economic well-being: insights from Thailand's Chiang Mai province. Water, 9(5), 319. https://doi.org/10.3390/w9050319

LAMBRECHT, I., MAHRT, K., SYNT, N., WIN, H., & WIN, K. (2023). Gender gaps in land rights: explaining different measures and why households differ in Myanmar. Agricultural Economics, 54(5), 728-741. https://doi.org/10.1111/agec.12789

LANDMAN, C. AND SHUMBA, S. (2020). Religion and gender policy implementation in Zimbabwe. Studia Historiae Ecclesiasticae, 46(2). https://doi.org/10.25159/2412-4265/7246

LEE, H., MCNAMARA, P., & BHATTACHARYYA, K. (2022). Does linking women farmers to markets improve food security? Evidence from rural Bangladesh. Agriculture & food security, 11(1). Https://doi.org/10.1186/s40066-022-00373-6

LEDWABA, S. AND NKOMO, T. (2021). An exploration of motivations for women mine workers to work underground. Sage Open, 11(3), 215824402110321. https://doi.org/10.1177/21582440211032157

LEKUNZE, J. & LUVHENGO, U. (2019). Is amending section 25 of the South African constitution an end to the land reform debate? https://doi.org/10.20944/preprints201912.0152.v1

LI, Y. (2018). Institutional reform in the irrigation sector in china. Irrigation and Drainage, 68(1), 98-102. https://doi.org/10.1002/ird.2248

LIU, Y., YANG, R., TANG, Z., & ZHU, Y. (2021). Impact of institutional constraints on participatory irrigation management: the regulating role of moral obligation*. Irrigation and Drainage, 70(5), 1287-1297. https://doi.org/10.1002/ird.2602

LIU, W., CHENG, Y., LI, J., & FELDMAN, M. (2022). Livelihood adaptive capacities and adaptation strategies of relocated households in rural china. Frontiers in Sustainable Food Systems, 6. https://doi.org/10.3389/fsufs.2022.1067649

LOEPER, W.J., DRIMIE, S. & BLIGNAUT, J. (2018). The Struggles of Smallholder Farmers: A Cause of Modern Agricultural Value Chains in South Africa. Available: DOI: 10.5772/intechopen.75710 (Accessed on 23 November 2021).

LOUBSER, C., CHIMBANGA, B., & JACOBS, H. (2021). Intermittent water supply: A South African perspective. Water Sa, 47(1 January). https://doi.org/10.17159/wsa/2021.v47.i1.9440

LOWE, N. (2021). The global challenge of hidden hunger: perspectives from the field. Proceedings of the Nutrition Society, 80(3), 283-289. https://doi.org/10.1017/s0029665121000902

MAKWANISE, N. AND MASUKU, M. (2016). Gender and land dispossession in Zimbabwe: a case of the Ndebele at Esigodini area 1893â€ “2003. Oral History Journal of South Africa, 2(1), 3-14. https://doi.org/10.25159/2309-5792/1579

MANONA, S., DENISON, D., VAN AVERBEKE, W. & MASIYA, T. (2010). Proposed land

MARU, H., HAILESLASSIE, A., ZELEKE, T., & ESAYAS, B. (2021). Analysis of smallholders' livelihood vulnerability to drought across agroecology and farm typology in the upper awash sub-basin, Ethiopia. Sustainability, 13(17), 9764. https://doi.org/10.3390/su13179764

MASASI, B. & NG'OMBE, J. (2019). Does a market systems approach revitalize smallholder irrigation schemes? evidence from Zimbabwe. Sustainable Agriculture Research, 8(2), 36. https://doi.org/10.5539/sar.v8n2p36

MASIPA, T. (2017). The impact of climate change on food security in South Africa: current realities and challenges ahead. Jàmbá Journal of Disaster Risk Studies, 9(1). https://doi.org/10.4102/jamba.v9i1.411

MASSAY, G. (2019). The struggles for land rights by rural women in sub-Saharan Africa. African Journal of Economic and Management Studies, 11(2), 271-283. https://doi.org/10.1108/ajems-03-2019-0120

MASUKU, M.M., MTHEMBU, Z. & MLAMBO, V.H. (2023). Gendered effects of land access and ownership on food security in rural settings in South Africa. Frontiers in

Sustainable Food Systems 7: 2023. Available: https://www.frontiersin.org/articles/10.3389/fsufs.2023.1158946 (Accessed on December 2022).

MATHIBA, G. (2021). Corruption in land administration and governance: a hurdle to transitional justice in post-apartheid South Africa? Obiter, 42(3). https://doi.org/10.17159/obiter.v42i3.12902

MATHIVHA, F., KUNDU, P., ODIYO, J., & MAKUNGO, R. (2012). Utilization and management of irrigation water for sustainable farming of macadamia nuts in Piesanghoek cropland in Limpopo province, South Africa. https://doi.org/10.2495/si120221

MAWERE, J., MATSHIDZE, P., KUGARA, S., & MADZIVHANDILA, T. (2021). The efficacy of preserving communal tenure in South Africa. The Oriental Anthropologist a Bi-Annual International Journal of the Science of Man, 21(2), 272-289. https://doi.org/10.1177/0972558x211033369

MELKETO, T., GETA, E., & SIEBER, S. (2019). Understanding livelihood diversification patterns among smallholder farm households in Southern Ethiopia. Sustainable Agriculture Research, 9(1), 26.

MEINZEN-DICK, R., & ZWARTEVEEN, M. (EDS.). (2020). Gender: A key dimension linking agricultural water management and agricultural productivity. International Water Management Institute (IWMI). doi:10.5337/2020.204

MEINZEN-DICK, R., J. BEHRMAN, P. PANDOLFELLI, A. PETERMAN, A. QUISUMBING, A. RAGASA, AND E. SEYMOUR. (2019). "Engendering agricultural systems." Journal of Development Studies 55(7): 1450-1464.

MESHESHA, A., SIMANE, B., & AYELE, M. (2022). Effects of perceptions on adoption of climate-smart agriculture innovations: empirical evidence from the upper blue Nile highlands of Ethiopia. International Journal of Climate Change Strategies and Management, 14(3), 293-311. https://doi.org/10.1108/ijccsm-04-2021-0035

MOOREHEAD, S. & WOLMER, W. (2001). Food Security and the environment. In Devereux, S and Maxwell, S. (eds) Food Security in Sub-Saharan Africa, London, ITDG Publishing

MORALLES, S., EGAL, A., & OLDEWAGE-THERON, W. (2021). Do smallholder farmers need nutrition education? a case study from KwaZulu-Natal, South Africa. Journal of International Agricultural and Extension Education, 28(3), 14-27. https://doi.org/10.5191/jiaee.2021.28314

MORSE, S. & MCNAMARA, N. 2013. Sustainable Livelihood Approach: A Critique of Theory and Practice. Springer. Available:

file:///C:/Users/Naidook12/Downloads/9789400762671-c2.pdf (Accessed 24 November 2014).

MOVIK S., MEHTA L., VAN KOPPEN B. & DENBY K., (2016). Emergence, interpretations and translations of IWRM in South Africa. Water Alternatives 9(3), 456.

MOYO, M., ROOYEN, A., CHIVENGE, P., & BJØRNLUND, H. (2016). Irrigation development in Zimbabwe: understanding productivity barriers and opportunities at Mkoba and Silalatshani irrigation schemes. International Journal of Water Resources Development, 33(5), 740-754. https://doi.org/10.1080/07900627.2016.1175339

MOYO, T. (2016). The contribution of smallholder irrigation farming to rural livelihoods and the determinants of benefit distribution: The case of Limpopo Province of South Africa. https://repository.up.ac.za/bitstream/handle/2263/57264/Moyo_Contribution_2016.pdf?sequence=1

MOYO, S. (2011). Three decades of agrarian reform in Zimbabwe. The Journal of Peasant Studies, 38(3), 493-531. https://doi.org/10.1080/03066150.2011.583642

MUBECUA, M.A. & NOJIYEZA, S. (2022). The Dichotomy of Land Laws in South Africa: The Challenges Faced by Women in Accessing Land. African Journal of Gender Society and Development. https://hdl.handle.net/10520/ejc-aa_jgida1_v11_n2_a6

MUCHARA, B., ORTMANN, G., WALE, E. & MUDHARA, M. (2014). Collective action and participation in irrigation water management: A case study of Mooi River Irrigation Scheme in KwaZulu-Natal Province, South Africa. *Water SA*, *40*(4), pp.699-708.

MUDALY L, & VAN DER LAAN M. (2020). Interactions between Irrigated Agriculture and Surface Water Quality with a Focus on Phosphate and Nitrate in the Middle Olifants Catchment, South Africa. *Sustainability*. 12(11):4370. https://doi.org/10.3390/su12114370

MULLINS, L., CHARLEBOIS, S., FINCH, E., & MUSIC, J. (2021). Home food gardening in Canada in response to the covid-19 pandemic. Sustainability, 13(6), 3056. https://doi.org/10.3390/su13063056

MULUKI, K., RASUGU, M., NJERI, M., & NYARINDO, I. (2022). Factors influencing adoption of irrigation technologies among smallholder farmers in Machakos county, Kenya. Journal of Agricultural Extension, 26(3), 44-59. https://doi.org/10.4314/jae.v26i3.5

MUNYAI, D. 2018. Partnerships and access to resources to advance land reform. Johannesburg, South Africa: Department of Rural Development and Land Reform.

MUGEJO, K., NCUBE, B., & MUTSVANGWA, C. (2022). Infrastructure performance and irrigation water governance in Genadendal, western cape, South Africa. https://doi.org/10.20944/preprints202208.0168.v1

MUSIC, J., MULLINS, L., CHARLEBOIS, S., LARGE, C., & MAYHEW, K. (2022). Seeds and the city: a review of municipal home food gardening programs in Canada in response to the covid-19 pandemic. Humanities and Social Sciences Communications, 9(1). https://doi.org/10.1057/s41599-022-01301-6

MWADZINGENI, L., MUGANDANI, R., & MAFONGOYA, P. (2022). Socio-demographic, institutional and governance factors influencing adaptive capacity of smallholder irrigators in Zimbabwe. Plos One, 17(8), e0273648. https://doi.org/10.1371/journal.pone.0273648

MWADZINGENI, L., MUGANDANI, R., & MAFONGOYA, P. (2020). Factors affecting the performance of Tshiombo irrigation scheme in Limpopo province, South Africa. Journal of Agribusiness and Rural Development, 57(3). https://doi.org/10.17306/j.jard.2020.01314

NCHAKE, M.A. & KOATSA, N. (2017). Female Labour Force Participation in Sub-Saharan Africa.

NDLOVU, C. & MASUKU, M. (2021). small-scale farming and access to market: challenges and opportunities in South Africa. Journal La Sociale, 2(5), 50-63. https://doi.org/10.37899/journal-la-sociale.v2i5.491

NEPHAWE, N., MWALE, M., ZUWARIMWE, J., & TJALE, M. (2021). The impact of water-related challenges on rural communities food security initiatives. Agraris Journal of Agribusiness and Rural Development Research, 7(1), 11-23. https://doi.org/10.18196/agraris.v7i1.9935

NETSHAKHUMA, N. (2019). Analysis of archives infrastructure in South Africa. Global Knowledge Memory and Communication, 69(4/5), 221-239. https://doi.org/10.1108/gkmc-03-2019-0043

NGEMA, P.Z., SIBANDA, M. & MUSEMWA. L. (2018). "Household Food Security Status and Its Determinants in Maphumulo Local Municipality, South Africa" Sustainability 10, (9): 3307. Available: https://doi.org/10.3390/su10093307 (Accessed on 19 November 2021).

NGUBANE, S. (2019). Critical investigation of challenges in the recognition of customary law in the democratic South Africa. International Journal of Law and Society, 2(3), 26. https://doi.org/10.11648/j.ijls.20190203.11

NGWAKWE, C. (2020). Gender equality and extreme poverty alleviation in sub-Saharan Africa. Demography and Social Economy, (4), 56-70. https://doi.org/10.15407/dse2020.04.056

NHEMACHENA, C., NHAMO, L., MATCHAYA, G., NHEMACHENA, C., MUCHARA, B., KARUAIHE, S.& MPANDELI, S. (2020). Climate change impacts on water and agriculture sectors in Southern Africa: threats and opportunities for sustainable development. Water, 12(10), 2673. https://doi.org/10.3390/w12102673

NIEWOEHNER-GREEN, J., STEDMAN, N., GALINDO, S., RUSSO, S., CARTER, H., & COLVERSON, K. (2019). The influence of gender on rural Honduran women's participation and leadership in community groups. Journal of International Agricultural and Extension Education, 26(2), 48-63. https://doi.org/10.5191/iaee.2019.26204

NJIEASSAM, E.E. (2019). Gender Inequality and Land Rights: The Situation of Indigenous Women in Cameroon. PER/PEIJ, 2019 (22): 2-29. Available: http://dx.doi.org/10.17159/172 (Accessed 20 December 2020).

NWAFOR, C. (2020). Marketing constraints among smallholder farmers in South Africa: an overview of potato market outlets in Lusikisiki township. https://doi.org/10.20944/preprints202003.0232.v1

NWAPI, C. (2016). Land grab, property rights and gender equality in pluralistic legal orders: a Nigerian perspective. African Journal of Legal Studies, 9(2), 124-146. https://doi.org/10.1163/17087384-12340005

OFORI, K., ANTONIELLO, S., ENGLISH, M., & ARYEE, A. (2022). Improving nutrition through biofortification–a systematic review. Frontiers in Nutrition, 9. https://doi.org/10.3389/fnut.2022.1043655

OKEYO, A., NONTONGANA, N., FADARE, T., & OKOH, A. (2018). Vibrio species in wastewater final effluents and receiving watershed in South Africa: implications for public health. International Journal of Environmental Research and Public Health, 15(6), 1266. https://doi.org/10.3390/ijerph15061266

OLADELE, O. & MUDHARA, M. (2016). Empowerment of women in rural areas through water use security and agricultural skills training for gender equity and poverty reduction in KwaZulu-Natal and North West province. Water Research Commission, 2176/1/16. Available: http://www.wrc.org.za/wp-content/uploads/mdocs/2176-1-16.pdf (Accessed November 2020).

ONGORO, E., ONTITA, E., & CHITERE, O. (2022). The contribution of new rice for Africa (Nerica) farming to livelihood security of smallholder households in Migori, Kenya. Asian Journal of Agricultural Extension Economics & Sociology, 369-382. https://doi.org/10.9734/ajaees/2022/v40i1031085

OSHIKOYA, T. & IFEDIORA, C. (2022). Women land ownership and participation in decision making about housing development in Oyo South-west Nigeria. International Journal of Developing and Emerging Economies, 10(3), 14-22. https://doi.org/10.37745/ijdee.13/vol10n31422

PACHECO-TREVIÑO, S, AND MARIO G. MANZANO-CAMARILLO. (2024). "The Socioeconomic Dimensions of Water Scarcity in Urban and Rural Mexico: A Comprehensive Assessment of Sustainable Development" Sustainability 16, no. 3: 1011. https://doi.org/10.3390/su16031011

PAHLOW, M., SNOWBALL, J., & FRASER, G. (2015). Water footprint assessment to inform water management and policy making in South Africa. Water Sa, 41(3), 300. https://doi.org/10.4314/wsa.v41i3.02

PARK, Y. & SHIN, Y. (2022). Trend analysis of balcony vegetable gardens in Korea, before and after covid-19 pandemic using big data. Journal of People Plants and Environment, 25(5), 447-456. https://doi.org/10.11628/ksppe.2022.25.5.447

PARKER, H., OATES, N., MASON, N. & CALOW, R. (2016). Gender, agriculture and water insecurity. Policy brief. ODI insights. Available: https://www.odi.org/sites/odi.org.uk/files/resource-documents/10533.pdf (Accessed 21 December 2020).

PAWLAK, K. & KOŁODZIEJCZAK, M. (2020). The Role of Agriculture in Ensuring Food Security in Developing Countries: Considerations in the Context of the Problem of Sustainable Food Production" Sustainability 12, no. 13: 5488. https://doi.org/10.3390/su12135488

PERERA, T., WICKRAMAARACHCHI, N., KARUNARATHNE, H., MUNASINGHE, L., & RUPASINGHE, K. (2021). Covid-19 lockdown home gardening in the western province of Sri Lanka. Journal of Social Sciences and Humanities Review, 6(2), 79-105. https://doi.org/10.4038/jsshr.v6i2.63

PHALI, L., MUDHARA, M., FERRER, S. & MAKOMBE, G. (2022) Household-level perceptions of governance in smallholder irrigation schemes in KwaZulu-Natal Province. *Irrigation and Drainage*, 71(2), 394–405. Available from: https://doi.org/10.1002/ird.2659

PIENAAR, H., XU, Y., BRAUNE, E., CAO, J., DZIKITI, S., & JOVANOVIC, N. (2021). Implementation of groundwater protection measures, particularly resource-directed measures in South Africa: a review paper. Water Policy, 23(4), 819-837. https://doi.org/10.2166/wp.2021.016

PIENAAR, L. & TRAUB, N. (2015). Understanding the smallholder farmer in South Africa: Towards a sustainable livelihoods' classification. International Conference of Agricultural economists. Available: https://ageconsearch.umn.edu/record/212633/ (Accessed 26 November 2020).

PILLAY, B. & SINGH, J. (2017). 'mental capacity', 'sufficient maturity', and 'capable of understanding' in relation to children: how should health professionals interpret these terms? South African Journal of Psychology, 48(4), 538-552. https://doi.org/10.1177/0081246317747148

PLAGERSON, S., PATEL, L., HOCHFELD, T., & ULRIKSEN, M. (2019). Social policy in South Africa: navigating the route to social development. World Development, 113, 1-9. https://doi.org/10.1016/j.worlddev.2018.08.019

PLAYÁN, E., SAGARDOY, J., & CASTILLO, R. (2018). Irrigation governance in developing countries: current problems and solutions. Water, 10(9), 1118. https://doi.org/10.3390/w10091118

QANGE, S. & MDODA, L. (2020). Factors affecting subsistence farming in rural areas of Nyandeni local municipality in the Eastern Cape Province. *South African Journal of Agricultural Extension (SAJAE)*, *48*(2), 92–105. https://doi.org/10.17159/2413-3221/2020/v48n2a540

RACE, D., SUKA, A., OKTALINA, S., BISJOE, A., MUIN, N., & ARIANTI, N. (2022). Modern smallholders: creating diversified livelihoods and landscapes in Indonesia. Small-Scale Forestry, 21(2), 203-227. https://doi.org/10.1007/s11842-021-09495-4

RAMUTSINDELA, M. & MOGASHOA, M. (2013). The people's choice: options for land ownership in South Africa's land reform. Social Dynamics, 39(2), 308-316. https://doi.org/10.1080/02533952.2013.796118

RANGAN, H. & GILMARTIN, M. (2002). Gender, traditional authority, and the politics of rural reform in South Africa. Development and Change, 33(4), 633-658. https://doi.org/10.1111/1467-7660.00273

ROCKSTRÖM, J., FALKENMARK, M., KARLBERG, L., HOFF, H., ROST, S., & GERTEN, D. (2009). Future water availability for global food production: the potential of green water for increasing resilience to global change. Water Resources Research, 45(7). https://doi.org/10.1029/2007wr006767

ROHR, H. (2015). Addressing water concerns through spatial planning initiatives for rural communities. Agriculture Forestry and Fisheries, 4(4), 52. https://doi.org/10.11648/j.aff.s.2015040401.17

ERS, C. & AMADI-ECHENDU, J. (2022). Investment models for the water infrastructure value chain in South Africa: investment measures, needs and priorities. Water Sa, 48(4 October). https://doi.org/10.17159/wsa/2022.v48.i4.3852

RUSHFORTH, R. & RUDDELL, B. (2015). The hydro-economic interdependency of cities: virtual water connections of the phoenix, Arizona metropolitan area. Sustainability, 7(7), 8522-8547. https://doi.org/10.3390/su7078522

SACHS, C., JENSEN, L., CASTELLANOS, P., & SEXSMITH, K. (2020). Routledge handbook of gender and agriculture. https://doi.org/10.4324/9780429199752

SAUTI, G. & THIAM, M. (2018). The land-grabbing debacle: an analysis of South Africa and Senegal. Ufahamu a Journal of African Studies, 41(1). https://doi.org/10.5070/f7411042305

SCHREINER, B. & KOPPEN, B. (2020). Hybrid water rights systems for pro-poor water governance in Africa. Water, 12(1), 155. https://doi.org/10.3390/w12010155

SHARAUNGA S. & MUDHARA M., (2016). Factors influencing water-use security among smallholder irrigating farmers in Msinga, KwaZulu-Natal Province. Water Policy 18(5), 120.

SIHLANGU, P. & ODEKU, K. (2021). Critical analysis of transformative interventions redressing apartheid land discrimination and injustices in South Africa: from land segregation to inclusivity. International Journal of Discrimination and the Law, 21(4), 328-356. https://doi.org/10.1177/13582291211025136

SINYOLO, S., MUDHARA, M., & WALE, E. (2014). The impact of smallholder irrigation on household welfare: the case of Tugela ferry irrigation scheme in KwaZulu-Natal, South Africa. Water Sa, 40(1), 145. https://doi.org/10.4314/wsa.v40i1.18

SMITH, L. G. E. & HANSON, S. (2003). Access to water for the urban poor in cape town: where equity meets cost recovery. Urban Studies, 40(8), 1517-1548. https://doi.org/10.1080/0042098032000094414

SPANGLER, K. AND CHRISTIE, M. (2019). Renegotiating gender roles and cultivation practices in the Nepali mid-hills: unpacking the feminization of agriculture. Agriculture and Human Values, 37(2), 415-432. https://doi.org/10.1007/s10460-019-09997-0

SPIERENBURG, M. (2019). Living on other people's land; impacts of farm conversions to game farming on farm dwellers' abilities to access land in the eastern cape, South Africa. Society & Natural Resources, 33(2), 280-299. https://doi.org/10.1080/08941920.2019.1584342

STATS SA (2023). Share of households involved in agricultural activities in South Africa in 2022, by province. https://www.statista.com/statistics/1116075/share-of-agricultural-households-in-South-africa-by-province/#:~:text=As%20of%202022%2C%2016.3%20percent,households%20involved%20in%20agricultural%20production.

STATS SA (2019). The extent of Food security in South Africa. Available: http://www.statssa.gov.za/?p=12135&gclid=CjwKCAiA9bmABhBbEiwASb35V2EsLew5ITirDwgKZUTIMGvCoJ93WYF3QKjEMn8KRh2aevjod3f9GBoC8rwQAvD_BwE (Accessed 26 November 2020).

STATS SA (2019). Towards measuring food security in South Africa: An examination of hunger and food inadequacy. https://www.statssa.gov.za/publications/03-00-14/03-00-142017.pdf

STATS SA (2016). Community Survey 2016 Agricultural households. Available: https://www.statssa.gov.za/publications/03-01-

05/Presentation_CS2016_Agricultural_Households.pdf (Accessed 20 November 2020).

SU, F., SAIKIA, U., & HAY, I. (2019). Impact of perceived livelihood risk on livelihood strategies: a case study in Shyang river basin, china. Sustainability, 11(12), 3349. https://doi.org/10.3390/su11123349

SU, M., SUN, Y., MIN, Q., & JIAO, W. (2018). A community livelihood approach to agricultural heritage system conservation and tourism development: Xuanhua grape garden urban agricultural heritage site, Hebei province of china. Sustainability, 10(2), 361. https://doi.org/10.3390/su10020361

TANNER, J., MANTEL, S., PAXTON, B. R., SLAUGHTER, A., & HUGHES, D. A. (2022). Impacts of climate change on rivers and biodiversity in a water-scarce semi-arid region of the western cape, South Africa. Frontiers in Water, 4. https://doi.org/10.3389/frwa.2022.949901

TEKWA, N. & ADESINA, J. (2023). Land, water, and gender questions in South africa: a transformative social policy perspective. Agrarian South Journal of Political Economy a Triannual Journal of Agrarian South Network and Cares, 12(1), 72-97. https://doi.org/10.1177/22779760231151517

THAMAGA-CHITJA, J.M. & PHOLOHO, M. (2014). The Context of Smallholder Farming in South Africa: Toward a Livelihood Asset Building Framework. Journal of Human Ecology, 45 (2): 147-155.

THE ADVISORY PANEL ON LAND REFORM AND AGRICULTURE. (2019). Final Report of The Presidential Advisory Panel on Land Reform and Agriculture

TOULMIN, C. & QUAN, J. (2000). Evolving Land Rights, Policy and Tenure in Africa. Available: http://pubs.iied.org/pdfs/7416IIED.pdf (Accessed 24 November 2014).

TSCHIRHART, N., KABANGA, L. & NICHOLS, S. (2018). Equal Inheritance is not always advantageous for women: A discussion on gender, customary law, and access to land for women in rural Malawi. Gendered Perspectives on International Development: Working Paper no 310, pp. 1-16.

UNRUH, J. (2008). Carbon sequestration in Africa: the land tenure problem. Global Environmental Change, 18(4), 700-707. https://doi.org/10.1016/j.gloenvcha.2008.07.008

UGWU, P. (2019). Women in agriculture: Challenges facing women in African farming. Research report: Postgraduate school of agricultural and food economics, Catholic University of the Sacred Heart, Italy.

UN WOMEN, (2021). Impact of COVID-19 on Gender Equality and Women's Empowerment in East and Southern Africa. Available: https://data.unwomen.org/news/new-report-

sounds-alarm-impact-covid-19-gender-equality-east-and-Southern-africa (Accessed on 20 November 2021).

USAID (2018). Women's Empowerment in Agriculture Study Feed the Future Senegal–Naatal Mbay. Available at: https://pdf.usaid.gov/pdf_docs/PA00T8KB.pdf (Accessed 11 January 2022).

USMAN, M. AND CALLO-CONCHA, D. (2021). Does market access improve dietary diversity and food security? evidence from southwestern Ethiopian smallholder coffee producers. Agricultural and Food Economics, 9(1).

VALENTE, C. (2011). Household Returns to Land Transfers in South Africa: A Q-squared Analysis. Available: https://doi.org/10.1080/00220380903428415 (Accessed 11 November 2016).

VAN AVERBEKE, W., DENISON, J. & MNKENI, P.N.S. (2011). Smallholder irrigation schemes in South Africa: A review of knowledge generated by the Water Research Commission. *Water S.A.* 37(5): 797-808.

VAN AVERBEKE, W. & KHOSA, T.B. (2011). Smallholder irrigation schemes in South Africa with a focus on Dzindzi Canal Irrigation Scheme in Limpopo: dynamic smallholders amidst contested policy priorities. Strategies to support South African smallholders as a contribution to government's second economy strategy. Vol 2: Case studies, ed M. Aliber, 145-62. Cape Town: Institute for Poverty, Land and Agrarian Studies, School of Government, University of the Western Cape

VAN AVERBEKE, W. (2008). Best Management Practices for Sustainable Subsistence Farming on Selected Irrigation Schemes and Surrounding Areas through Participatory Adaptive Research in Limpopo Province. WRC Report No. TT 344/08. Water Research Commission, Pretoria, South Africa. 318 pp.

VAN AVERBEKE, W. & MOHAMED, S. (2006). 'Smallholder farming styles and development policy in South Africa: The case of Dzindzi Irrigation Scheme'. Agrekon, 45 (2): 136 – 157.

VAN KOPPEN, B., NHAMO, L., CAI, L., GABRIEL, M.J., SEKGALA, M., SHIKWAMBANA, S., TSHIKOLOMO, K., NEVHUTANDA, S., MATLALA, B. & MANYAMA, D. (2017). Smallholder Irrigation Schemes in the Limpopo Province, South Africa. Available: http://dx.doi.org/10.22004/ag.econ.257964 (Accessed on November 18, 2021).

VAN KOPPEN, B., SALLY, H., ALIBER, M., COUSINS, B. & TAPELA, B. (2009). 'Water resources management, rural redress and agrarian reform'. Development Planning Division, Working Paper Series 12. Midrand: Development Bank of Southern Africa.

VAN KOPPEN, B. (2000). Water rights, gender, and poverty alleviation: Inclusion and exclusion of women and men smallholders in public irrigation infrastructure development. Agriculture and Human Values 15: 361-374.

VAN KOPPEN, B. (1999). Sharing the last drop: water scarcity, irrigation and gendered poverty eradication. Gatekeeper Series No 85, IIED Sustainable Agriculture and Rural Livelihoods Programme. Available: http://www.iied.org/pubs/pdfs/6153I IED. pdf (Accessed 2011, May 8).

VAN KOPPEN, B. (1998). Water rights, gender, and poverty alleviation. Inclusion and exclusion of women and men smallholders in public irrigation infrastructure development. Agriculture and Human Value 15: 361-374.

VIGNOLA, R., HARVEY, C., BAUTISTA-SOLIS, P., AVELINO, J., RAPIDEL, B., DONATTI, C. & MARTINEZ, R. (2015). Ecosystem-based adaptation for smallholder farmers: definitions, opportunities and constraints. Agriculture Ecosystems & Environment, 211, 126-132. https://doi.org/10.1016/j.agee.2015.05.013

VILLA, M. (2017). Women own less than 20% of the world's land. It's time to give them equal property rights. World Economic Forum. Available: https://www.weforum.org/agenda/2017/01/women-own-less-than-20-of-the-worlds-land-its-time-to-give-them-equal-property-rights/ (Accessed 21 December 2020).

VYAS, S. & JANSEN, H. (2018). Unequal power relations and partner violence against women in Tanzania: a cross-sectional analysis. BMC Women S Health, 18(1). https://doi.org/10.1186/s12905-018-0675-0

WALKER, C. (2005). Women, gender policy and land reform in South Africa. Politikon, 32(2), 297-315. https://doi.org/10.1080/02589340500353664

WALKER, C. (2003). Piety in the sky? gender policy and land reform in South Africa. Journal of Agrarian Change, 3(1-2), 113-148. https://doi.org/10.1111/1471-0366.00052

WANG, X., LI, P., XU, D., & WANG, X. (2019). Sensitivity of rural households' livelihood strategies to livelihood capital in poor mountainous areas: an empirical analysis in the upper reaches of the min river, china. Sustainability, 11(8), 2193. https://doi.org/10.3390/su11082193

WATER ALTERNATIVES. (2022). South African "Free Basic Water" policy: from progressive to regressive agenda? Available at: water-alternatives.org/index.php/blog/fbw (Accessed October 2022).

WATI, S., AFRIANTO, W., PUTRA, R., & HIDAYATULLAH, T. (2022). Community empowerment through online training of drumstick tree (moringa oleifera) cultivation and its utilization during the covid-19 pandemic for urban communities in Kediri, east java, Indonesia. Journal Pengabdian Magister Pendidikan Ipa, 5(2), 361-367. https://doi.org/10.29303/jpmpi.v5i2.1548

WEIDEMAN, M. (2004). Who shaped South Africa's Land Reform policy? Politikon: *South African Journal of Political Studies* 31 (2): 219-238.Widows Rights International (2006).

WORLD BANK. (2019). "High and Dry: Climate Change, Water, and the Economy." World Bank, Washington, DC. doi:10.1596/978-1-4648-1328-0

WORLD BANK. (2012). Land Tenure and Gender: Approaches and Challenges for Strengthening Rural Women's Land Rights. Women's Voice, Agency, & Participation Research Series 2017 No. 6. Available: http://www.worldbank.org/content/dam/Worldbank/document/Gender/Namubiru-Mwaura%202014.%20Rural%20Women%20and%20Land%20Tenure.pdf (Accessed 12 August 2017).

WORLD ECONOMIC FORUM. (2019). Global Gender Gap Report 2020. Available: http://www3.weforum.org/docs/WEF_GGGR_2020.pdf (Accessed 21 December 2020).

WRC. (2012). Report on selection, description and motivation of at least two smallholder irrigation schemes for field research. Deliverable No.2. (Unpublished). Project Number: K5/2179: Water use productivity associated with appropriate entrepreneurial development paths in the transition from homestead food gardening to smallholder irrigation crop farming in Limpopo Province

WYK, J. & ORANJE, M. (2013). The post-1994 South African spatial planning system and bill of rights: a meaningful and mutually beneficial fit? Planning Theory, 13(4), 349-369. https://doi.org/10.1177/1473095213511966

YANG, G., GIULIANI, M., & CASTELLETTI, A. (2023). Operationalizing equity in multipurpose water systems. Hydrology and Earth System Sciences, 27(1), 69-81. https://doi.org/10.5194/hess-27-69-2023

YATES, J. & HARRIS, L. (2018). Hybrid regulatory landscapes: the human right to water, variegated neoliberal water governance, and policy transfer in cape town, South Africa, and Accra, Ghana. World Development, 110, 75-87. https://doi.org/10.1016/j.worlddev.2018.05.021

ZANDE, V. & WINTER, A. (2020). Evaluating the potential for low energy emitters to facilitate solar-powered drip irrigation in sub-Saharan Africa. Proceedings of the Design Society Design Conference, 1, 2177-2186. https://doi.org/10.1017/dsd.2020.329

ZEWDIE, M., MORETTI, M., TENESSA, D., AYELE, Z., NYSSEN, J., TSEGAYE, E. & PASSEL, S. (2021). Agricultural technical efficiency of smallholder farmers in Ethiopia: a stochastic frontier approach. Land, 10(3), 246. https://doi.org/10.3390/land10030246

ZULFIQAR, F., ABID, M., ULLAH, R., & SHAHZAD, S. (2021). Water management under climate change: the role of water commons and policy options. Water and Environment Journal, 35(4), 1217-1225.

ZUMA, M., KOLANISI, U., & MODI, A. (2018). The potential of integrating provitamin a-biofortified maize in smallholder farming systems to reduce malnourishment in South Africa. International Journal of Environmental Research and Public Health, 15(4), 805.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter outlines the research methods employed in conducting the study, offering insights into participant selection criteria, sampling procedures, methodological justifications, research design, data collection instruments, implementation procedures, data analysis methods, and ethical considerations. To begin, the chapter presents information about the study's participants, detailing the criteria for their inclusion, their identities, and the sampling methodology utilized. The subsequent section justifies the rationale behind the chosen research methods.

The researcher elaborates on the research design chosen for this study, providing a clear rationale for this selection. Subsequently, the data collection instrument employed is described, along with the procedural steps taken in conducting the study. Furthermore, the chapter delves into the methods used to analyze the collected data, ensuring a transparent presentation of the analytical processes applied. In closing, the chapter addresses ethical considerations, emphasizing the adherence to ethical guidelines throughout the research process, including obtaining ethical clearance from UKZN, as documented in the attached ethical clearance letter.

In summary, chapter three is an abridged methodology because each of the research chapters has a methodology section for each of the specific objective, which are to: (i) Identify and describe the livelihood assets of small-scale irrigation scheme women farmers; (ii) Determine the current household food security status of small-scale irrigation scheme women farmers. The overarching purpose of this study is to explore the role of small-scale irrigation schemes in influencing livelihoods and household food security among irrigation farmers in Limpopo Province.

3.2. Research Design

3.2.1. Rationale for Mixed Methods

The mixed methods case study approach was chosen for this study because it allowed for a comprehensive exploration of the role of small-scale irrigation schemes in enhancing livelihoods and household food security in Limpopo Province. This approach integrated the depth of qualitative insights with the breadth of quantitative analysis, providing a richer, more nuanced understanding of the research problem (Hess-Biber & Leavy, 2017; Creswell & Creswell, 2018). By combining qualitative and quantitative methods, the study benefited from

triangulation, which enhanced the validity and reliability of the findings through cross-verification from multiple sources (Creswell & Creswell, 2018). Additionally, this approach offered complementarity, where qualitative data elucidated the 'why' and 'how' behind observed quantitative trends, and quantitative data provided measurable evidence of these phenomena (Creswell & Creswell, 2018). Furthermore, the quantitative and qualitative findings are juxtaposed to "generate complementary insights" and produce a more comprehensive (Hess-Biber & Leavy, 2017).

3.2.2. Qualitative Component

The qualitative component of the study included semi-structured interviews, focus group discussions (FGDs), participant observation, and document analysis. Semi-structured interviews were conducted with 96 small-scale women farmers participating in the selected irrigation schemes. These interviews aimed to capture personal experiences, perceived benefits, challenges, and impacts on livelihoods and food security (Hess-Biber & Leavy, 2017). Additionally, key informants such as local agricultural officers, scheme managers, and community leaders were interviewed to gain expert insights and contextual understanding.

FGDs were organized with community members involved in the irrigation schemes. These discussions facilitated the exchange of collective experiences and perceptions, identifying common themes, challenges, and success stories (Creswell & Creswell, 2018). FGDs were structured to capture diverse perspectives, fostering a comprehensive understanding of community dynamics and social factors influencing the effectiveness of the irrigation schemes.

Participant observation involved immersing the researcher in the daily activities and practices related to the irrigation schemes. This method provided a nuanced understanding of how the schemes operated in practice and their day-to-day impacts on households (Creswell & Creswell, 2018). Document analysis was also conducted, reviewing relevant government reports, NGO publications, and records from the irrigation schemes. This analysis provided historical context, policy background, and supplementary data to enrich the primary qualitative data.

3.2.3. Quantitative Component

The quantitative component included household surveys and statistical analysis. Structured surveys were administered to a larger sample of households participating in the irrigation schemes. These surveys collected quantitative data on demographics, income, agricultural

productivity, food security status, and access to resources (Creswell & Creswell, 2018). The survey questions were designed based on insights gained from the qualitative data to ensure relevance and comprehensiveness. The quantitative data from the household surveys were analyzed using statistical methods to identify patterns, correlations, and trends. Statistical analysis quantified the impact of irrigation schemes on household income and food security, enabling generalizations beyond the case study sites. This component provided a broader context for the qualitative findings and helped to identify significant trends and relationships.

3.2.4. Integration of Qualitative and Quantitative Data

The integration of qualitative and quantitative methods was achieved through concurrent triangulation and sequential explanation. During data collection, qualitative insights informed the development of survey instruments, and quantitative data provided a broader context for qualitative findings. This concurrent collection allowed for immediate cross-verification and deeper understanding (Creswell & Creswell, 2018). After quantitative data analysis, a detailed qualitative exploration followed to explain observed statistical trends. For instance, if a particular pattern of income improvement was noted, qualitative interviews and observations were used to understand the underlying mechanisms and personal experiences contributing to this trend. Triangulation involved cross-verifying data from interviews, FGDs, observations, surveys, and document analysis to ensure consistency and credibility.

3.2.5. Case Selection and Sampling

Three distinct small-scale irrigation schemes in Limpopo Province were selected based on their diversity in size, management structures, and geographic locations. This selection ensured comprehensive representation of the various types of irrigation schemes operating in the province. Households were purposively sampled to include a range of socio-economic backgrounds and levels of engagement with the irrigation schemes, ensuring a diverse and representative sample. Key informants were identified using snowball sampling, leveraging the networks of initial contacts to find knowledgeable individuals who could provide deep insights into the functioning and impact of the schemes. The qualitative sample included 96 small-scale women irrigation farmers for interviews, several FGDs, and a smaller number of participant observation sessions. The quantitative sample for the household surveys included a larger number of households to ensure statistical validity and reliability.

The mixed methods case study approach provided a robust framework for exploring the impact of small-scale irrigation schemes on livelihoods and household food security in Limpopo Province. By integrating qualitative and quantitative methods, this research achieved a comprehensive and nuanced understanding of the research problem. The findings offered valuable insights for policymakers, practitioners, and stakeholders aiming to enhance agricultural interventions and improve community outcomes in the region. This approach ensured that the study captured the complexity of the irrigation schemes' impacts, providing both detailed personal experiences and generalizable trends.

3.3 Site Selection and Sampling

The selection of the three irrigation schemes for sampling was primarily guided by specific criteria aligned with a larger WRC project, 2082/1/15, in which this study was a part. To participate, individuals had to be affiliated with an established irrigation scheme employing canal irrigation, operational, and actively engaged in production and product sales. Furthermore, community members were chosen based on their willingness to participate and their capacity to provide essential information for the study's objectives. The overarching aim of the WRC project was to explore women's empowerment through enhanced water and land use security, coupled with knowledge generation, to improve household food security and sustain rural livelihoods in Limpopo Province.

The selection of an irrigation scheme with existing agricultural activity and production was done deliberately. The criteria for this purposive sampling included the requirement that participants be part of an established irrigation scheme utilizing canal irrigation, that the scheme be operational, and that active production and sales were evident. These criteria were essential to ensure that the selected sites and respondents possessed the necessary characteristics relevant to this study. Prior knowledge gleaned from fieldwork conducted by the research team members in 2011, encompassing all schemes in Limpopo Province, where 57% of South African smallholder irrigation schemes are situated (Mohamed, 2006; Van Averbeke et al., 2011), informed this selection process. Additionally, care was taken to select an operational irrigation scheme as the research site, and it had to comprise smallholder farming households, namely scheme irrigators.

Consequently, purposive sampling was employed to select both the research sites and the participants who would best facilitate data collection for investigating the livelihoods and food security of small-scale irrigation scheme women farmers. Purposive sampling, also known as

judgmental or selective sampling, is a non-probability sampling technique employed when characteristics of the population and the study's objectives guide participant selection (Crossman, 2018). This method is especially useful when the objective is to quickly reach a specific target group, and proportional representation is not the primary concern. The sites and respondents were chosen in this manner due to their possession of specific desirable characteristics pertinent to this study (Palinkas et al., 2015). Although this approach does not render the study representative of all smallholder farmers in South African irrigation schemes, it allowed for the selection of knowledgeable farmers and key informants with expertise on the subject (Teddlie and Yu, 2007).

The study took place in Limpopo Province, located in the northern region of the Republic of South Africa in 2011. The dataset were updated in 2018, with a specific focus on socio-economic variables, including gender, age, education, primary income source, and the involvement of males aged 18 and above in agricultural activities. This rigorous updating process was necessitated by the temporal gap resulting from recurring well-being concerns affecting the primary researcher. The collection of fresh data in 2018 aimed to ensure socio-economic information's relevance, accuracy, and comprehensiveness, thus addressing potential fluctuations and changes in the participants' circumstances over the intervening period. This province shares its borders with Zimbabwe to the north and Mozambique to the east. Limpopo Province was deliberately chosen for this research due to its classification as one of South Africa's three poorest provinces, alongside the Eastern Cape and Mpumalanga (Statistics South Africa, 2014). It ranks as the most impoverished province, with 78.9% of its population living below the national poverty line (Statistics South Africa, 2018). Moreover, Limpopo Province faces significant water insecurity challenges (Schultze, 2010). The study encompassed three villages within the Capricorn, Greater Sekhukhune, and Vhembe districts, namely Mafefe, Steelpoortdrift, and Rambuda, as illustrated in Figure 3.1.

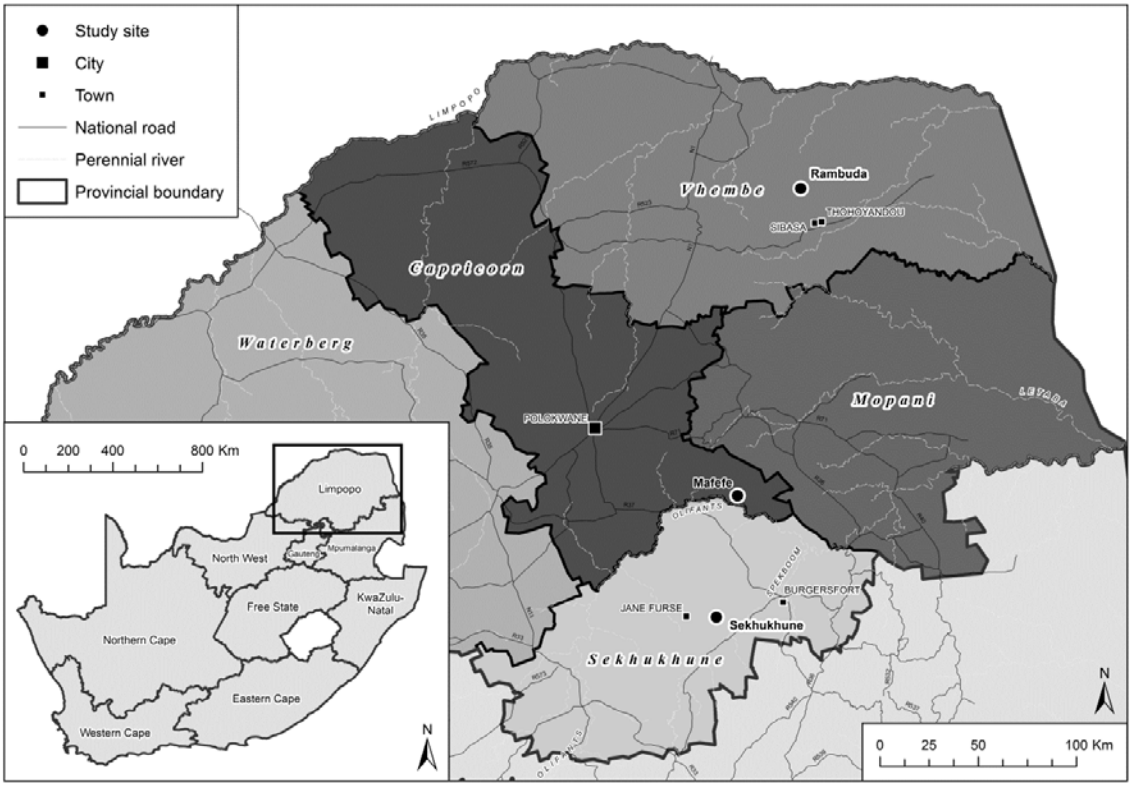

Figure 3. 1: Map of Limpopo Province indicating the study areas

Smallholder farms are predominantly situated in the former homeland areas, covering approximately 30% of the provincial land surface area. Within these rural areas, a significant proportion of households engage in agriculture as their primary means of livelihood. However, a noteworthy demographic shift has occurred, with the majority of working-age men from the Province migrating to seek employment opportunities in Gauteng Province, Mpumalanga, and the Western Cape. This trend has resulted in a considerable number of de facto female-headed households, where women make up the majority of smallholder farmers (Statistics South Africa, 2014).

Local employment opportunities in these rural areas are relatively scarce, and residents often rely on a combination of livelihood sources, including mining, small-scale farming, remittances, and government grants. Small-scale farming, in particular, plays a crucial role in ensuring household food access and security (Statistics South Africa, 2012b; Hope et al., 2004).

The Province boasts numerous irrigation schemes, many of which were established during the apartheid era. These schemes serve as vital sources of irrigation water for smallholder farmers (Tapela, 2008).

3.3.1 Research Area Description

Agriculture has been identified as one of the three pillars of the economic development strategy for Limpopo Province (Stats SA, 2014). The Province boasts abundant agricultural resources and is renowned as one of the country's premier agricultural regions, known for producing fruits, vegetables, cereals, tea, and sugar (Department of Agriculture, Forestry and Fisheries, South Africa, 2015). It can be categorized into three distinct climate regions: the lowveld (arid and semi-arid), the middle veld and highveld (semi-arid), and the escarpment region with a sub-humid climate and annual rainfall exceeding 700mm (South African Weather Service, 2014). This climatic diversity allows Limpopo Province to cultivate a wide variety of agricultural produce.

A noteworthy feature of the agricultural industry in Limpopo Province is its duality, consisting of two distinct agricultural production systems: large-scale commercial farming and small-scale farming ((Bryceson & Fonseca, 2006). These two systems have emerged as a result of past policies implemented during the apartheid regime.

White farmers predominantly practice large-scale farming, employing advanced production technologies. These commercial farmers manage extensive, well-organized farms situated on prime land. In contrast, the small-scale farming sector is primarily located in the former homeland areas (Cousins, 2019). It is characterized by lower levels of production technology and small farm holdings, typically averaging around 1.5 hectares per farmer. The primary focus of small-scale farming is subsistence, with limited surplus available for the market (Ngwenya et al., 2013).

3.3.2 Study Sites Description

Mashushu Irrigation Scheme (Mafefe)

Mashushu irrigation scheme, located in Mafefe, Limpopo Province, was one of three irrigation schemes constructed in 1959 to serve the GaMampa community (Masiyandima et al., 2006). Situated within the Lepelle-Nkumpi local municipality, this region falls under the former homeland area of Lebowa and is characterized by its predominantly rural setting with low population density. The primary livelihood source for the residents revolves around small-scale agriculture, which is often supplemented by social grants and pensions. The scheme's livestock farming predominantly involves cattle and donkeys, serving both as draft power and a means of saving. Crop production in this area is divided into two categories: wetland and irrigation

crop production. Notably, maize, a staple crop, holds a central position in both these categories. The GaMampa area, surrounding the wetland, houses an estimated 394 households, consisting of approximately 2758 people. The economic status of the area reveals a stark reality, with over 80% of households categorized as poor and vulnerable (Tinguery, 2006). The wetland, a crucial resource, plays a vital role in provisioning services, including crop production, livestock grazing, edible plants collection, reeds collection, sedge collection, and water supply (Darradi, 2005; Adekola, 2007). However, the period between 1996 and 2004 witnessed a significant transformation of the wetland, with more than half of its area converted to agriculture. This conversion has been attributed to several factors, including the collapse of small-scale irrigation schemes due to government support withdrawal in the early nineties, destruction of remaining irrigation infrastructure by floods in 2000, frequent droughts experienced since 2000, and high dependence on the wetland for crop production and natural products due to limited access to fertile lands and other livelihood alternatives.

Steelpoortdrift Irrigation Scheme

Steelpoortdrift irrigation scheme, established in 1972, is the result of the concerted efforts of 69 community members mobilized by Kgoshi Malekane. Situated in Ngwaabe Ga-Malekane village, within the Greater Tubaste Municipality of the Sekhukhune district, this scheme is located approximately 56 km from Burgersfort (Mthombeni et al., 2017). Under the Permission to Occupy (PTO) land tenure system, the scheme's land allocation took place. The primary focus of the scheme is to cultivate crops such as maize, spinach, onions, cabbage, carrots, and beetroot for the local market, contributing significantly to the livelihood of local households and neighboring villages. In terms of land distribution, the scheme covers a total area of 69 hectares, with each of the 69 beneficiaries owning one hectare. Notably, the gender composition of beneficiaries' skews toward females, with 64 women and four men being the primary stakeholders. Importantly, all beneficiaries are adults, with ages ranging from 50 to 90 years.

Rambuda Irrigation Scheme

Rambuda Irrigation Scheme, founded in 1952, was conceived with the primary objective of enhancing rural household livelihoods and promoting rural economic development through agriculture. Located north of Thohoyandou in the Mutale Municipality of the Vhembe District, Limpopo Province, South Africa, this scheme occupies a distinct geographical region Nethononda & Odhiambo, 2011). The scheme encompasses a total area of 120 hectares, which

is divided into 104 terraced plots, each spanning 1.28 hectares or 1.5 morgens. These plots are further subdivided into subplots, with sizes ranging from 300 square meters to 900 square meters. The agricultural focus of Rambuda primarily revolves around the cultivation of sweet potatoes and maize, with additional minor crops such as vegetables being grown during the winter season. The scheme's soils are characterized as deep and well-drained, with some sections featuring moderately drained soils. The South African Taxonomic system classifies these soils into Oakleaf form (Neocutanic, chromic, haplic, and chromic rhodic, luvic) and Hutton form (Rhodic, eutrophic; mesotrophic, haplic, and luvic) (Nethononda & Odhiambo, 2011). The scheme draws its water from the Tshala River, which is channeled into a concrete canal via a weir, and from there, it is distributed through secondary canals to specific plots. Short earth furrows are employed as the irrigation method to nourish crops planted on ridges. To ensure efficient water allocation, an irrigation program/schedule is adhered to, with the scheme divided into six management blocks, each receiving a full day of irrigation per week.

3.4 Data-Collection and Analysis

3.4.1 Sub-problem 1: To identify and describe the livelihoods assets of small-scale irrigation women farmers

Data collection for this sub-problem occurred during the period of 2018/2019, with the aim of comprehensively understanding the livelihoods of small-scale irrigators concerning the five crucial assets: human, social, financial, physical, and natural capitals. To achieve this, a survey incorporating both open-ended and closed-ended questions was employed to engage small-scale irrigation scheme farmers. Notably, due to a time lag in the initial data collection, a return visit to the study area in 2018/2019 was necessitated to update and validate the collected data. This step was deemed critical as livelihoods are dynamic and subject to change over time. Furthermore, during field trips for data collection in 2018/2019, additional data updates were carried out to encompass socioeconomic characteristics.

The selection of household interviews as the primary data collection method was deliberate, given that informants within the study are distinct individuals with unique experiences, statuses, needs, and motives. By opting for this approach, it was possible to acknowledge and categorize individual experiences, behaviours, and values, facilitating the derivation of overarching insights about the specific group of people under examination and their livelihoods.

Additionally, focus group discussions (FGD's) were conducted in each community to gain a deeper understanding of how water and land security impacts the livelihoods of the farmers. These FGD's offered valuable qualitative insights into the description of a "normal" year, week, and day in the lives of the participants. They also shed light on hazards that affect livelihoods, such as droughts and floods, along with the coping strategies employed by the community. FGD's served as a participatory research tool, fostering open debates among community members and yielding data on their yearly activities.

Furthermore, detailed individual interviews were conducted with key informants and officials from district municipalities, extension officers, and the Department of Water Affairs. These interviews provided valuable data on various aspects, including water access, governance, organizational structures, and institutional arrangements. A household water audit was also carried out to assess pronunciations and their impact on water access.

In the analytical phase, an SLA (Sustainable Livelihoods Approach) developed by scholars like Scoones (1998); Makame et al. (2018); Gotor et al. (2021) was employed. This approach was integrated into a case-study framework, enabling the empirical examination of how various selected factors related to water security influenced or hindered the livelihoods of the rural poor who rely on small-scale irrigation schemes. The data collected were subjected to analysis using descriptive statistics in SPSS 23, coupled with content and theme analyses

3.4.2 Sub-problem 2: To determine the current household food security status of small-scale irrigation schemes women farmers

The research methodology employed in this study encompassed several key approaches, including documentary review, observation, informal interviews, key informant interviews, household surveys, and the compilation of case histories and livelihood mapping, all aimed at elucidating their pivotal role in determining food security.

It is widely acknowledged that gathering information regarding the livelihoods of pastoral communities' hinges on establishing a substantial level of trust between the researcher and the respondents (Juma, 2016). To engender this trust among villagers, informal discussions with community members and local leaders were conducted during the reconnaissance phase preceding the formal interviews. This initial engagement served as a means of fostering rapport and building confidence among the villagers.

Additionally, the credibility of the research was bolstered by enlisting research assistants who were residents of the study area. Their familiarity with the community and its members further enhanced trust among the local population.

To ensure the reliability of the data collected, a diverse array of methods was employed, coupled with the practice of posing identical questions to different individuals. This methodological diversity was instrumental in minimizing bias and corroborating the information gleaned.

The utilization of open-ended questions played a crucial role in acquiring in-depth and nuanced insights into the livelihood responses of various groups, each possessing different levels of access and rights to socioeconomic resources.

In the subsequent data analysis phase, correlation analysis was utilized to ascertain the current status of household food security among small-scale irrigation scheme women farmers across three district municipalities in the Limpopo Province. Correlation analysis, as a statistical and quantitative research method, serves to measure relationships between two or more variables, thereby shedding light on the dynamics affecting food security.

3.4.3 Sub-problem 3: To analyse the current policies on livelihoods and food security on small-scale irrigation scheme women farmers in Limpopo province

To comprehensively evaluate the impact of land and water allocation policies, strategies, and legislation on women in rural households, this study employed a multifaceted research approach. Two primary methods were utilized: Focus Group Discussions (FGDs) with farmers and semi-structured interviews with key informants.

The FGDs with farmers served as a valuable avenue for gathering insights directly from the community members who are most affected by these policies. These discussions allowed for open dialogue and provided a platform for participants to share their experiences, concerns, and perspectives regarding the implications of land and water allocation policies on their lives.

In parallel, semi-structured interviews were conducted with key informants who possessed specialized knowledge and expertise in the domain of land and water allocation. These interviews enabled the researcher to gain deeper insights into the intricacies of policy implementation, its real-world impact, and potential areas for improvement.

To complement these firsthand accounts and to provide a comprehensive overview of the policy landscape, document analysis was conducted. This approach involves the qualitative

interpretation of relevant documents, including land and water policies, legislation, and strategic documents.

Document analysis, as a form of qualitative research, plays a pivotal role in providing context and depth to the research findings. By delving into these official documents, the researcher gains access to the broader framework within which policies are crafted and implemented.

Moreover, document analysis offers a unique perspective by allowing the researcher to uncover latent themes and patterns present in the policies and strategies. Much like the analysis of focus group or interview transcripts, content coding was applied to these documents to extract meaningful themes and insights (Bowen, 2009).

In essence, this multi-pronged approach, which incorporates both direct engagement with stakeholders and in-depth analysis of policy documents, provides a robust and holistic understanding of the impact and effectiveness of land and water allocation policies. Through the triangulation of these various data sources, the study seeks to shed light on the complex interplay between policies and their real-world implications for women in rural households.

3.5 Summary

In this chapter, we delved into the intricate details of the research methodology that underpinned this study. Specifically, we explored the research design, elucidated the rationale behind the chosen methodologies, and elucidated the process of data collection and analysis. Additionally, we provided a comprehensive description of the study area, augmented by a visual map illustrating the geographical locations of the Mafefe, Steelpoortdrift, and Rambuda irrigation schemes. This map served to contextualize the study within its geographical framework.

The cornerstone of our primary data collection revolved around face-to-face interviews. These interviews were meticulously structured, employing well-designed questionnaires as the primary instrument for data collection. The structured questionnaires were thoughtfully crafted to ensure alignment with the research objectives. This methodical approach to data gathering was chosen for its ability to provide standardized responses and facilitate rigorous analysis.

The choice of conducting face-to-face interviews through structured questionnaires was underpinned by several justifications. Firstly, it allowed for a systematic and consistent collection of data, ensuring that all participants were presented with identical questions and prompts. This standardization was paramount to maintaining data integrity and comparability.

Moreover, face-to-face interviews offered a dynamic platform for interaction between the researcher and the respondents. This interpersonal engagement fostered a conducive environment for participants to articulate their thoughts, experiences, and insights effectively. It also allowed for clarifications and probing when necessary, enhancing the depth and richness of the data collected.

In parallel, structured questionnaires were instrumental in ensuring that the research objectives were adequately addressed. These questionnaires were designed to encompass a range of relevant variables and themes, thereby enabling a comprehensive exploration of the research problem.

The study area, as elucidated in this chapter, encompassed the geographic backdrop against which the research was conducted. By presenting a map highlighting the locations of the Mafefe, Steelpoortdrift, and Rambuda irrigation schemes, we offered readers a visual reference point, enhancing their understanding of the study's context.

REFERENCES

ADEKOLA, O. 2007. Economic valuation and livelihood analysis of the provisioning services provided by GaMampa wetland, South Africa. Master of Science in Environmental Sciences, Wageningen University.

BOWEN, G.A. 2009. Document Analysis as a Qualitative Research Method. Qualitative Research Journal, 9 (2), 27-40.

BRYCESON, D. F., & FONSECA, J. 2006. Ganyu casual labour, subsistence farming, and cattle marketing in Malawi: Complementary or competitive labour? Development Southern Africa, 23(4), 465-490.

COUSINS, B. 2019. Contesting customary claims: Complex tenure narratives and the negotiation of social difference in post-apartheid South Africa. Journal of Agrarian Change, 19(4), 716-736.

CRESWELL, J.W. & CRESWELL J.D. 2018. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Fifth Edition. United Kingdom: SAGE Publications.

CROSSMAN, A. 2018. Understanding Purposive Sampling: An Overview of its methods and Applications. Available: https://www.thoughtco.com/purposive-sampling-3026727 (Accessed 28 August 2018).

DARRADI, Y. 2005. Analysis of the perception of the stakeholders. The case of the wetland of Mohlapitse River Watershed, Limpopo Province, South Africa. Memory of graduation for obtaining the title of Engineer of Agricultural Works, School of National Agricultural Engineers Bordeaux, Gradignan, France.

HESSE-BIBER, S.N. & LEAVY, P. 2017. Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches. United States of America: Guilford Press.

JUMA, R.O. 2016. Livelihoods Fieldwork. A practical guide on data-collection methods in pastoral regions in Sub-Saharan Africa. IOSR Journal of Humanities and Social Science (IOSR-JHSS), 21 (12), 39-43.

MASIYANDIMA, M., TAABAZUING, J., & ZWARTEVEEN, M. 2006. Inequality and Water Resource Access in the Limpopo River Basin: The Case of the GaMampa Irrigation Scheme. Research Report No. 16. International Water Management Institute.

MTHOMBENI, D., MACHINGAMBI, L., & OGUNDEJI, A. A. 2017. Water use and productivity in small-scale irrigation schemes: A case study of Steelpoortdrift, South Africa. International Journal of Water Resources Development, 33(2), 272-288.

NETHONONDA, L. O. & ODHIAMBO, J. J. O. 2011. Indigenous soil knowledge relevant to crop production of smallholder farmers at Rambuda Irrigation Scheme, Vhembe District South Africa. African J. Agric. Research, 6(11), 2576-2581.

NGWENYA, B. N., WALE, E., & DLAMINI, N. R. 2013. Smallholder farming systems in the Vhembe district, Limpopo Province, South Africa: Typologies and sustainability implications. African Journal of Agricultural Research, 8(28), 3879-3887

PALINKAS, L.A., HORWITZ, S.M., GREEN, C.A., JENNIFER P. WISDOM, J.P., DUAN, N. & HOAGWOOD, K. 2015. Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. Administration and Policy in Mental Health and Mental Health Services Research, 42 (5): 533–544. Available: https://link.springer.com/article/10.1007%2Fs10488-013-0528-y (Accessed 21 August 2018).

SOUTH AFRICAN WEATHER SERVICE. 2021. Climate of South Africa. Retrieved from http://www.weathersa.co.za/Climatology/Climatology

STATISTICS SOUTH AFRICA. 2018. Living conditions survey 2014/2015. Available: http://www.statssa.gov.za/publications/Report%2003-10-01/Report%2003-10-012015.pdf (Accessed 17 August 2018).

STATISTICS SOUTH AFRICA. 2014. General Household Survey 2014. Pretoria: Statistics South Africa.

TINGUERY, N. 2006. The interface between the local community - based wetland resources management and the formal wetland policies, laws and institutions. Case studies in South Africa and Zambia. Master, Brandeis University.

VAN AVERBEKE, W., DENISON, J. & MNKENI, P. 2011 Smallholder irrigation schemes in South Africa: a review of knowledge generated by the Water Research Commission. Water S.A. 37 (4).

CHAPTER 4

TOWARD SUSTAINABLE LIVELIHOODS THROUGH INDIGENOUS KNOWLEDGE & WATER USE SECURITY: INSIGHTS FROM SMALL-SCALE IRRIGATION SCHEMES IN LIMPOPO PROVINCE1

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Abstract

Water is integral to sustainable rural livelihoods and household food security due to its key role in household use, small-scale and homestead farming. Water security is an emerging concept, gaining increasing attention over the past five years. The World Economic Forum describes water security as "the gossamer" that links together the web of food, energy, climate, economic growth and human security challenges the world economy faces. Livelihoods in rural areas are at risk due to poor access and supply of water and resource limitation and degradation. The role of indigenous and local knowledge in navigating livelihood options was explored through an SLA among three purposefully selected rural female farmer groups was conducted to elicit the role of water in agriculture and rural livelihoods. Complimentary to the SLA, a household water audit was conducted to assess water supply, water availability and associated challenges. Face-to-face interviews were conducted with willing irrigation scheme members. Key informants' interviews were held with officials from district municipalities, extension officers and Departments of Water Affairs. Water Policy Analysis was conducted for pronunciations and impact on water access, governance, organizational structures and institutional arrangements. Content Analysis and SLA were adopted as main data analysis tools. Key findings indicate knowledge gaps on policy and implementation, lack of understanding water management structures. The discourse between the transformation agenda of water reform and rural people's way of life thus eliciting gender tensions among study participants. The complexity of these issues resulted in poor livelihoods for participants who experience poor water access for current and future water use. Competition on the water supply coupled with climate change was also identified with a serious threat due to expanding mining operations in the Limpopo Province. The study concludes that water use management and water policy reform intentions require robust investments in capacity-building of small-scale farmers in rural areas to improve access to water and its management to improve.

Keywords Water security. Rural Livelihood. Sustainable livelihood analysis. Water policy analysis

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4.1 Introduction

In many parts of the world, rural livelihoods are closely linked to agriculture, often performed at a smallholder and subsistence level. Nevertheless, rural food producers are ironically and tragically the most food-insecure demographic group (Windfuhr & Jonsén, 2005). In light of the global food crises and the fact that many people cannot afford adequate food, the present Special Rapporteur on the Right to Food has pressed for attention to the rights and voices of small-scale farmers and to agro-ecological approaches employed particularly by them to achieve food security (De Schutter, 2011).

Most smallholder irrigation schemes are found in the former homelands of South Africa, where the incidence of poverty peaks (May 2000; Aliber, 2003). In these particular socioeconomic environments, smallholder irrigation schemes present an attractive opportunity for the development of local livelihoods. Locally adapted knowledge on what to produce and how to produce is often embedded in farmers being passed from generation to generation (WRC Report, 2012). Indigenous knowledge is often defined as acknowledging associated with a specific location has developed and evolved over time (Scoones & Thompson, 1994).

According to Chambers and Conway (1992) livelihoods consist of four parts, namely, (i) people and their livelihood capabilities; (ii) assets, including both the tangible (resources and stores) and intangible (claims and access), which provide the material and social means that are used to construct livelihoods; (iii) activities, i.e. what people do; and (iv) a living, which refers to the outcomes of what people do. When viewed from this livelihood perspective, smallholder irrigation schemes are assets. They can be used to increase and diversify the livelihood activity of crop production, resulting in improved livelihood outcomes, either directly in the form of food or income for farm holders, or indirectly by providing full or partial livelihoods to people who provide goods and services in support of irrigated agriculture on these schemes. Due to the subsistence nature of many of the producers in such irrigation schemes, indigenous knowledge often having evolved into local knowledge is critical for crop and marketing knowledge of their crops in order to derive a livelihood.

4.2 Women, Water and Livelihoods

It is not always possible for direct beneficiaries from disadvantaged communities to avail themselves of opportunities e.g. water. Rural people and food producers across the urban-rural expanse, especially women, in particular, are a marginalized group and often disconnected and alienated from water, land, tools, skills and knowledge systems that might develop prosperous local food systems and sustainable livelihoods (Lemke et al., 2012). It then becomes even more important to ensure that the available resource, in this case, water, is used to generate sustainable livelihoods in an equitable manner.

Research undertaken by Cullis & Van Koppen (2007), highlights different approaches to evaluating equity. It shows that where there is extreme inequality between men and women in direct access to water (a Gini coefficient of 0.96 to inequality of water use); the situation is less severe when the distribution of livelihood benefits is considered a Gini coefficient of 0.64. The coefficient could be improved further if water were to be made available for smallholder farmers.

This suggests that, in the absence of opportunities for direct "redistribution", should that water be used productively and efficiently to improve as many livelihoods as possible. Such an approach may still go a long way in ensuring that the objectives of water management are achieved.

A more controversial view is that, even if opportunities for direct redistribution exist, and if poverty reduction, job creation and improved livelihoods are the prime objectives of water management policy, equitable direct access to water should be a secondary consideration (Poverty Environment Partnership, 2006). Put simply, this would mean that water is allocated to activities that would generate the maximum number of jobs and income for local people, rather than allocated to disadvantaged users who cannot use the resource as productively (Lenton & Muller, 2009). Furthermore, local understandings of management of water often clash with legalistic management guidelines. Water is generally understood to be a free resource by many rural and less educated subsistence and smallholder farmers where licensing procedures have proven to be not well understood by such users (WRC Report, 2012).

Over 80 per cent of the poorest households in rural areas rely heavily on farming and agricultural labour for livelihoods (IFAD, 2011). Agricultural land is a critical resource in economies where subsistence agriculture is an important livelihood activity (Aliber & Hart, 2009). Most rural women are unemployed, and engage in subsistence agriculture, contributing significantly toward household food production, food security for a better livelihood (Altman et al., 2009; Kerr, 2005; Agarwal, 2003). Rural households engage in land-based strategies of arable farming, livestock husbandry, and consumption and trade in natural resources (Shackleton et al., 2001). These strategies are part of different forms of supplementary food production measures alleged to be employed by approximately 1.3 million South African households on at most 3.3 million ha of rain-fed and irrigated agricultural land (Backeberg & Sanewe, 2010).

This approach would not rule out the use of small volumes of water for household gardens or businesses, which are usually allowed under the general authorisation or Schedule one provisions of the legislation. Nor does it mean that agriculture should always be expected to sacrifice its share of water. While it is a large water user, agriculture can be relatively labour intensive and an important source of employment and livelihoods.

4.3 Mainstreaming Gender in Water Management

Gender equality and access to basic water services are complexly interlinked objectives for both poverty alleviation and sustainable development. In South Africa, research shows that despite the emphasis on mainstreaming gender equality in the water services sector, (and the related policies and structures) a series of institutional arrangements have been put in place to ensure their implementation and enforcement (Office of the Status of Women 1999), the lives of poor women in this sector are not substantively being transformed.

Research conducted by Stimie & Chancellor (1999) in Limpopo Province showed that women contributed 70 to 90% of the total labour in the Agricultural sector, but they were usually not involved in the decision-making on the design and management of irrigation schemes. Women were also the major role-players in small-scale irrigation where they focused on vegetable gardens. The following conclusions were drawn from this study:

- Although women were responsible for most of the labour done on the irrigation schemes, only men were responsible for most of the management and decision-making;
- Women did not have any power and influence because they were generally poor, and power resided with the rich men;
- Women irrigators struggled with pump breakdown and maintenance because they lacked technical skills;
- Extension services and other advisory initiatives did not reach most women farmers because officials who were male did not recognise women as legitimate irrigators;

For water services delivery initiatives to succeed, particularly in rural areas, the role and the status of women in the sector have to give effect to the fact that *water is women's work*. They cook and clean with water, thereby managing the health of their families. When family members become ill, the burden falls on the women whose time is already over-committed, to care for them. If water sources are far from home, it is the girl children who stay away from school to fetch and carry water.

Women, however, use water for more than domestic applications. As stated in Agenda 21, women are the main food producers, playing a crucial, yet underestimated, role in official economic statistics. Women are clearly the main stakeholders in any rural water service delivery initiative.

Furthermore, women have often played an important role in environmental protection and management (UNDP, 2006b:17). Therefore, empowering women to play a leadership role in the water services sector will facilitate environmental sustainability, which is one of the pillars of sustainable development. Putting the efficiency argument aside, however, when the role and status of women in the water services sector are viewed from an ethical perspective, the continued domination and exclusion of women are to be rejected on moral grounds (Warren, 1998:28).

The need for gender equality in the water services sector has found expression in a number of policy directives, institutional initiatives and gender-mainstreaming guidelines. However, research shows that these are not meeting their objectives (Monyai, 2003; Mbumba Development Services, 2004; and Duncker, 1999). These authors show that women are still mostly excluded from the decision-making structures in the rural water services sector and that their local environmental knowledge is not utilised in the protection of water resources.

Furthermore, as discussed by these authors, when looking at the status of gender-mainstreaming in the water services sector through the lens of societal transformation, the view is uninspiring. There has been very little transformative transfer of resources and influence on women in the sector. Moreover, gender-mainstreaming initiatives in particularly the rural areas are stymied by discriminatory cultural attitudes still prevalent among both men and women. Perhaps the most damning comment comes from a consultant with long experience in gender-mainstreaming in the water services sector: "It is difficult to maintain energy when nothing is happening" (Lowe Morna et al., 2004).

4.4 Water Access and Gender

Water is crucial for sustainable development. However, limited access to clean and safe water associated with poor water supply, hygiene and sanitation at the household level and significant

demand for crop cultivation is widening the poverty gap and gender inequalities (Gender and Water Alliance [GWA], 2006). Although the Millennium Development Goals (MDGs) target seven seeks to "halve by 2015 the proportion of people without access to safe drinking water and sanitation" (UNDP, 2005), it is anticipated that Sub-Saharan Africa will only reach the MDGs water target by 2040 (Sutton, 2008). Yet, some 400 million of the people living in Sub-Saharan Africa will be left without access to safe water with the majority of them being women and children living in rural households (Sutton, 2008). Moreover, several empirical studies indicate a gender-skewed bias limiting water access for irrigation in rural areas like Limpopo Province.

According to Mehra & Esim (1998), women were usually poorly represented in Water User Associations (WUAs) because membership was based on ownership of land and water rights. Even the few women that owned land and water feared participation in a male-dominated public gathering and facing men's resistance to women's participation. The devolution of irrigation management to the local level targeted landowners who were typically male household heads as members of the WUA, and they had the responsibility for making decisions on the distribution and management of water resources at the local level. Women were not seen as primary stakeholders but only as indirect ones through the husband's rights (GWA, 2006). Other uses of water by women such as domestic use, watering of cattle and vegetable gardens were usually not taken into consideration. Cultural stereotypes on acceptable behaviour for women in the presence of males restricted active participation of women in public gatherings in Africa and Asia (Zwarteveen & Neupane, 1996)

South Africa is classified as a water scarce country implying that even with the highest feasible efficiency and productivity, the country will not have sufficient water resources to meet its agricultural, domestic, industrial and environmental needs in the year 2025 (Seckler & Amaransinghe, 2000). This could have an adverse effect on livelihoods. Despite the threat to water resources, irrigation water continues to be an important resource in crop production to date.

Limpopo Province is considered semi-arid with a greater portion of the region receiving less than 600 mm of annual rainfall and experiencing high summer temperatures. Despite the harsh limitations imposed by the environment on agricultural productivity, several small-scale farming activities occur throughout the Province. Crops grown include a wide array of field and vegetable crops as well as fruit crops. Several production constraints are encountered in the production fields of the resource-poor farmers in the region, yet most of these farmers have never benefited from any research intervention. Crop yields are marginal and continue to decline in most parts of the region.

4.5 Challenges of Water Use

Competition for water has resulted in the collapse of water-based ecological systems hence declining river flows and large-scale groundwater depletion (UNDP, 2006a). This has led to the potential for conflict within communities and between countries with the rural populations being the most affected and the ones likely to bear the brunt of this scenario (UNDP, 2006a; Anand, 2007). Even though the water crisis is observed as a general problem for the rural population, women bare the greatest burden because of their socially gendered roles, which involve looking for and collecting water for their households (Buckingham, 2000). Women's minority social status, the subservience accorded to their roles in society and their

predominance in domesticated labour in which access to water and its use are crucial (Bhana, 2009; Morojele, 2011). These make women particularly susceptible to most problems associated with the scarcity of water. In addition to other household chores, the participation of women in education, income generating activities as well as in cultural and political engagements are often compromised (Panda, 2007).

4.6 Water Supply in South Africa

South Africa is water scarce, being the 29th driest of 193 countries and having an estimated 1110 m^3 of water per capita in 2005 (Chenoweth, 2008). Moreover, its rainfall varies dramatically from season to season, and the limited available water is distributed unevenly across the country. Because the South African economy and its urban settlements developed largely in response to mining opportunities, much of the demand for water comes from inland areas, far from major rivers or other sources of water.

There is agreeing tendency to consider access to water as a human right (WHO, 2003). This is also translated in the Millennium Development Goals, where one of the targets is to halve population without access to clean water by 2015 (UNDP, 2005). Today, with increasing demand for water from alternate users and prevailing poverty and unemployment in the former homelands and by extension rural areas of South Africa, there is a strong need to increase the efficiency of resource utilisation and productivity in smallholder irrigation farming and households (Hedden-Dunkhort & Mphahlele, 2000; Backeberg, 2006).

The limited water endowment has not prevented society from harnessing the water supply that is available. It is used to support social and economic activities in thriving urban areas, as well as in extensive, water-dependent mining operations. The water resource base also underpins extensive commercial agriculture and sustains an environment sufficiently attractive to generate significant tourism activity (Grey & Sadoff, 2007). Where social needs persist, notably in rural areas but also in poor urban townships, this is more a reflection of poverty, an absence of livelihood opportunities and the lack of organisational resources, than of a shortage of water resources as such. This is not to say, however, that water resources and their management can be ignored and that no challenges exist. As pointed out, water in South Africa is already being used intensively, at 31% of the available water supply (Lenton, & Muller, 2009).

The move to water access as a human right would not benefit women much without a shift in the current dominant constructions of gender, which continue to perceive masculinities and femininities in oppositional terms (Gleick, 2007), and the exaltation of the masculinities above femininities in ways that inculcate inequitable gendered power relations in the rural communities (Connell, 1995). With women normally operating in the lower tiers of the social strata, their challenges in having access to water and its use would only become compounded as they may not have the necessary social capital and other resources to favourably contest for access to water. So, the move for water access as a human right is not complete without the strategies to unravel the existing gendered power relations in ways that affirmatively position women in the status of power, decision-making and access to economic resources requisite for sustainable access to water and its use.

The objectives of this paper are to document the role of water in livelihood security; women's agricultural and livelihoods in smallholder irrigation schemes in Limpopo Province; to assess

challenges in water supply and water availability; identify opportunities for future development using livelihood as a cross-cutting theme. For example, work is done by Dorward et al., (2003), which illustrate an important gap in much of the conceptualisation and application of livelihood approaches. Dorward states that the lack of emphasis on markets and their roles in livelihood development and poverty reduction. If the roles of markets and market relations are not properly addressed in livelihoods analysis and action, it can lead to failure to identify and act on (i) livelihood opportunities and constraints arising from critical market processes and (ii) institutional issues that are important for pro-poor market development.

4.7 Methodology and study site

4.7.1 Study Site

The Limpopo Province is generally characterised as one of the provinces with water security (Schultze, 2010). Rainfall is variable in the Province, ranging from as low as 200mm to 1200mm (ARC, 2010). About 2.3% of the Province receives less than 400mm of rain while only 6% receives more than 800mm (Pieterse, Du Toit, 2009). As a result, there is competition between established users (commercial farmers a total of 2915), mines, municipalities and emerging farmers that historically have had limited or no access to surface water before. The three selected schemes, Mashushu, Steelpoort and Rambuda in this study are fed by two main catchment systems, the Livubu Catchment (Vhemebe) and Olifants Catchment Systems: Tubatse Catchment system is the sub-catchment feeding Mashushu and Steelpoort irrigation Schemes.

4.7.2 Descriptions of Livelihood

Mashushu, Steelpoort Drift and Rambuda irrigation schemes area is part of Lepelle-Nkumpi, Greater Tubatse and Mutale local municipality respectively, and is located in the former homeland area of the Limpopo Province. It is predominantly rural with low population density. The main source of livelihood is small-scale agriculture complemented by social grants and pensions. There is a high rate of outward migration to Gauteng and Western Cape Provinces. Agriculture is a livelihood activity for about 1% of the population, 98.36% of these are African households which derive significant amounts of their food from small-scale agriculture (Ramathoka *et.al,* 2009). Agricultural production is a widespread livelihood activity, mostly; women are involved in crop cultivation as land-based livelihood activity animal husbandry is not the mainland-based livelihood and less time is spent on animal husbandry compared to crop cultivation. More than 80% of the households in the area are poor and vulnerable (Tinguery 2006).

4.7.3 Study Approaches

A Mixed method approach attempts to bring together methods from different paradigms. In a mixed method study, the researcher can conduct a series of semi-structured interviews with a small number of respondents and also carry out a large-scale survey. This kind of integration, of qualitative with quantitative methods, is also referred to sometimes as *multi-strategy* research.

A mixed method approach provides a basis for triangulation but, more often, becomes the source of different ways of conceptualising problems. They might set out to look at the same things from different points of view. For this particular study a mixed method approach included:

- A survey followed by detailed individual interviews with key informants and officials from district municipalities, extension officers and the Department of Water Affairs.
- A household water audit was conducted for pronunciations and impact on water access, governance, organisational structures and institutional arrangements.
- Furthermore, an SLA developed by scholars such as Scoones (1998) was used. A case-study approach was adopted to examine empirically how various selected factors associated with water security issues have enhanced or detracted from the livelihoods of the rural poor who depend on small-scale irrigation schemes.

The Sustainable Livelihoods Framework, as developed by the Department for International Development (DFID, 1999), serves as a theoretical framework and analytical structure to explore the role of water in agriculture and impact on the livelihood of participating women. Sustainable Livelihoods by Chambers & Conway (1992) and as developed further by Scoones (1998), a livelihood "comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintains or enhances its capabilities and assets, while not undermining the natural resource base." At the household and community level, livelihood assets (a combination of physical, natural, financial, social, and human capital) play an essential role for households and individuals in pursuing strategies (livelihood strategies) with the aim of achieving desired goals (livelihood outcomes). Livelihood outcomes in turn impact livelihood assets. National- and provincial-scale institutional and policy structures and processes influence the capability to amass and arrange livelihood assets and livelihood strategies, directly shaping the vulnerability context of individuals and groups. Engaging a sustainable livelihoods research approach, therefore, requires investigating the conditions of access to a full range of resources for insecure populations.

Following livelihoods theory, households draw on 'assets', including natural, social and other 'capitals' and engage in activities, which they combine in a livelihood strategy (Chambers & Conway, 1992). Table 4.1 displays the livelihood assets, identified in the three sites using a transect walk. Rapid rural appraisal (RRA) comprises a group of methods to collect information, if possible, with the participation (and not just the passive response) of those with whom the researcher is interacting (Chambers 1992). The advantage of RRA over other more formal methods such as questionnaires is that it allows wider participation of and dialogue with the community about the study objectives and evolving findings.

For this study, the RRA tool – transect walk – was conducted with small –scale irrigation farmers. The transect walk involves developing an understanding of a village and its associated farming and natural resource use areas through, as far as practicable, walking through the area in a straight line. The transect walk is not passively observational; it allows investigators to talk with and discuss observations with villagers who accompany the researchers on the walk and with people who are encountered along the way (Chambers 1992).

As it was difficult to know the complete study area a guide was used to take a cross section through the study area along the passable roads. This method was used to get a quick picture

of the small-scale irrigation farming communities, socioeconomic condition of farmers, and their livelihoods situation.

4.8 Results and Discussion

The following table summarises the description of livelihood assets in three study sites.

Table 4.1: Livelihood Asset Base of the three Study Sites

Assets	DM Greater Sekhukhune/LM Greater Tubatse (Steelpoort Drift)	DM Capricorn/LM Lepelle-Nkumpi (Mashushu)	DM Vhembe/ LM Mutale (Rambuda)
Natural	• Steelpoort, Rivers • 72 hectares of Land' (Small-scale farming)	• Natural Wetlands • Mothlapitsi River • 42 hectares of Land (Small-scale farming) • Fruit Trees • Wetlands and springs	• Tshala River • 120 hectares of Land (small-scale farming) • Fruit Trees
Physical	• Canals • Communal Boreholes • Rain water tanks • House or brick structure and concrete wall and corrugated iron/ zinc roof • Clinic • Libraries • Community centres • Police station • Grid Electricity • Farming equipment (Axe, Wheelbarrow, hoe, panga) • One or more cell phones at home • Tap water house/plot (not always available) • Pit Toilets, Pit Latrine ventilation (VIP)	• Canals • Water ways • Fence and gate of houses or gardens/ small farms • Hall • Grid Electricity/ Wood and coal • Boreholes • House or brick structure and concrete wall and zinc roof tiles • Hospital and clinics • Farming equipment Axe, Wheelbarrow, hoe, panga • Pit Toilets, Pit Latrine ventilation (VIP)	• Canals • Water ways • Taps (private and communal) • Fence and gate • Hall • Grid Electricity/ Wood and coal • Boreholes • House or brick structure and concrete walls • Clinics • Irrigation schemes • Farming equipment) Axe, Wheelbarrow, hoe, panga) • One or more cell phones at home • Pit Toilets, Pit Latrine ventilation (VIP)
Social	• Health services • Schools (education) • Community centres • Land access • Water committee	• Land access and land tenure • Water committee • Schools (Primary and Secondary) • Church	• Land access and land tenure • Water committee • Schools • Health services • Church

Human	• Labour force (mainly elderly women with low education levels) • Untapped large youth population • Artisan Builders • Limited agricultural training	• Labour force (mainly elderly women with low education levels) • Untapped large youth population • Limited agricultural training	• Labour force (mainly elderly women with low education levels) • Untapped large youth population • Artisan builders • Limited agricultural training
Financial	• Active Mining (some local people are employed in the mines, mainly young men) • Land (privately owned and some under traditional governance) • Roads • Remittances • Grants (old age and child support)	• Main road • Irrigation schemes • Food crops and cash crops • Donkeys • Cattle • Maize crops • Schools • Agriculture • Land (privately owned and some under traditional governance) • Grants (old age pensions, Child support) • Remittances • Trading and shop keeping • Small livestock rearing • Tourism	• Active mining (platinum and Chrome) • Agriculture • Main road (poor condition) • Irrigation schemes • Food crops and Maize cash crops • Donkeys • Cattle • Milling (privately owned and some under traditional governance) • Tourism • Block making • Grants (old age pension, child support, remittance, income from petty trade) • Small livestock rearing • Piece job creation for foreigners from Zimbabwe mainly young man and women

Table 4. 2: Analysis of the asset base for the three study sites

DM Greater Sekhukhune/ Greater Tubaste (Steelpoort)	DM Capricorn/ LM Lepelle-Nkumpi (Mashushu)	DM Vhembe /LM Mutale (Rambuda)
Demographics: • Language: Sepedi • Population: 343 468 • No Household: 66 611 • Average Household (HH) size: 4.76% • The area is made up of 29 wards with 166 villages. • Steelpoort irrigation scheme was established in 1972 with 72 hectares and 69 members situated at Ngwaabe Ga-Malekane village. • Their livelihoods are at the centre of farming on smallholder irrigation schemes to produce various vegetables for household consumption and community at large.	**Demographics:** • Language: Sepedi • Population: 241 414 • No. of Households: 58 485 • Average HH size: 4.1 • Villages: 109 with 29Wards • Their livelihoods are at the centre of farming on smallholder irrigation schemes • Mashshsu irrigation scheme is settled in sandy soil with three long earth main canals from the Mothlapitsi River. The irrigation scheme is divided into three blocks which reach around 42 ha with 45 farmers and was established in 1956. But during the winter season, only 3 to 4 ha are cultivated because of the water requirement issue.	**Demographics:** • Language: Venda • Population: 108 215 • No. of Household: 21 075 • Rambuda Irrigation Scheme was established in 1952 with 120 hectares • Their livelihoods are at the centre of farming on smallholder irrigation schemes
Natural: *Land* • Land ownership was through PTO as the area is under Tribal Authority issued by Kgoshi Malekane. Women used land through ownership, borrowing or sharecropping • In certain areas, the topography is very steep creating mountainous terrain which is unable to have home gardens. This terrain dictates that agricultural activities occur mainly in flat, low lying areas. • Comprises 175 farms, which is indicative of the rural composition of the area *Water*	**Natural:** *Land* • The municipality is predominantly rural with approximately 95% of its land falls under the jurisdiction of Traditional Authorities. • *Water* • The area is generally characterised by water scarcity as a result, there is competition between established water users (commercial farmers, mines, municipalities, parks and reserves, etc.) and emerging farmers who have had limited or no access to surface water before. • CDM has provided water tankers as an interim measure for areas that experience shortage water supply. In trying to address	**Natural:** *Land* • The plots are subdivided into subplots with sizes ranging between 300 and 900 m^2. There are 104 farmers who are farming at Rambuda Irrigation Scheme. The chief is the custodian of the land and allocates plots to families. • The land is very fertile and good for agriculture. A large part of the land falls under the tribal authorities. This makes it difficult for development to take place, as the land tenure system is not favourable to commercial development. • Land ownership was through PTO as the area is under Tribal Authority. Women used land

• There are three main rivers in GTM from which water is collected, Steelpoort River being one of them. The existence and topography of these watercourses present an opportunity to create water storage infrastructure. The construction of a dam in Steelpoort River could have major benefits for agriculture, as well as general development in the region. • The scheme receives water from the dam through the canal to the balancing dam into the canal to the furrows. • The rivers traversing the area are important in that they are natural habitats for a range of fauna and flora species that also sustain the livelihood of both rural and farming. • The protracted drought in the Sekhukhune region has forced the public authorities to speed up the extension of water network or delivery of water through tanks in the rural/peri-urban areas. This demand has been exacerbated by the increasing densification of few settlements where the population is gravitating toward. The recent proliferation of mining activities. • In the rural or peri-urban areas, water is provided mainly through standpipes on the streets. It is therefore not surprising that "17 % of the people obtain their water from natural resources which includes rivers, streams and rainfall, 51.8 % of people obtain water from public taps, 6.8% from a borehole and only 12.3% from an onsite tap" (Integrated Development Plan (IDP), 2009-2013).	the operation and maintenance issues that are affecting the sustainable provision of water supply, local municipalities have been appointed as water service providers (decentralised the function from the district) (IDP, 2012-2012).	through ownership, borrowing or sharecropping. *Water* • Vhembe district is a Water Service Authority municipality and its local municipalities are Water Service Provider: the district provides clean bulk water to the local municipalities. The district purchase bulk raw water from the Department of Water Affairs, then process or clean the water to supply the locals for reticulation. The goal of Vhembe District Municipality Water Service Authority (WSA) is to supply every household with an adequate and reliable water supply and to manage the water supply services in an affordable, equitable and sustainable manner • The District has a relatively limited supply of both the ground and surface water. The area comprised of few catchments areas which are stressed by high demand of water for development activities such as agriculture, human consumption and mining. Water management in the district faces the following challenges: the imbalance between the supply and demand for water • The main source of water is the Tshala River. Water is supplied from a weir into the main concrete canal that supplies water by gravity into the four balancing dams on the irrigation scheme. Water is distributed to specific plots by secondary canals. Short earth furrows are used to irrigate the crops planted on ridges. An irrigation programme is used to allocate irrigation times to each plot holder

		• While it appears that a large percentage of households have access to sources of water, it cannot be confirmed that these households have access "to a secure source of water for human consumption". Many people have to travel a distance to collect water from a public tap. The rural areas mostly make use of fountains and boreholes as their water source as there are, in many cases, difficulties experienced with water supply from farm owners
Physical: • Farms 61 are under the control of tribal leadership • There are 11 medical facilities in the GTM, which mainly constitute regional clinics that provide localised inputs to the community. However, there are three clinics located in Steelpoort, which were previously the responsibility of the National Health Department and hence, these clinics offer improved service to those scattered across the region. Specialist treatment is exclusively available at the major hospitals outside of the municipal area, where sustainable health care is at an optimum • There are 247 schools (primary and secondary) situated in GTM. One Primary school in Steelpoort • Bulks of the units within GTM are found in rural and peri-urban settlements, with brick houses on separate stands or yards • The scheme has good access road as it is situated next to the main road from Burgersfort to Jane-Furse; howeve, there is a problem of transport although some	**Physical:** • To reach the GaMampa valley, 1 hour on the tarred road and 1 hour on an untarred road with 4x4 are necessary to link the capital to the valley. • Mampa Development Centre: the purpose of this centre was to create a place where groups can operate, where farmers can store their equipment, where the meeting can be held.	**Physical:** • Ten Tourism facilities are available in the Mutale Municipality • There are 83 Primary Schools and 27 Secondary schools in the Mutale area, which are predominantly government funded and operated. There is no tertiary facility. Due to the agricultural character of the area, as well as the lack of education facilities in the rural areas, the development of a quality agricultural school for the region should be investigated. The establishment of a tertiary institution should also be investigated and facilitated.

farmers are able to deliver their produce to nearby markets		
Social: • There are Traditional Authorities and their Indunas within the GTM, which play a role in local management. • The rural villages often have some informal sports facilities such as an open soccer field used for community sports. However, these are just open pitches in the communities that do not have the necessary infrastructure to develop sustainable sports and recreation precincts. • School halls often also serve as community halls where local elections, community meetings, etc. are held. • There are currently three municipal libraries in the GTM and these are situated in Ohrigstad, Ga-Mapodile and Burgersfort. Given the literacy levels in the GTM, these facilities are inadequate. There is a need for additional libraries in the area. There is a need for the Provincial department of arts and culture to start providing this service in the rural areas as this will assist in reducing the illiteracy level in the municipality. • Farmers on irrigation schemes are dependent on each other because they share the water distribution system. This interdependence requires a willingness on the side of farmers to work collectively in order to achieve their individual objectives.	**Social:** • There are three villages in the valley under the local authority control lead by the "Headman" one of which is Mashushu (around 15 families). Lots of connections between the villages and the familial history show the deep social relationships in the valley. • Males between 25 to 60 years old usually find work outside the GaMampa valley. Women still stay in the valley to keep the house, the fields and to raise the children. So, the women of the Mampa valley conserve social links. • Farmers on irrigation schemes are dependent on each other because they share the water distribution system. This interdependence requires a willingness on the side of farmers to work collectively in order to achieve their individual objectives.	**Social:** • Social Cohesion is the process through which individuals or groups are included to participate fully in the society they live e.g. Social cohesion allows young people to participate and engage in activities that build their social capital and networks and strengthen the relations that bind people together. Various special programmes are functioning as part of social coherent in the district: People with disability, Children, Gender and Senior citizens programmes • One Library in Mutale Municipality • Farmers on irrigation schemes are dependent on each other because they share the water distribution system. This interdependence requires a willingness on the side of farmers to work collectively in order to achieve their individual objectives.
Human: • The quality of education for the African population has long been poor and	**Human:** • The age of the farmers shows a lack of involvement and seeming disinterest in farming activities by younger people, raising a	**Human:** • The population mainly comprised of 54,4% women and 45, 5% men, with 51,3% of the

insufficient in terms of standard requirements • The majority of people are moving to urban areas, that is, ward 1 (Burgersfort) and 3(Steelpoort). This is simply because these are the areas of employment opportunities (GTM Integrated Waste Management Strategy Plan, 2005) • The expansion of the mining activities in the GTM area presents an opportunity to address unemployment in the area. However, the low skills levels pose a threat in this regard. Education should be geared toward meeting the skills needs of the growing economy as a result of the mining activities • The age group below 18 years forms a larger number of the population, meaning the population is largely young. The male-female ratio is almost equal at the age of between 0 and 17 years. This substantially changes when comparing male-female distribution in the economically active age cohorts, i.e. 19 – 65 year where there are more women. This may suggest that more men seek employment in outside economic centres of Gauteng, Limpopo and Mpumalanga provinces (Steelpoort IDP, 2009-2013), additionally, young people lack interest in agriculture and this poses serious problems in the transfer of skills and knowledge as well as the age of current membership. Therefore, succession planning within the irrigation scheme is needed due to the high number of ageing members.	concern about the sustainability of rural farming-based livelihoods and transfer of knowledge. • The main source of livelihood is small-scale agriculture complemented by social grants and pensions. Maize is the main crop grown under irrigation and in the wetland. It is estimated that 394 households (2758 people) reside in the five villages of GaMampa (Adekola, 2007). More than 80% of the households in the area are poor and vulnerable (Tinguery 2006). It is estimated that over 55% of the economically active population (people between the ages of 15 and 64 years) are unemployed (CDM, 2008).	population being under the age of 20 years (IDP, Date) • There are 83 Primary Schools and 27 Secondary schools in the Mutale area, which are predominantly government funded and operated • There is no tertiary facility. Due to the agricultural character of the area, as well as the lack of education facilities in the rural areas, the development of a quality agricultural school for the region should be investigated. The establishment of a tertiary institution should also be investigated and facilitated. Adult Basic Education and Training (ABET) projects within the municipal area are non-functional, mainly because of budgetary constraints and lack of interest • For irrigation farmers, it could be that they lack management skills or do not have access to certain inputs required on the irrigation projects • Emerging farmers need support from existing commercial farmers and the Department of Agriculture in terms of knowledge and information sharing. The agricultural sector should be made more accessible to emerging farmers • Composting is practised at Rambuda Farm, located at the western side of Tshilamba town. The farm covers an area of 240 hectares. A total number of 105 families are involved in farming at Rambuda farm. Each of these families has 1-4 hectares of the farming area. Some of the farmers use compost to improve the fertility level of the soil, while others make use of

		chemical fertilisers. The farmers have two methods for compost use: - ○ Organic waste is placed in a pit with manure and then cover with soil ○ Organic manure is placed in a pit and covered with the soil. The pits are watered once per week and left for three months.
Financial: • The lack of growth of existing job opportunities as there are more people in the region than present job opportunities. Greater Tubatse has relatively low-skilled labour available in comparison with the urban areas in Limpopo, there is a significant concern of how to achieve sustainable growth to provide for the largely uneducated youth enter the market place. • Strong reliance on mining and agriculture and subsistence farming. • SASSA indicates that a big portion of the State resources is spent in the form of child grant in the Area of Greater Tubatse Municipality especially in areas that are predominantly rural. Many of the beneficiaries are either fostered, old aged, need support one way or the other hence they receive different forms of the grant, issues contributing to high dependency rate on grants range from among others, orphans resulting from HIV/AIDS-related death, child-headed households. • GTM integrated transport plan indicates that there are two modes of public transport found in the GTM area, viz, railway and road transport. The road transport is the common public transport to provide service to the	**Financial:** • The main source of livelihood is small-scale agriculture complemented by social grants and pensions. Maize is the main crop grown under irrigation and in the wetland. It is estimated that 394 households (2758 people) reside in the five villages of GaMampa (Adekola 2007). More than 80% of the households in the area are poor and vulnerable (Tinguery, 2006). It is estimated that over 55% of the economically active population (people between the ages of 15 and 64 years) are unemployed (CDM, 2008).	**Financial:** • According to Community Survey 2007, there are 194 386 people employed in Vhembe District municipality of which 97 036 are female and 97 350 males. 130 549 people are unemployed of which 76 838 are female and 53 711 males. There are 359 144 people who are not economically active: female 205 199 and male 153 945 (Stats S.A., 2007). • Vhembe is located in the remote areas of South Africa thus makes it difficult for the produce of Vhembe to reach the National Markets of South Africa. Nevertheless, when it comes to the SADC markets, Vhembe is strategically located as it is easy for companies to access these markets through the three border gates found in Vhembe. • Department of Labour ensures improved access to employment services in the district. 3300 work seekers have registered annually on employment services database. Annual estimated employment opportunities in the district are 225 but only 50 registered. 50% of the registered work seekers are expected to be placed annually but less than 10% are being placed (Labour dept., 2010). • The provision of social grants is the government's biggest poverty relief programme.

community in remote areas, i.e. buses (Greater North Transport) and mini-taxis.		• Agriculture and tourism are the main sources of rural economic development in Vhembe district; however, there are various challenges that hinder their development: Land tenure system (Communal land rights), Accessibility to business opportunities, Lack of mechanization in agriculture, high input cost etc. • Overall, the roads within the jurisdiction area of the municipality are in a poor condition and in dire need of upgrading from gravel to tar (VDM, 2007).

4.8.1 Livelihoods

Study participants were found to engage in different activities and strategies to make a living. They employed local and indigenous knowledge that shaped activities and strategies they used to employ the use of resources available to them. For example, people require certain skills, time, relationships, tools and materials to be able to grow, find, buy or barter for food, or to collect, buy and store water. They needed a variety of resources to generate a livelihood. Table 4.2 illustrates an in-depth analysis of the assets and resource base for the three study sites.

4.8.1.1 Assets and Activities

The land is the most important natural asset, used to grow food for consumption and sale. Of the three study sites, Steelpoort irrigation scheme grew food in mainly flat and low-lying areas. The general topography is very steep creating mountainous terrain which is unable for home or backyard gardens. Mashushu irrigation scheme is settled on in sandy soil which makes it difficult for farming; as a result, some farmers have grown food along the wetlands that exist in the community. However, for Rambuda Irrigation Scheme plots are subdivided into subplots, the land is fertile and good for agriculture and some of the farmers do have backyard gardens.

Agriculture was often described as critical; its relative importance to livelihoods however, depended on the availability of other income streams. Successful agriculture was dependent on productive land being available, as well as other inputs (labour, technology etc.). Access to water influenced the crops cultivated, where crops were grown, yield, and whether they were grown for consumption or sale. This was evident between the three sites, where Rambuda was more organised, had better crop yields and have access to markets within their community.

In the three study sites, farmers interviewed received pensions and grants. Social security was critical if other income was limited. The income is regular and women often use it for household welfare. In Steelpoort the lack in the growth of existing job opportunities as there are more people in the region than present jobs available. There is a strong reliance on mining and agriculture and subsistence farming. This also indicates that a large portion of state resources are spent on support grants to sustain households and people's livelihoods. The same is true for Mashushu and Rambuda as the main source of livelihood is small-scale agriculture complemented by social grants and pensions.

Formal employment contributed to livelihoods in some households. In the one household sampled only one member out of seven in the family was formally employed. Where formal employment was not available, other activities became important. Households received regular income from self-employment, for example, some farmers in the Rambuda Irrigation Scheme would regularly take their produce to the local markets to sell, additionally, they would use their vehicle to transport learner to school at a stipulated monthly fee for an additional income generation activity (IGA). However, it became clear during interviews that many more people were involved in IGA. Out of 89 adults interviewed, three were formally employed, one was self-employed and some were involved in harvesting crops and selling along the main road. Although IGA is included in the official government definition of employment, most people did not consider their IGA employment, or describe themselves as self-employed, because the income they received was very

low (R<100– 900/month) and was not regular or guaranteed. People engaged in IGA because they had no other income source. Finally, remittances were claimed from relatives living and working elsewhere, and social capital drew on (e.g. sharing meals and collecting water from neighbours' sources).

4.8.1.2 Vulnerability, Institutions and Constraining Factors

The Municipal Structures and Municipal Systems Acts demarcated and gave new powers to municipalities and the WSA responsibilities, in terms of the Water Services Act (RSA, 1997). In former homeland areas, the new system led to TA's losing a great deal of their formal power.

The political and institutional situation sketched, is one characterised by a powerful TA, with tensions between municipal and traditional structures, and confusion over who is responsible for water service delivery. People feel that neither municipal nor traditional institutions assist them adequately, to access water, and draw on community-level support instead. The situation concurs with Nichol & Mtisi's (2003:45) description of institutional complexity in the rural water sector, and findings of other livelihood researchers that people still access productive resources via the chief in former homeland areas (Francis, 2002; Rangan & Gilmartin, 2002).

Livelihoods are affected by a range of factors in these communities and wider environment; those of particular relevance to the study are discussed here. The TA is the most powerful institution influencing daily life; land and other productive resources are accessed via the TA. Access to land and irrigation affects agricultural success, and agriculture underpins many livelihood strategies; thus, the TA has a critical influence over livelihood outcomes. Drought and low rainfall were blamed for poor harvests. Poor water access and frequent water cut-offs were cited as preventing people from engaging in IGA such as block making. However, there are other livelihoods constraining factors, for example, lack of finance and, poor access to technology, transport and markets. Social capital appeared strong; community-level institutions featured prominently in daily life, as did support from relatives and neighbours, perhaps due in part to the lack of support from institutions at higher levels.

Dorward (2003) articulates that, a more imaginative approach is needed, rooted in a stronger understanding of the importance of and nature of institutional development in economic growth, with market development being one part of that institutional development. Institution supporting markets and the other means of exchange and coordination, and to the dynamics of livelihood change and of relations between the livelihoods of different poor and non-poor stakeholders is an important point to development. An analysis of the dynamics of livelihood and economic development and of market access tends to show that many non-farm activities are dependent directly or indirectly on agriculture, and the poor often lack access to higher-return non-farm activities through lack of financial, social and human capital (Reardon et al., 2000). Policies that ignore agricultural growth and that support higher-return non- farm enterprises without addressing the factors constraining the access of the poor to these opportunities may then end up helping the better- off more than the poor (Dorward, 2003).

There was a differentiation in terms of livelihood outcomes for each of the three study sites. There were significant differences between households with access to formal employment and those

without; between households with access to land, irrigated land and those without; It was surprising - in light of the differentiation - that there was a limited range of assets, and the livelihoods activities were remarkably similar. The context was relatively homogenous, but households manipulated it to achieve different outcomes. It has been suggested that households diversify to survive and/or accumulate (Ellis, 1998; Francis, 2002). In Rambuda it was found that some households diversify to survive. If income from formal employment was not available, other assets and activities became important – agriculture, social security, IGA's and social capital. Growing food was critical to the survival of many households. In the context of rising global food prices, growing food is likely to become even more important.

4.9 Water Supply and Water use

The average household size in the village is nine (9) people, though in all district's children were majority household members. This portrayed a direct link with the amount of water use and demand. It was significant that people are likely to take more trips to collect water because they depend entirely on communal sources. However, in all study sites, there is an apparent lack of water storage infrastructure especially dams which are critical for storing water. In Steelpoort, the small dam which feeds the stream faces several challenges. One of the main key findings with regards to water supply and water use in the three sites is that those who participated in the study did not differentiate between water for irrigation (canal water) and water for household purposes in that when people (participants and the rest of the community) experience water shortage for household use, the canals became the main source of water for household consumption.

The main uses of water in households in all three districts are drinking, cooking, and washing clothes, cleaning including personal hygiene and other activities. The average household water use in all three districts is varied. However, this varied per household depending on the household size and priority of water is allocated to. The respondents said, "*It is very difficult to collect water because facilities are few and the distance to the source is long and so the little water collected is used sparingly*". Some respondents who harvested rainwater are saved for drinking. Harvested rainwater from the roof gutter is captured I plastic and metal tanks. Clear competing demands for water use are indicated above, and this points to the earlier point regarding the effects of poverty and lack of basic resources on women in these rural communities. Despite the likelihood of water shortages in the context of these competing but all legitimate demands for use, there is also a matter of hygiene regarding the readiness of the water from the canal for human consumption.

Table 4.3: Sharing of water sources (canal Water)

Site	Do You Share the Water Source (Canal) With Your Household?			Total
	No Responses	Yes &%	No	
Rambuda	1	29 (78%)	7	37
Steelpoort	1	26 (92%)	1	28
Mashushu	3	19 (79%)	2	24
Total	5	74	10	89
Chi-square test 6.844* Statistic, df=4				

Participants in all three sites admitted to this fact and raised a serious issue of water availability for supporting all household activities and agricultural activities which is important for household food security and livelihoods. Households who have home gardens [Rambuda (54%); Mashushu (4.5%)], indicated using water collected for household use and water recycled from the household to irrigate their home gardens. However, Steelpoort, participants did not have home gardens due to the rocky terrain of the area. Water access and availability to alternate water sources were located far away in Mashushu, and this resulted in all the Mashushu irrigation scheme participants in the study facing a great challenge for home gardens. This, in turn, resulted in almost all the study participants in this area with no home garden activity.

Women and children are the main people responsible of looking for and collecting water in these communities, although men sometimes do help their wives when they are sick and or when the nearest water sources in the village are broken down or not functional. This is because they have to go to the other alternative sources which are in most instances far away from the villages and sometimes quite difficult for the women and children to collect the water. The men, however, do not carry water on their heads like the women do but they use wheelbarrows to the nearest villages to collect water for household use.

However, for widowers and those who separated with their wives, children bare the greatest burden. It should be noted that the respondents did not specify if it is only the girls or boys who help, but all the children in the household participate in water collection. The main source of water supply in all districts is communal sources such as taps which is often an irregular supply but communities use alternate sources e.g. canals, rivers and springs. Households collect water from communal sources but also depend on communal ponds which are natural springs which locals in Rambuda refer to as “The Fountain” especially during the dry season. However, such sources are very far away from households and are often dangerous for women and children.

Figure 4. 1: Rambuda Spring “The Fountain”

People also collect water from private sources located at the individual premises which are sometimes shared with neighbours as is the case of Rambuda and Mashushu. Some household has pipes that pump water from the canals to their household as they are close to the water source (+/- 50 meters) from the household, while in Steelpoort some household have JoJo tanks that collect rainwater for household consumption. While in Mashushu some community members have created a funnel system that collects water from the mountain through the pipes to their households.

4.9.1 Seasonality of Water Supply

People also collect water from private sources located at the individual premises which are sometimes shared with neighbours as is the case in Rambuda and Mashushu. Some household has pipes that pump water from the canals to their household as they are close to the water source (+/- 50 meters) from the household, while in Steelpoort some household have JoJo tanks that collect rainwater for household consumption. While in Mafefe some community members have created a funnel system that collects water from the mountain through the pipes to their households.

Mashushu irrigation scheme (Mefefe) along main canals from the Mohlapitse River covering around 42 ha with 45 farmers. The study participants stated, during winter season only 3 to 4 ha are cultivated because of the water shortages in the river and the area. A key informant at Mashushu reported, Mohlapitse River crosses the valley from the north to the South and it runs in a winding riverbed. The annual rainfall fluctuates from 480mm to 875mm. the minimum of monthly rainfall is 0mm during winter and the maximum of monthly rainfall can reach 240mm in January. According to the farmers ", the average number of monthly rainfall events varies from three (3) to six (6) events during the summer season (November to February)". One key informant at Mafefe articulated

"Water supply is a challenge; however, we are mobilizing the scheme member to do things for themselves currently we are getting pipes from a non-functional irrigation scheme. These pipes will be used to increase the flow of water to the fields. These pipes will be installed by locals with the guidance of the Natural Resource Management team. This pipe will be laid down where there is breakage along the canals" he further elaborated, "more water will reach the farmer's field and also assist in less water wastage as well as fixing the broken areas along the canal. There will also be less water evaporation. This will also help to equip locals with skill and knowledge and enable them to develop innovative and appropriate technologies that work for them".

The rainfall for Rambuda ranges from 400mm to 800mm per annum. The high natural water flow (126.99 Mill Cubic Meters/annum, Mutale River) in Rambuda suggest that investment in a dam for storage can be a worthwhile initiative to impact positively on water supply and availability in Rambuda and its surrounding area. During the dry season, those that are close to the "spring fountain" use this water source. These alternate sources are not protected due to the fact that they are located in areas considered to in the "wild" and close to the forest area away from human settlements. People often hare these water sources with animals hence compromising the water quality. Women found at the "spring fountain" source in Rambuda said:

"*We have to send away the animals and have our turn. The water is often very dirty and therefore one has to clean up the source by scoping the dirty water out and wait for the clean water. This takes a lot of time and energy but we have no option.*"

In Steelpoort the rainfall averages a low 440mm per annum with most rainfall during the October-March period. The Steelpoort irrigation Scheme receives water from a small dam that is fed by a small river originating inland. Although natural water flow data is not available on the small river, observations suggest that water can be a great challenge due to the low volumes in the canal as a result of the small river being the main water source. Participants in the Steelpoort Scheme reported water shortages in the area during the winter months. Water availability, access and quality are just a few of the many factors that affect rural livelihoods. While it is clear that water can have a strong influence on crop yields, opportunities for agro-ecosystem diversification, many other distinct roles played by water are not always easy to define, even when these roles are important.

4.10 Weak institutional arrangements and gender

Farmers on the three (3) irrigation schemes are dependent on each other because they share the water distribution system. This interdependence requires a willingness on the side of farmers to work collectively in order to achieve their individual objectives the domains in which farmers on irrigation schemes have to collaborate included the routine maintenance of the water distribution system (Letsoalo and Van Averbeke, 2006), and payment for water where this has been instituted (Backeberg, 2005). On these schemes with reference to canal irrigation, collaborative arrangements governing the distribution of water to the various hydraulic units and individual plots is essential for all farmers to get their fair share (Letsoalo and Van Averbeke, 2006; Van Averbeke, 2008).

Indications are that on their own, these small-scale irrigator farmers and leadership structures, usually in the form of elected scheme committees, find it difficult to enforce rules. Rules to govern collaboration (institutions) and structures to enforce these rules (organisations) are necessary for the effective and sustainable functioning of collective action (Van Averbeke et al., 2011). The institutional and organisational decline has its most profound impact on routine maintenance of the water distribution system, which includes cleaning and minor repairs (Letsoalo and Van Averbeke, 2006). Inadequate routine maintenance reduces water delivery and shortens the life-span of the water distribution system, posing a threat to the sustainability of irrigated farming.

The establishment of the new WUAs for poor Black farmers indicates the top-down approach followed was not aligned with the vision of the NWA which envisaged a user-driven process whereby water users would define the organisational structure based on their needs. The Catchment Management Agency (CMA) was supposed to provide support to WUAs but currently, there was no functional CMAs that could provide guidance to the WUAs and DWAF did not have the capacity to provide the support to fill this institutional gap. The new WUAs were not functional because of a lack of institutional support and there were no support programmes for poor women and men so that they could access resources necessary to participate in the productive use of water. Unlike the transformed irrigation boards, these new WUAs could not be self-sustaining without government funding because of poor resourcing. Ways to support the institutions and organisations of smallholder irrigation scheme communities need to be investigated more thoroughly.

The vision of new WUAs as vehicles for poverty reduction required effective cooperative governance at all levels of the government system but this was currently not in place. The lack of formal structures for collaboration and coordination of relevant national government departments at the local level and through the vertical spheres of government – local, regional, provincial and national – in the support for the poor Black farmers continued to perpetuate the marginalization of the poor rural men and women. There were also no clear processes to ensure accountability of government officials.

The gender policies were not supported with strategies and guidelines for mainstreaming gender in water management institutions. There were no special budgets allocated to the support of the meaningful participation of women in management structures of WUAs. No special capacity-building and training programmes were initiated to prepare women for their new leadership roles. The lack of an enabling environment for the empowerment of women could raise a question on the government's commitment to gender equality.

4.11 Organisational Arrangements Affecting Smallholder Irrigation in Limpopo Province

The Provincial Department of Agriculture was the only organisation involved in one way or the other in the provision of services to smallholder farmers in the irrigation schemes under study. These are described below:

The Provincial Department of Agriculture

The Provincial Department of Agriculture is one of the key role-players in smallholder irrigation in Limpopo Province and provided the following services:

- The creation and maintenance of irrigation infrastructure;
- Agricultural extension services;
- Mechanization services;
- Irrigation water; and
- Development of cooperatives and appointment of managers to run the cooperatives;

Local Authorities

Local authorities play a critical role in the project area through land administration and allocation. The chiefs themselves are also involved in farming and may, therefore, monopolize irrigation water use. New projects or agricultural matters in the project area cannot be initiated without consultation with the local authority.

Irrigation Committees

Irrigation committees were established in all the schemes. Each committee consists of seven to 10 elected members. The committee is responsible for the allocation of water to individual plots, supervision of canal maintenance and water schedule. They also play a key role in the planning of agricultural activities in the schemes.

4.12 Conclusions and Recommendations

The study set to contextualise dynamics of water access and use within the three study sites of rural Limpopo Province, Rambuda, Mashushu and Steelpoort and how knowledge was utilised to derive livelihoods. The study found that assets were employed to derive livelihoods and that knowledge on agricultural production, water management and marketing strategies determined their livelihood outcomes in the irrigation schemes. The study further found that the escalating cost of water and increasing competition over water use is posing a major challenge facing smallholder farm owners in the study regions. Water is necessary for survival, health and wellbeing. Access to sufficient water to meet basic needs has been identified as a critical development issue and a human right and sustains livelihoods (UNDP, 2006a). Furthermore, the study indicated that women are in the majority in irrigated agriculture who have been historically disadvantaged and may continue to be marginalized by culture and the impact of past regimes of apartheid. Women access to water use has been found to lack sustainability as the majority of water supply had diminished, thereby relegating women to the mentality to farm for subsistence as opposed to farming for commercial purposes. The impact of water access goes far beyond basic needs. Water is an asset and input into myriad livelihood activities. While there is a general recognition that water plays an important role in improving the livelihoods of poor rural people, there is a need to distribute the benefits of water equitably to both men and women in rural societies. Gender dynamics in these communities; mainly relegate women to subservience increasing the likelihood that the majority of farming activities by women were mostly done for purposes of sustenance of the household.

Seasonality of water supply and availability which denoted periods during the year example of winter, when water was scarce due to limited rainfall. Lack of storage infrastructure such as dams affected water access for agricultural purposes. Volumetric water supply was found to be generally low in these communities and this together with poverty which required women farmers to produce for household consumption and collect whatever meagre amount of money they could on a daily basis, discouraged women to have ambitions for large-scale farming. The study found that without attempts to address the scarcity of water supply and to ensure that women are empowered to compete favourably in their pursuits to water access the prospect for large commercial farming in these communities remain far-fetched.

The level of interplay and cooperation between the local and external institutions between the local and external institutional organisations with regard to water use, access and management were found to be limited to the occasional presence of extension officers. Absence and lack of government support related to water was a concern by participants in all sites. Participants from the irrigation scheme perceived lack of interaction was related predominantly to undermining knowledge they would gain in terms of water scheduling management. Although local communities develop their own ways of managing water use, limited roles of state agencies meant critical aspects of water use and management that extended beyond local communities' capacities could not be addressed. Weak support services are a recurrent theme in most smallholder irrigation schemes.

The complexity of these issues resulted in poor livelihoods for participants who experienced poor water access for current and future water use. Competition on the water supply coupled with climate change was also identified and a serious threat due to expanding mining operations in

Limpopo. The study concludes that water use management and water policy reform intentions require serious investments in capacity-building of small farmers in rural areas in order for access to water and its management to improve the livelihoods of small-scale irrigator farmers.

REFERENCES

AGARWAL B. (2003). Gender and Land Rights Revisited: Exploring New Prospects via the State, Family and Market. Journal of Agrarian Change, 3 (1-2): 184-224.

ALIBER M. (2003). Chronic poverty in South Africa: incidence, causes and policies. World Development, 31 (3): 473-490.

ALIBER M. AND HART T. (2009). Should subsistence agriculture be supported as a strategy to support rural food insecurity? Agrekon, 48 (4): 434-458.

ALTMAN, M., HART, T.G.B. AND JACOBS, P. T. (2009). Household food security status in South Africa. Agrekon, 48(4): 345–361.

ANAND P.B. (2007). Rights to water and access: an assessment. Journal of International Development, 19 (4): 511-526.

ANAND P.B. (2007). Scarcity, entitlements and the economics of water in developing countries. Cheltenham: Edward Elgar Publishers.

BACKEBERG, G. R. (2005). Water institutional reforms in South Africa. Water Policy, 7: 21–34.

BACKEBERG, G.R. (2006). Reform of user charges, market pricing and management of water: problems of opportunity for irrigated agriculture. Irrigation and Drainage, 55: 1-12.

BACKEBERG, G.R. AND SANEWE, A. (2010). Toward Productive Water use and Household Food Security in South Africa. Available at: http://www.rid.go.th/thaicid/_6_activity/Technical-Session/SubTheme2/2.08-Gerhard_RB-Andrew_JS.pdf Accessed on 10 October 2012.

BHANA, D. (2009). "Boy will be boys" What do early childhood teachers have to do with it? Educational Review, 61:327-339.

BUCKINGHAM, S. (2000). Gender and Environment London & New York: Routledge Publishers.

CHAMBERS, R. AND CONWAY G.R. (1992). Sustainable Rural Livelihoods: Practical Concepts for the 21st Century (IDS Discussion Paper 296). Brighton, U.K.: Institute of Development Studies. Available at: http://www.ids.ac.uk/go/idspublication/sustainable-rural-livelihoods-practical-conceptsfor-the-21st-century Accessed on 11 August 2012.

CHAMBERS, R. (1992). Rural Appraisal: Rapid, relaxed and participatory. IDS Discussion Paper 311. Brighton.

CHENOWETH, J. (2008). A reassessment of indicators of national water scarcity. Water International, 33 (1): 5–18.

CONNELL R.W. (1995). Masculinities. University of California Press, Berkeley, California.

CULLIS, J. AND VAN KOPPEN, B. (2007). Applying the Gini coefficient to measure inequality of water use in the Olifants River Water Management Area, South Africa. International Water Management Institute (IWMI) Colombo, Sri Lanka: Report 113: 1-17.

DE SCHUTTER, O. (2011). Agroecology and the right to food. Report presented by the Special Rapporteur on the Right to Food at the 16th Session of the United Nations Human Rights Council, [A/HRC/16/49]. Available at: http://www.srfood.org/images/stories/pdf/officialreports/20110308_a-hrc-16-49_agroecology_en.pdf Accessed on 13 July 2012.

DFID. 1999. Sustainable Livelihoods Guidance Sheets. London: DFID. Available at http://www.polity.org.za/polity/govdocs/white_papers/landwp.html Accessed on 10 October 2012.

DORWARD, A. (2001)'Pro-Poor Livelihoods: Addressing the Market/Private Sector Gap'. Paper presented at Sustainable Livelihoods Seminar on Private Sector and Enterprise Development Crown Plaza Hotel, Manchester

DUNCKER, L. (1999). Strategies for the Empowerment of Women in Water Supply and Sanitation Projects. Pretoria: Water Research Commission. Report 817/1/99: 1-58.

FRANCIS, E. (2002), 'Rural Livelihoods, Institutions and Vulnerability in North West Province, South Africa. Journal of Southern African Studies, 28 (3): 531-550.

GLEICK, P. (2007). The human right to water. Available at http://www.pacinst.org/reports/human_ right_may_07.pdf. Accessed on: 6 Dec 2012.

GREY, D. AND SADOFF, C.W. (2007). Sink or swim: Water security for growth and development. Water Policy, 9: 545-571.

GTM IDP (2009-2013). The Greater Tubatse Municipality Integrated Development Plan 2009-2013. Available at: http://www.tubatse.gov.za/docs/idp/GTM%20IDP%202009%202010.pdf Accessed on 11 November 2012.

GWA (2006) Resource Guide – Mainstreaming gender in water management. Available at: http://www.genderandwater.org Accessed on 18 August 2012.

GWA, (2006). Gender, Water and Poverty. Available at: http://www.genderandwater.org Accessed on: 18 August 2012.

HEDDEN-DUNKHORT, B. AND MPHAHLELE, R.E. (2000). Where to go? A socioeconomic analysis of smallholder irrigation farming in South Africa's Northern Province.

Proceedings of the 6th International Micro-Irrigation Congress on Micro-irrigation technology for Developing Agriculture. South Africa: 22-27 October 2000.

IFAD (2011). Facts and Figures: Rural Poverty Report 2011. Available at: www.ifad.org/rpr2011 Accessed on: 15 September 2012.

KERR, R.B. (2005). Food security in Northern Malawi: Gender, kinship relations and entitlements. Journal of Southern African Studies, 31 (1): 53–74.

LENTON, R. AND MULLER, M. (2009). Integrated water resource management in practice: Better water management for development. London: Earthscan Publishers.

LETSOALO, S.S. AND VAN AVERBEKE, W. (2006) Water management on a smallholder canal irrigation scheme in South Africa. In: Perret, S., Farolf, S and Hassan, R. (eds.) Water Governance for Sustainable Development: Approaches and Lessons from Developing and Transitional Countries. London: Earthscan Publishers.

LOWE MORNA, C. (2006). Mainstreaming gender in the water and sanitation sector: Literature review for the South African DWAF, under the banner of Genderlinks. Available at: www.genderlinks.org.za Accessed on: 15 September 2012.

MAY, J. (2000). The structure and composition of rural poverty and livelihoods in South Africa. In: Cousins, B. (ed.) At the crossroads: Land and agrarian reform in South Africa into the 21st century. Plass: 21-34.

MBUMBA DEVELOPMENT SERVICES. (2004). Preliminary Research Report for the Water Research Commission and the DWAF on Gender-Mainstreaming in the Water Sector: Situational Analysis. Pretoria: Report TT 407/09: 8

MEHRA, R. AND ESIM, S. (1998). What Gender Analysis Can Contribute to Irrigation Research and Practice in Developing Countries: Some Issues. In Merrey, D and Baviskar, S. (eds.). Gender Analysis and Reform of Irrigation Management: Concepts, Cases and Gaps in Knowledge. Colombo: IWMI.

MONYAI, P.B. (2003). The Gender Dimension of the Water Policy and its Impact on Water and Sanitation Provision and Management in the Eastern Cape: The Case of the Peddie District. Pretoria: Water Research Commission. Report 1021/1/03.

MOROJELE, P. (2011). What does it mean to be a boy? Implications for boys' and girls' schooling experiences in Lesotho rural school. Gender and Education, 23: 677-693.

NICHOL, A. AND MTSISI, S. (2003). Politics and Water Policy: A Southern African Example. Institute for Development Studies Bulletin, 34 (3): 41-53.

OSW (Office on the Status of Women). (1999). South Africa's National Policy Framework for Women's Empowerment and Gender Equality. Pretoria: The South African Presidency (National Policy Gender Framework) 1-64.

PANDA, S.M. (2007). Mainstreaming gender in water management: A critical view, Gender, technology and development 11; 321. Available at: http://gtb.sage pub.com/cgi/content/refs/11/3/321. Accessed on: July 2012.

POVERTY ENVIRONMENT PARTNERSHIP, (2006). Linking poverty reduction and water management. A joint product of staff from the Stockholm Environment Institute (SEI) and the United Nations Development Programme (UNDP), prepared on behalf of the Poverty Environment Partnership. Norway and Sweden: 1-75.

RANGAN, H. AND GILMARTIN, M. (2002). Gender, Traditional Authority, and the Politics of Rural Reform in South Africa. Development and Change, 33 (4): 633-658.

SCHULTZE, R.E. (2010). Atlas of Climate Change and the South African Agricultural Sector: A 2010 Perspective. DAFF, Pretoria South Africa: 391.

SCOONES, I. (1998). Sustainable rural livelihoods: A framework for analysis. Working Paper No. 72, Institute for Development Studies, Brighton. Available at: https://www.ikipedia.net/images/a/a5/Scoones_1998_Sustainable_Rural_Livelihoods.pdf Accessed on: 12 July 2012.

SCOONES, I. AND THOMPSON, J. (1994). Beyond farmer first: Rural people's Knowledge, agricultural research and extension practice. London: Intermediate Technology Publication.

SECKLER, D. AND AMARANSINGHE, U. (2000) Water Supply and Demand, 1995 to 2025. IWMI. Colombo, Sri Lanka. Available at: http://publications.iwmi.org/pdf/H026790.pdf Accessed on: 12 November 2012.

SHACKLETON, S., SHACKLETON, C. AND COUSINS, B. (2000). Revaluing the communal lands of Southern Africa: New understandings of rural livelihoods. Natural Resource Perspectives, 62, 1–4. Available at: http://www.odi.org.uk/resources/docs/2833.pdf Accessed on: 12 July 2012.

STIMIE, C. AND CHANCELLORM, F. (1999). Smallholder irrigation – South African women's part in rehabilitation and design of irrigation projects, GRID Issue 13, February 1999. In Schreiner, B. and Hassan, R. (eds) Transforming Water Management in South Africa: Designing and implementing a New Policy Framework. London: Springer Publishers.

SUTTON, S. (2008). The risks of technology-based MDG indicator for rural water supply. Available at: www.rwsn.ch Accessed on: 12 July 2012

TINGUERY, N. (2006). The interface between the local community - based wetland resources management and the formal wetland policies, laws and institutions. Case studies in South Africa and Zambia. Masters Dissertation, Brandeis University, Zambia.

UNITED NATIONS DEVELOPMENT PROGRAM (2005). UN Millennium Development Goals. Overview. New York: UNDP.

UNITED NATIONS DEVELOPMENT PROGRAM (2006a). Human Development Report 2006. Beyond Scarcity: Power, poverty and the global water crisis. United Nations Development Programme, New York, USA. Available at: http://dspace.cigilibrary.org/jspui/bitstream/123456789/20135/1/Human%20Development%20Report%202006%20Beyond%20Scarcity%20Power%20poverty%20and%20the%20global%20water%20crisis.pdf?1 Accessed on: 23 August 2012.

UNITED NATIONS DEVELOPMENT PROGRAM (2006b) Resource Guide: Mainstreaming Gender in Water Management. Produced by the Energy and Environment Group of the UNDP and the Gender and Water Alliance, Available at: www.groundwater.org. Accessed on: 11 September 2012.

VHEMBE, IDP. (2012). Vhembe District Municipality 2011/2012 Integrated Development Plan Review. Available at: http://www.vhembe.gov.za/docs/idp/IDP_201213_201617.pdf Accessed on: 11 September 2012.

VAN AVERBEKE, W. (2008) Best Management Practices for Sustainable Subsistence Farming on Selected Irrigation Schemes and Surrounding Areas through Participatory Adaptive Research in Limpopo Province. Pretoria South Africa: Water Research Commission Report TT 344/08: 318.

VAN AVERBEKE, W., DENISON, J. AND MNKENI, P.N.S. (2011). SIS in South Africa: A review of knowledge generated by the Water Research Commission. Water S.A., 37 (5): 797-808.

WARREN, K. J. (1998). 'The Power and Promise of Ecological Feminism'. In Eugene, C Hargrove (eds), The Environmental Ethics. Washington: Wadsworth Publishing, 125-146.

WEIR, S. AND KNIGHT, J. (2000). Education Externalities in Rural Ethiopia: Evidence from Average and Stochastic Frontier Production Functions, Working Paper Series 2000-4, Oxford: Centre for the Study of African Economies.

WHO. (2003). The right to water. Health and Human rights publication Series No. 3. France: World Health Organisation. Available at: http://www.who.int/water_sanitation_health/en/righttowater.pdf Accessed on: 12 November 2012.

WINDFUHR, M AND JONSÉN, J. (2005). Food Sovereignty: Toward democracy in localised food systems. The Schumacher Centre for Technology and Development, Bourton Hall.

Available at: http://www.nyeleni.org/IMG/pdf/foodsovereignty_itdg_fian_print.pdf Accessed on 12 November 2012

ZWARTVEEN, M AND NEUPANE, N. (1996). Free riders or victims: women's non-participation in irrigation management in Nepal's Chattis Mauja irrigation scheme. IWMI Colombo Sri Lanka. Report.7: 1-21.

CHAPTER 5

Analysis of household food security status of small-scale irrigation scheme women farmers in Limpopo: implications for livelihoods

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Abstract

The paper examines household food security status of small-scale irrigation scheme women farmers in Limpopo Province, South Africa. The study used a mixed-method approach to determine the household food security status of 96 households using the Household Dietary Diversity Score (HDDS) and analyzed the determinants of household food security status using a logistic regression model. The study found that about one-third of the farming households sampled were food insecure, and the logistic regression model showed that gender, age, education, income, and males above 18 years of age positively influence household food security status. The study concludes that there is a need to create an enabling environment for small-scale irrigation scheme women farmers and that government policies and strategies must be reviewed to address and enhance food security. Additionally, agricultural stakeholders should invest in education and support households, especially women, who are key role players in dietary diversity and are responsible for nutrition. Lastly, small-scale irrigation scheme women farmers should be given priority for government initiatives that will support households.

Keywords: Household food security; smallholder irrigation farmers; rural livelihoods

5.1. Background and contextualisation

Achieving food security for small-scale irrigation farmers, particularly among women and the rural populace, presents formidable challenges. These challenges stem from various factors, including low per capita staple crop production, seasonal fluctuations, water availability and management, institutional frameworks, and price volatility (Mthethwa & Wale, 2021; Nephawe et al., 2021). The concept of food security, encompassing dimensions such as availability, accessibility, utilization, stability, and agency, remains a dynamic phenomenon. It is noteworthy that food insecurity is pervasive among smallholder farming households globally, with research underlining its acute and chronic nature. Studies conducted in Nigeria (Otekunrin et al., 2021) and Afghanistan (Samim et al., 2021) reveal elevated levels of food insecurity among smallholder

farming households, indicating significant hurdles in accessing adequate and affordable food supplies. Additionally, investigations by Akudugu, Guo, & Dadzie (2019) shed light on the challenges confronting rural populations in adopting small-scale irrigation technologies, offering insights into the barriers and opportunities for bolstering food security in rural settings.

In Africa, hunger and food insecurity stand as critical issues for smallholder farming households, who constitute over 80% of the world's food-insecure smallholder farmers (Ogunyemi et al., 2022; Samberg et al., 2016). These farmers heavily rely on land and water for sustenance and livelihood (Samberg et al., 2016). Notably, approximately 78% of the global poor reside in rural areas, with many depending on agriculture for income and sustenance (World Bank, 2021). Moreover, the escalation in global food prices and climate variability has spurred increased land allocation for biofuel production, further imperilling food security (Kwaw-Nimeson & Tian, 2021). Concurrently, prevailing water shortages compound the challenges faced by food security (Omar & Aly, 2021).

In South Africa, the right to food is enshrined as a fundamental and constitutional right, with the government committed to alleviating poverty and ensuring household food security. However, despite national food security, significant challenges persist at the household level, particularly in informal settlements and rural areas (Ijatuyi et al., 2018; Ngema et al., 2018). Studies illustrate that household food security remains a pressing issue in South Africa, exacerbated by factors such as agricultural decline, dependence on purchased food, and income disparities (Chakona & Shackleton, 2018; Santeramo & Phali, 2023; Mbajiorgu, 2019). While the country attains sufficient food production at the national level, securing food at the household level remains a critical concern (Ijatuyi et al., 2018). Moreover, the looming threat of climate change on food security necessitates proactive measures to address current challenges and future uncertainties (Masipa, 2017). The National Development Plan (NDP) 2030 outlines strategies to enhance food and nutrition security while tackling poverty and inequality (Hendriks, 2013). However, the absence of food security legislation in South Africa poses enforcement challenges to the right to food (Hendriks & Olivier, 2015). Food security remains elusive for small-scale irrigation farmers, especially women and rural populations, due to various challenges such as low staple crop production, water availability issues, and institutional barriers. While studies have highlighted the challenges faced by rural populations in adopting small-scale irrigation technologies, there is a lack of comprehensive understanding regarding the specific barriers hindering food security in these communities, particularly in the context of gender disparities and institutional constraints. Further research is needed to identify these barriers and explore potential solutions to enhance food security in rural settings.

In addressing food security in South Africa, it is imperative to acknowledge the multifaceted determinants influencing household food security, with income playing a pivotal role in ensuring access to adequate nutrition. Numerous studies underscore income's significance as a primary determinant of household food security, particularly in rural settings. Pienaar and Traub (2015) highlight income's importance, especially among South African Black rural households, where alternative income sources like social grants, wages, and remittances are vital. Furthermore,

while farming contributes to household income, it typically constitutes a minor proportion, emphasizing the diversification of income sources among rural households (Odoh et al., 2019). Income diversification, prevalent across various regions including Nigeria, Ethiopia, Bangladesh, and Ghana, has been associated with improved welfare for farming households (Danso-Abbeam et al., 2020).

Additionally, social grants play a significant role in augmenting household income and welfare, particularly in mitigating income and wealth inequality, as evidenced by the Gini coefficient. The prominence of income sources, notably among female-headed households, underscores the importance of addressing impediments to gender equity to enhance household food security and livelihoods (Baiphethi & Jacobs, 2009; Nedombeloni & Oyekale, 2015).

The issue of food insecurity in South Africa is particularly pronounced in densely populated provinces such as Limpopo, KwaZulu-Natal, Eastern Cape, and Free State (De Cock, 2013). Research findings indicate severe food insecurity among households in Limpopo, underscoring the gravity of the situation in this region (De Cock et al., 2013). According to Stats SA (2021), despite a significant number of households reporting sufficient food access, a sizable portion still faces varying degrees of food insecurity, largely attributed to poverty. Furthermore, food insecurity's ramifications extend beyond economic implications, impacting health outcomes, particularly among vulnerable demographics (Koyanagi et al., 2019).

To mitigate food insecurity, leveraging agriculture and smallholder farming is crucial. Subsistence farming's contribution to food security in South Africa has been extensively studied, emphasizing the role of sustainable agricultural practices such as in-field rainwater harvesting (Dlamini et al., 2023). Moreover, addressing food insecurity necessitates considering its intersection with social, economic, and environmental factors, including climate change and technological innovations in agriculture (Moralles et al., 2021; Toit et al., 2023).

Agriculture not only bolsters food supply but also offers economic opportunities, especially for marginalized communities. However, women continue to face numerous challenges in farming, necessitating efforts to address gender disparities. Furthermore, improving household water security is pivotal for enhancing food production, particularly through irrigation, which mitigates the adverse effects of water scarcity on crop growth (van Averbeke et al., 2011).

Achieving food security for small-scale irrigation farmers, especially among women and rural populations, demands a comprehensive approach addressing multifaceted challenges. By addressing income disparities, promoting sustainable agricultural practices, and ensuring equitable access to resources, stakeholders can work towards alleviating food insecurity and fostering resilient food systems

5.2. Small-Scale Irrigated farming and Food Security

Small-scale irrigated farming plays a crucial role in enhancing food security and alleviating poverty in various regions including South Africa. The adoption of small-scale irrigation farming has been recommended as a climate-smart agriculture practice with the potential to increase agricultural production and household income (Mango et al., 2018; Mume, 2021). Studies have

shown that small-scale irrigation can significantly affect household poverty, livelihoods, and food security (Bacha et al., 2011; Zeweld et al., 2015). For example, the adoption of small-scale irrigation has been associated with increased agricultural productivity, reduced poverty, and decreased dependence on erratic rainfall (Iticha, 2019). Furthermore, small-scale irrigated agriculture has been identified as a means of mitigating climate change and variability, thereby contributing to sustainable livelihoods (Mume, 2021).

In South Africa, where food security is a significant concern, small-scale irrigation farming can play a vital role in addressing household food security (Sekhampu, 2013). The government and relevant stakeholders can leverage the findings of studies on small-scale irrigation farming to formulate policies aimed at enhancing food security and agricultural productivity in the country (Mango et al., 2018; "Review on the Impact of Small-Scale Irrigation Scheme on Household Income and Poverty Reduction in Ethiopia Review on the Impact of Small-Scale Irrigation Scheme on Household Income and Poverty Reduction in Ethiopia", 2019). Additionally, the adoption of sustainable small-scale irrigation farming has been recommended as a climate-smart agricultural practice, particularly in regions such as the Chinyanja Triangle in Southern Africa (Mango et al., 2018).

Small-scale irrigation farming has the potential to contribute to poverty alleviation, increased household income, and enhanced food security. Therefore, policymakers and agricultural authorities in South Africa must consider the promotion and support of small-scale irrigation initiatives as part of broader efforts to ensure food security and sustainable agricultural development.

5.3. Theoretical Framework: Sustainable Livelihoods Approach

This study aims to estimate the current household food security status among smallholder irrigation female farmers in Limpopo Province, underpinned by the theoretical framework of the sustainable livelihood approach (SLA). This framework provides a comprehensive and structured perspective that helps understand the complex factors that influence poverty and food insecurity among smallholder farmers in the specific context of Limpopo Province.

SLA emphasizes the importance of understanding the basis of people's livelihood strategies, which aligns closely with the objectives of the study. It recognizes that households adapt to their physical, social, economic, and political environments by utilizing various assets (DFID 2000). In the context of this study, these assets could include land, water resources, market access, and social networks. By examining how these assets are utilized, this study can gain insights into how smallholder irrigation female farmers secure their livelihoods and, by extension, their food security.

Furthermore, SLA highlights the interplay between internal and external influences on households and their livelihoods. This aspect of the framework is critical for assessing the rationality of smallholder farmers' choices and their ability to overcome structural challenges related to poverty and food insecurity. By considering both internal factors (such as resource availability and household strategies) and external factors (such as policy interventions and

economic conditions), this study provides a comprehensive analysis of the context in which food security is achieved or compromised (Sileshi et al., 2019).

Household resilience is a central concept within SLA and directly relates to the study's aim of estimating food security status. The framework defines household resilience as the capacity to react to threats without negatively affecting potential well-being (DFID, 2000). This concept allows the study to explore how resilient smallholder irrigation female farmers face food insecurity challenges. It can investigate which assets contribute to resilience and how these assets are managed to mitigate food security risks (Ncube, 2015).

The ownership of livelihood resources is another key element emphasized by the SLA. This suggests that improving ownership of these resources increases the probability of sustaining livelihoods (DFID, 2000). In the study's context, examining land tenure, access to irrigation infrastructure, and ownership of productive assets can provide valuable insights into the relationship between resource ownership and food security outcomes among smallholder farmers.

SLA's focus on income generation and asset accumulation aligns with the goals of this study. It allows the investigation of how income-generating activities and the accumulation of assets, such as savings or agricultural equipment, relate to food security outcomes among smallholder irrigation female farmers in Limpopo Province.

Moreover, the framework's emphasis on reducing rural asset insecurity is crucial for enhancing food security and livelihoods in rural communities. By considering the challenges related to asset insecurity, such as land tenure insecurity or vulnerability to external shocks, this study identifies potential interventions and strategies to improve food security among this vulnerable population.

Finally, SLA's capacity to contextualize poverty and inequality within South Africa is valuable for this study. Given South Africa's significant income inequality (Thamaga-Chitja & Morojele, 2014; Statistics South Africa, 2012), the framework provides a lens through which to analyse how poverty and inequality within the region influence the food security status of smallholder irrigation women farmers. It allows for a deeper understanding of the unique challenges and opportunities faced by this group in a complex socioeconomic landscape.

5.4. Materials and Methods

5.4.1. Study Area

By mid-2011, the province of Limpopo had approximately 5.55 million people or approximately 10% of the population of South Africa (Rankoana, 2018). Almost nine out of ten people live in rural areas, and almost half are younger than 15 years of age. In Limpopo Province, the population increased by 3.9% per year on average in the country as a whole (Kyei & Ramuya, 2021). The province occupies an area of 12.46 million hectares, representing 10.2% of the Republic of South Africa's total land area (Braack et al., 2020). The province is rich in agricultural resources, and an important agricultural area is known to produce various crops, including fruits and vegetables, cereals, and tea (Kephe et al., 2022). The province has three distinct climatic zones.

Three irrigation schemes were investigated in the rural province of Limpopo, northern South Africa. The Province has 60% of its land in private hands and 25% in traditional government (Limpopo Provincial Government, 2009). The Limpopo Province is the least heavily populated in South Africa, and it comprises 96% of the country's African population, most of whom are subsistent farmers (Kephe et al., 2022). They are high out-migrants from the Limpopo Province to other South African provinces. The Mashushu, Steelpoort Drift, and Rambuda populations were chosen from three separate agricultural regions. As racial segregation meant restrictions on housing and living space, agricultural land was limited to a set number of hectares (Tapela, 2008). Mashushu was established in 1959, with 42 ha under irrigation agriculture, Steelpoort in 1972, and Rambuda in 1952.

The following section details the methods used in this study to assess the existing household food security status of small-scale irrigation scheme female farmers. This study describes the status of household food security among small-scale irrigation farmers in Limpopo Province and highlights the challenges they face.

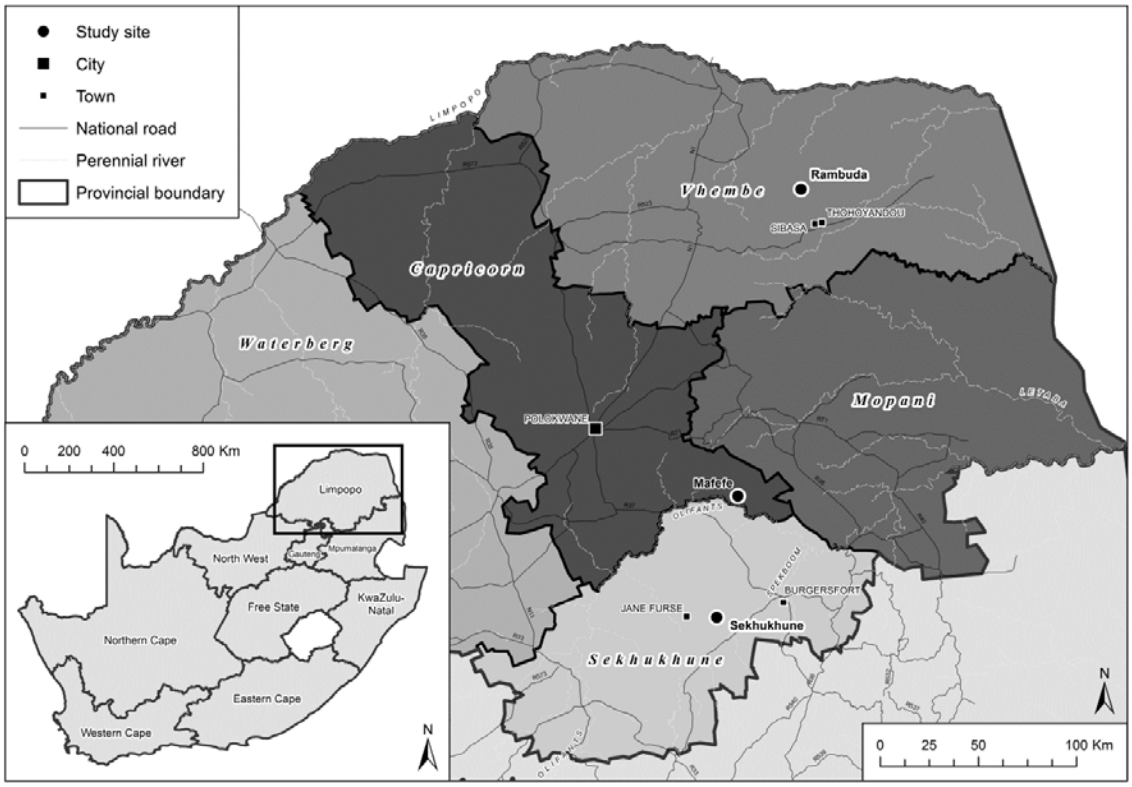

Figure 2: Map of Limpopo Province indicating the study areas.
Source: Author production, 2023

5.4.2. Research Design

This research employs a blend of quantitative and qualitative research methods. In the quantitative research design, a structured questionnaire was employed, while in the qualitative research design, focus groups and interviews were utilized. The use of a mixed-method approach

has gained increased attention due to its capacity to capture the intricacy of social issues. According to Dawadi et al. (2021), the adoption of a mixed-method approach in research broaden.

5.4.3. Study population and sampling design

The current research employed a purposive sampling technique to identify and select the villages and participants involved in the study. The study was conducted in three communities in the Limpopo region—specifically, in the Mafefe, Steelpoort, and Rambuda districts. Purposive sampling is a non-probability method of selection that chooses a sample based on the population's characteristics and the research study's objectives. The selected population consisted of individuals involved in irrigation schemes under traditional leadership, as well as small-scale farming communities and their families, and key stakeholders from the area. A total of 96 smallholder irrigation women farmers were chosen for a questionnaire-based survey, and three focus groups were conducted in each village. These focus groups varied in size between six and eight participants, with each group consisting solely of either male or female respondents. Additionally, key informant interviews were conducted with agricultural extension officers and traditional chiefs from the three villages.

5.4.4. Data Collection

Various data collection methods were employed, including questionnaires, key informant interviews, and observations of livelihood assets to assess food security. The Household Dietary Diversity Score (HDDS) was calculated using a list of 17 foods, serving as a proxy indicator for a household's access to a diverse range of foods over time (Swindale & Bilinsky, 2006). A 24-hour recall method was utilized to gather information on participants' eating patterns, employing a rating scale of 12 foods to determine dietary diversity.

To maintain continuity in the overall HDDS, subsets of the expanded 12 food groups were remerged into the original groups, aligning with the definitions provided by the Food and Agricultural Organization (FAO), World Health Organization (WHO), and Food and Nutrition Technical Assistance (FANTA). The study recognized the importance of the 12 food groups in evaluating dietary diversity.

In parallel, a desktop survey was conducted for trend analysis on food security determinants in Limpopo Province. This systematic approach involved an extensive literature review to identify key determinants such as Gender, Age, Education, and Income Source. Secondary data from government reports, academic publications, and NGO sources were compiled, standardized, and analyzed quantitatively using statistical tools. The temporal scope spanned from 2013 to 2024, focusing on livelihood trends, gender distribution, age demographics, education, and income sources, with an emphasis on regional variations. The process ensured data accuracy through validation and comparative analysis. The key variables of interest included:

- **Gender Distribution:** Collecting information on the head of the household's gender and tracking changes in the proportion of male- and female-headed households over the years.
- **Age Demographics:** Documenting the age structure within households, particularly focusing on the percentage of elderly individuals (65 years and above).
- **Educational Attainment:** Gathering data on the highest level of education attained by household members, categorizing individuals into groups such as no formal education, primary education, secondary education, and tertiary education.
- **Income Sources:** Identifying and categorizing the primary sources of household income, distinguishing between agricultural and non-agricultural sources.

5.4.5. Data analysis

The data were analyzed using the statistical tools Stata, version 15 (Stata, 2017), and IBM SPSS Statistics, version 24 (IBM SPSS, 2017). The HDDS measure was determined following Swindale & Bilinsky, (2006), and an average HDDS of 11.7 was obtained. A household's mean HDDS equal to or exceeding the average is considered food secure (Swindale & Bilinsky, 2006). For the study of the factors affecting household food security, a logistic regression model was used. The dependent variable, which evaluated food insecurity, was a binary variable with an average HDDS value of ≤ 11.7, and zero otherwise. The general logistic model can be written as:

$$Q_i = f(Y_i) = \frac{1}{1 + e^{-(\varphi + \sum \Psi_i X_i)}} \quad (1)$$

Where Q_i is the probability that an individual is food insecure given X_i, X_i represents the i^{th} explanatory variables φ and Ψ are regression parameters to be estimated? e is the base for natural logarithms.

To easily interpret the coefficients of the logistic model, equation (1) can be written in terms of the odds and log of the odds. The odds ratio shows the ratio of the probability that an individual or household would be food secure Q_i to the probability of a household not being food secure $1 - Q_i$, as expressed in:

$$\left(\frac{Q_i}{1 - Q_i}\right) = e^{Y_i}$$

The natural logarithm of equation (2) produces:

$$\ln\left(\frac{Q_i}{1 - Q_i}\right) = Y_i = \varphi + \Psi_i X_i + \Psi_2 X_2 + ...\Psi_n X_n \quad (2)$$

$$Y_i = \varphi + \sum_{i=1}^{n} \Psi_i X_i + \Phi_i \quad (3)$$

Thus, the parameters of the model, φ and Ψ, can be estimated using the maximum likelihood method proposed by (Maddala, 1997)

$$\ell = \log_b \frac{p}{1-p} = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$

The model parameters, φ and Ψ, can be estimated using the maximum likelihood approach, as indicated by Stern (Maddala, 1997).

This study investigates the implications for livelihood assets by improving approaches in the context of a state with multiple developmental demands as it transitions from a historical resource-poor sector to improving food security for small-scale irrigation schemes in the Province of Limpopo.

Table 1: Variables influencing food security status

Variable	Description	A prior Expectation
Gender	Gender of respondents	+/-
Age	Age of household head (1= Under25; 2=25-30; 3=30-40; =4=40-50; 5=50-65; 6= Over65)	+/-
Edu_lev	Level of education (0= No formal edu; 1= Primary; 2= Secondary; 3= Tertiary)	+
MainIncomeSource	Household main income source	+
FemalesAbove18	People live in your household	-
MalesAbove18	People live in your household	+/-
ProduceEnough4Family	Do you Produce enough (1=yes; 2=no	+/-
Rolewmnoperations	Role of women in management & maintenance	+/-
DistanceFrmHH	The distance of water from household	-
Water Access	How reliable is the water source	+
DoUShareH20withHH	Do share water source with household (1=yes; 2=no	-

To determine the food security status of socioeconomic characteristics of farming households were analysed using correlation analysis and results are presented in Table 1. The results showed significant relationships between seven variables: gender, age, education level, income, females above 18, males above 18, produce enough, role of women, water access, and water sharing with food security, except for females above 18 and water sharing, which showed a negative relationship with all other variables having a positive relationship with food security.

5.5. Results and Discussions

Tables 2 provide a breakdown of key demographic characteristics (education level, gender, age group, and household size) by site, allowing for a better understanding of the overall composition of the study population at each site.

Table 2: Descriptive demographic data of the study sites

		Education Level				**Total**
		No formal education	Primary	Secondary	Tertiary	
Site Name	Rambuda	1	12	22	4	39
	Steelpoort	12	12	5	1	30
	Mafefe	5	10	12	0	27
Total Percentage		18 (19%)	34 (35%)	39 (41%)	5(5%)	96
		Gender				Total
		Male		Female		
Site Name	Rambuda	15		23		38
	Steelpoort	4		26		30
	Mafefe	3		25		28
Total Percentage		22 (23%)		74 (77%)		96

		Age Group						**Total**
		Under 25	25-30	30-40	40-50	50-65	Over 60	
Site Name	Rambuda	2	2	8	9	12	6	39
	Steelpoort	0	0	0	8	7	14	29
	Mafefe	0	5	2	2	9	10	27
Total Percentage		2 (2.1%)	7 (7.3%)	10 (10.4%)	19 (19.8%)	28 (29.2%)	30 (31.2%)	96

		Household Size			**Total**
		1-5	6-10	More than 10	
Site Name	Rambuda	19	18	0	37
	Steelpoort	12	16	4	32
	Mafefe	17	8	2	27
Total percentage		48 (50%)	42 (44%)	6 (6%)	96

In this study, we examined the demographic characteristics of individuals within three distinct sites, namely Rambuda, Steelpoort, and Mafefe, all situated in the Limpopo Province. These demographic characteristics encompass education level, sex distribution, age group composition, and household size, which collectively offer valuable insights into the profile of the study population.

5.5.1. Education Level by Site

The examination of education levels across the three research sites unveiled a notable educational attainment within the study population. Specifically, 41% of individuals had achieved

secondary education, while an additional 5% had tertiary education, indicating a relatively high educational standard among residents in Mafefe, Steelpoort, and Rambuda districts. It is crucial to note that, while the majority in Rambuda and Mafefe possessed at least primary education, a noteworthy 19% segment lacked any formal education. This demographic characteristic underscores the significance of addressing educational disparities in the context of food security and livelihood strategies.

The educational landscape among women irrigation farmers in Limpopo has been a focal point in various studies. Rathnachandra et al. (2022) emphasized that women farmers in the region often have lower educational levels, potentially impacting their food security, access to modern farming technologies, and financial resources. This finding aligns with Berg's (2013) observation that a substantial number of women involved in farming are older than 60 years, with limited farming experience and a scarcity of young farmers.

Moreover, Reimers and Klasen (2013) discussed the pivotal role of education in agricultural productivity, positing that higher education levels could diminish farmers' aversion to risk. This holds relevance for women irrigation farmers in Limpopo, influencing their openness to adopting new technologies and practices. Quintana-Ashwell et al. (2020) supported this notion, demonstrating that higher levels of farmer education positively correlated with the adoption of irrigation-related precision agriculture practices, thereby enhancing livelihoods and food security.

5.5.2. Gender Distribution

The gender distribution within the study population was marked by a majority of females, constituting 77% of the total population, with males representing 23%. Notably, the site of Steelpoort exhibited a pronounced gender disparity, with a significantly higher proportion of females (87%). This finding suggests potential gender-specific dynamics within Steelpoort, hinting at influences from household structures, employment opportunities, and other socioeconomic factors. In contrast, Rambuda presented a more balanced sex distribution, with 39% males and 61% females, indicating a relatively equitable sex ratio in this community.

Understanding the gender dynamics of small-scale irrigation in agriculture and food security in Limpopo Province is crucial for comprehending the region's agricultural production landscape. Several studies emphasize the role of small-scale irrigation in contributing to food security among smallholder farmers (Mhembwe et al., 2019; Gidey, 2020). The influence of gender on factors affecting agricultural production, particularly the experiences of women small-scale farmers, has been underscored in existing literature (Ali-Olubandwa, 2019). The examination of access to irrigation has revealed insights into income inequality among small-scale farmers (Workneh et al., 2020), while studies on the challenges faced by small-scale farmers in Limpopo Province provide valuable insights into constraints affecting the agricultural practices of women in this context (Mpandeli & Maponya, 2014).

Moreover, the perception of climate change and its impact on community resources and livelihood systems has been explored, shedding light on the potential influence of climate change on agricultural practices and food security in the region (Rankoana, 2018).

5.5.3. Age Group Composition

The age composition of the study population revealed a concentration of individuals in the age groups of 30-40 (19.8%) and 50-65 (29.2%), indicating a mature population with a significant proportion in their prime working years and approaching retirement. In contrast, the younger age groups (< 25 and 25-30) were notably underrepresented, constituting only 2.1% and 7.3%, respectively. This demographic profile raises implications for workforce dynamics, intergenerational support, and succession planning.

Turning the focus to women farmers in Limpopo irrigation schemes, various studies underscore the prevalence of older individuals in this demographic. Dlangalala & Mudhara (2020) found that female farmers in South African smallholder irrigation schemes, on average, were 57 years old. Studies in the Vuwani district of Limpopo indicated that 23% of farmers were older than 61 years (Maponya & Mpandeli, 2012), with an average age of 52 reported in another study (Omotayo, 2018). Mwadzingeni et al. (2020) observed that female farmers in Limpopo Province owned an average of 64% of irrigation plots, aligning with the findings of Berg (2013), who reported average farmer ages between 53 and 61 years in different irrigation schemes in the province.

Moreover, Serote et al. (2021) highlighted the challenges faced by smallholder farmers, especially those with plots distant from the canal system, impacting crop yields. This resonates with Koppen et al.'s (2017) survey of public smallholder irrigation schemes in Limpopo, emphasizing the crucial role of water access in these agricultural systems.

5.5.4. Household Size

Household size distribution indicates that 50% of households comprise 1-5 members, with 44% having 6-10 members. A smaller segment (6%) consists of households with more than 10 members. The prevalence of smaller households (1-5 members) suggests a nuanced household structure within the study area, possibly affecting resource allocation and utilization. It is essential to further investigate the factors influencing household size, as larger households may face distinct challenges related to food security and livelihood strategies compared with smaller households.

In summary, the examination of the demographic characteristics within the study population revealed a diverse and dynamic profile. Relatively high levels of education, particularly at the primary and secondary levels, indicate a potential foundation for human capital development. Gender disparities at certain sites underscore the importance of gender-sensitive approaches in addressing food security and livelihood challenges. Age distribution highlights the need to consider the varying needs of different age groups, while the distribution of household sizes underscores the significance of household-level dynamics in the pursuit of sustainable livelihoods and enhanced food security. These demographic insights serve as a valuable foundation for the formulation of targeted interventions and policies aimed at addressing the specific needs of these communities and improving their overall well-being.

Table 3: Type of food consumed by household members (n = 96)

Food Type	Food Secure	Food Insecure
	Percentage (%)	Percentage (%)
Wheat flour	91.7	8.3
Rice	64.6	35.4
Potatoes	62.5	37.5
Cereal	96.6	3.1
Vegetable	97.9	2.1
Fruits and Juices	86.5	13.5
Beans, pulses and legumes	54.2	45.8
Eggs	71.9	28.1
Dairy products	64.6	35.4
Meat	61.5	38.5
Poultry	90.6	9.4
Fish	56.2	43.8
Oils and fats	80.2	19.8
Sugar and honey	90.6	9.4
Condiments	49.0	51.0
Nuts and seeds	37.5	62.5
Alcohol and Tabaco	16.7	83.3
HDDS	12.3	5.9

The Household Dietary Diversity Score allowed us to better understand the types of food consumed by the members of the household. Measurements of food consumed by households were used to compute the average daily dietary intake. First, most food-secure households eat twice as much food as food-insecure households. Households that were food secure consumed more roots, tubers, eggs, fish, pulses, legumes and nuts, milk, and more expensive miscellaneous foods. This illustrates the finding that food-secure households have a more varied diet than food-insecure households (Pereira et al. 2014; Vellema et al. 2015). The results demonstrated that the mean HDDS was higher among food insecure households, but differed between food secure and food insecure households (Table 3). The Food Secure Household score was relatively high compared with other households.

Table 4: Factors influencing the food security status of small-scale irrigation scheme women farmers in Limpopo

Food security status	Odds Ratio	Std. Err.	P-value
Gender	9.190	7.572	0.007***
Age	1.856	0.434	0.008***
Education	1.650	0.472	0.080*
Main Income Source	2.308	1.162	0.097*
FemalesAbove18	0.880	0.254	0.656
MalesAbove18	1.693	0.484	0.066*

ProduceEnough4Family	1.661	1.217	0.489
Rolewmnoperations	0.589	0.340	0.360
DistanceFrmHH	0.685	0.213	0.223
WaterAccess	0.601	0.598	0.609
DoUShareH2OwithHH	0.355	0.257	0.153
Constant	0.000	0.001	0.003

, **, * are significant at 1%, 5% &10% respectively*

5.6. Livelihood assets and characteristics of household food security

The results of the logistic regression model for food security status are presented in Table 4. The study found that gender, age, education, and income all had an impact on household food security in Limpopo. The results indicated that income, age, gender, education, and males older than 18 years are positively linked to a person's food security.

5.6.1. Gender

Agriculture and food security are distinguished by gendered aspects in that women play a major role in agricultural production, food processing, and marketing. Considerably, they contribute positively to dietary diversity and are key to providing nutrition to households. Women also play a major role in the domestication and cultivation of plants. The gender of the household head is positively correlated with food security and is a relevant variable (p=.001). This result indicates that the gender of the household head increases the probability of food security for the household. These findings confirm those of Lee et al. (2022), which indicate that the gender of the household head increases household food security. The study underscores the significance of market access for women in enhancing food security. Additionally, Kabir et al. (2019), conducted a study in Bangladesh to identify factors influencing rural women's income after participating in small-scale agricultural farming, emphasizing the contribution of women to household income and their empowerment status. Furthermore, Komatsu et al. (2019) discuss the gender effects of agricultural cropping work and nutrition status in Tanzania, emphasizing the potential trade-offs between women's time spent on agricultural production and their ability to care for and prepare nutritious food for their familiesThe study showed that increasing the role of women in households improved their households' food security.

5.6.2. Age

The sign of the coefficient of the age of the household head is statistically significant and positively correlated with food security status. The results show that the probability of a household being food secure increases with the age of the household head. This may be due to the farming background of agricultural operations, which helps them accumulate resources and use better planning, which later positions them to be more food secure. This is in line with the findings of a study by Park et al. (2019), which showed that food insecurity is more prevalent among the elderly

in developed countries. All things being equal, the chances of food security decline by a factor of 1.856 as the age of the household head increases by one year.

5.6.3. Education

Education is a capital asset expected to have a positive effect on household food security and the health of the country. Well-educated household heads have the necessary capacity to process and apply knowledge imparted to them. An increase in the total number of years of formal education will contribute to greater household food security. Education is an essential tool to improve food security in rural areas. The findings of this analysis were consistent with those of previous studies (Amaza et al., 2006; Asghar and Muhammad 2013; Bashir et al. 2013; Gebre 2012; Idrisa et al. 2008). Households generally have a low education level and do not have a significant amount of schooling. Many, 18.5% have no formal education, while a substantial percentage of them attended junior primary, senior primary, or secondary school. The mean education level is lower in the older generation as they have grown up with less access to formal education.

5.6.4. Main income source

This variable has the potential to positively impact households' food security status. The response indicates that the greater the household income, the more likely it is to be food secure. This increase in income is expected to lead to an increase in access and food consumption. The majority of respondents (52.17%) earned an average income of between R2001-3000 while (26.09% earned more than R3000 from off-farm and on-farm jobs combined Figure 1). Primary economic activity is centred on rural farming; therefore, no other source of income is possible. Income tends to be inversely correlated with food security. This finding is consistent with those of Babatunde et al. (2007), Adenegan & Adewusi (2007), and Arene & Anyaeji (2010), who demonstrated a positive and important relationship between household income and food security. The more households participate in gainful employment and earn money, the greater their capacity for food security, as this follows a positive relationship with food security (Bashir et al., 2010).

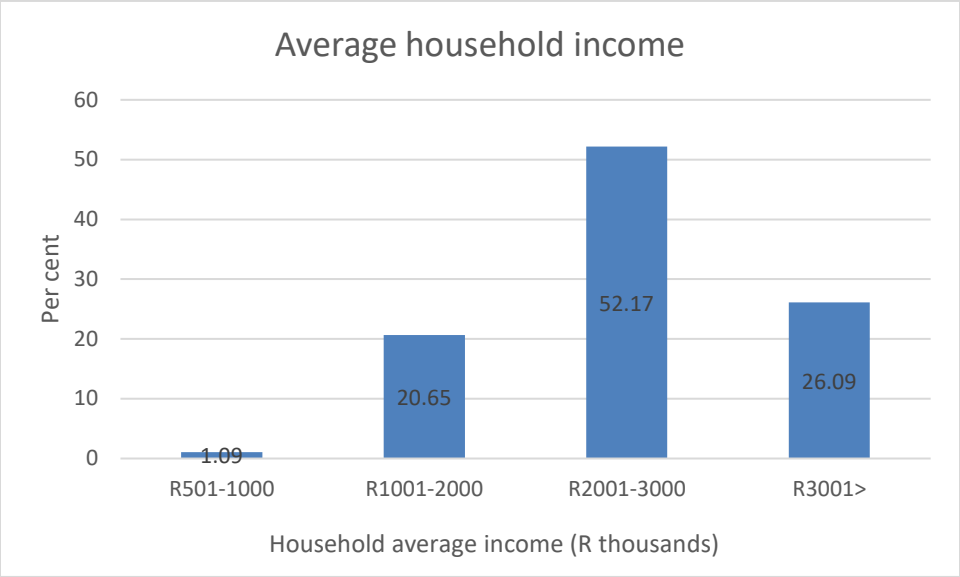

Figure 2. Average household income of respondents in the study site of Limpopo Province

5.6.5. Males above 18 years of age

The level of households in which males above 18 years of age are the household head is positively and substantially associated with food security status. The researchers pointed out that if there is an increase in the number of male adults above 18 in a household, the household's risk of being food secure increases. Due to gender-based practices, males have greater access to land and more exposure to advanced production methods, such as the use of fertilizers, pesticides, high-quality crops, and marketing services. This is in accordance with the study conducted by Bogale (2012) on the vulnerability of smallholder rural households to food insecurity in Eastern Ethiopia, which revealed that male household heads have better opportunities to have access to assets and that female-headed households are expected to be more susceptible to food insecurity. All things being equal, the odds ratio in favour of food security increased by a factor of 2.308.

5.7. Conclusions and Recommendations

This survey primarily concerned households' food security in various districts of the Limpopo Province. Logistic regression analysis was used to determine the various factors affecting food security. A sample of 96 households was analyzed, with food security status (0 =food insecure and 1 = food secure) as the dependent variable and various socioeconomic and demographic characteristics as explanatory variables. The HDDS was used to determine food security among the sampled households. The results of the regression analysis show that gender, age, education, household income, and males over 18 years of age were positively correlated with food-secured households. In this study, it was found that most of the households surveyed were food-secure, and at least four separate food groups were eaten by food-secure households.

The results of this study are important for the government and other development agencies to improve household food security status in Limpopo and other areas in general. Gender

contributes to dietary diversity by ensuring sufficient nutrition in households. Therefore, to resolve issues with female-headed households, the government should concentrate on them in particular and provide them with social security allowances, as most are poor and have no other job opportunities. The findings show that the older the head of the household, the greater the probability that the household will be able to reliably provide food. Education is a significant factor in educating societies about the value of knowledge and its role in improving the quality of life of an individual. Another significant factor is household income. The more households engage in gainful employment and receive income, the more they have the capacity for food security, which implies a positive relationship with food security. Owing to these demographic trends, the government should work hard to create job opportunities for its citizens. The initiatives or policies introduced in Limpopo province should consider the primary determinants of food security discussed above, the needs of communities in preventing and combating food insecurity, and the prioritization of poverty reduction as well as food protection.

Declaration: The authors declared that they have no conflict of interest.

Ethical Statement: The authors affirm that this work is original and has not been published elsewhere. All research procedures were conducted in accordance with ethical standards and were approved by the relevant institutional ethics review board. Informed consent was obtained from all participants involved in the study. Any conflicts of interest have been disclosed. The authors are committed to upholding the highest standards of integrity and transparency in their research endeavours.

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References

Adenegan, K.O. & Adewusi, O.A. (2007). Determinants of Food Security Status of Rural Households Living With HIV/AIDS in South-western Nigeria. African Journal of Biomedical Research, Vol. 10: 9 – 18.

Ali-Olubandwa, A. (2019). The influence of farmers' gender on factors affecting maize production among small-scale farmers in the agricultural reform era: the case of western region of Kenya. Asian Journal of Agricultural Extension Economics & Sociology, 1-7. https://doi.org/10.9734/ajaees/2019/v35i330223

Arene, C. J. & Anyaeji, J. (2010). Determinants of Food Security among Households in Nsukka Metropolis of Enugu State, Nigeria. Pakistan Journal of Social Sciences 30(1): 9-16.

Babatunde, R. O., Omotosho, O. A. & Sholotan, O.S. (2007). Factors Influencing Food Security Status of Rural Farming Households in North Central Nigeria. Agric. J., 2(3): 351 – 357.

Bacha, D., Namara, R., Bogale, A., & Tesfaye, A. (2011). Impact of small-scale irrigation on household poverty: empirical evidence from the Ambo district in Ethiopia. Irrigation and Drainage, 60(1), 1-10. https://doi.org/10.1002/ird.550

Baiphethi, M. & Jacobs, P. (2009). The contribution of subsistence farming to food security in South Africa. Agrekon, 48(4), 459-482. https://doi.org/10.1080/03031853.2009.9523836

Bashir, M.K., Schilizzi, S. & Pandit, R. 2013. Impact of socio-economic characteristics of rural households on food security: the case of the Punjab, Pakistan JAPS, J. Animal Plant Sci., 23 (2) (2013), pp. 611-618.

Bashir, M.K., Naeem, M.K. & Niazi, S.A.K. (2010). Rural and peri-urban food security: a case of district Faisalabad of Pakistan. WASJ, 9(4), 403-41.

Berg, J. (2013). Socio-economic factors affecting adoption of improved agricultural practices by small-scale farmers in South Africa. African Journal of Agricultural Research, 8(35), 4490-4500. https://doi.org/10.5897/ajar12.1025

Braack, L., Bornman, R., Kruger, T., Dahan-Moss, Y., Gilbert, A., Kaiser, M., … & Jager, C. (2020). Malaria vectors and vector surveillance in Limpopo province (South Africa): 1927 to 2018. International Journal of Environmental Research and Public Health, 17(11), 4125. https://doi.org/10.3390/ijerph17114125

Chakona, G. and Shackleton, C. (2018). Household food insecurity along an agroecological gradient influences children's nutritional status in South Africa. Frontiers in Nutrition, 4. https://doi.org/10.3389/fnut.2017.00072

Danso-Abbeam, G., Dagunga, G., & Ehiakpor, D. (2020). Rural non-farm income diversification: implications on smallholder farmers' welfare and agricultural technology adoption in Ghana. Heliyon, 6(11), e05393. https://doi.org/10.1016/j.heliyon.2020.e05393

Dawadi, S., Shrestha, S., & Giri, R. A. (2021). Mixed-Methods Research: A Discussion on its Types, Challenges, and Criticisms. Journal of Practical Studies in Education, 2(2), 25-36 DOI: https://doi.org/10.46809/jpse.v2i2.20

Dawid, I., Workalemahu, S., & Hassen, A. (2021). Small scale irrigation farming adoption as a climate-smart agriculture practice and its impact on household income in Ethiopia: a review. International Journal of Food Science and Agriculture, 5(4), 584-591. https://doi.org/10.26855/ijfsa.2021.12.004

De Cock, N., D'haese, M., Vink, N., Rooyen, C., Staelens, L., Schönfeldt, H. & D'haese, L. (2013). Food security in rural areas of Limpopo province, South Africa. Food Security, 5(2), 269-282. https://doi.org/10.1007/s12571-013-0247-y

DFID (Department for International Development, UK) & FAO (Food and Agriculture Organisation of The United Nations). (2000). Inter-agency experience and lessons from the Forum on operationalizing sustainable livelihood approach. Rome: DFID & FAO Available: www.fao.org/docrep/x7749e/x7749e00.htm (Accessed 11/12/2013).

Dlamini, S., Craig, A., Mtintsilana, A., Mapanga, W., Toit, J., Ware, L. & Norris, S. (2023). Food insecurity and coping strategies and their association with anxiety and depression: a nationally representative South African survey. Public Health Nutrition, 26(4), 705-715. https://doi.org/10.1017/s1368980023000186

Dlangalala, S. & Mudhara, M. (2020). Determinants of farmer awareness of water governance across gender dimensions in smallholder irrigation schemes in KwaZulu-Natal province, South Africa. Water Sa, 46(2 April). https://doi.org/10.17159/wsa/2020.v46.i2.8238

Gebre, G.G. (2012). Determinants of food insecurity among households in Addis Ababa city, Ethiopia Interdisciplinary Description Complex Syst., 10 (2) (2012), pp. 159-173 Gor Cornist. (1999) Peri-Urban Irrigation in Kumasi, FAO.

Gidey, G. (2020). Impact of small-scale irrigation development on farmers' livelihood improvement in Ethiopia: a review. JRDM. https://doi.org/10.7176/jrdm/62-02

Hendriks, S. & Olivier, N. (2015). Review of the South African agricultural legislative framework: food security implications. Development Southern Africa, 32(5), 555-576. https://doi.org/10.1080/0376835x.2015.1044075

Hendriks, S. (2013). South Africa's national development plan and new growth path: reflections on policy contradictions and implications for food security. Agrekon, 52(3), 1-17. https://doi.org/10.1080/03031853.2013.821741

Idrisa, Y.L., Gwary, M.M. & Shehu, H. (2008). Analysis of food security status among farming households in Jere Local Government of Borno State, Nigeria J. Trop. Agric. Food Environ. Ext., 7 (3), pp. 199-205

Ijatuyi, E., Omotayo, A., & Nkonki-Mandleni, B. (2018). Empirical analysis of food security status of agricultural households in the platinum province of South Africa. Journal of Agribusiness and Rural Development, 47(1), 29-38. https://doi.org/10.17306/j.jard.2018.00397

Iticha, M.D. (2019). Review on the impact of small-scale irrigation scheme on household income and poverty reduction in Ethiopia review on the impact of small-scale irrigation scheme on household income and poverty reduction in Ethiopia. JESD. https://doi.org/10.7176/jesd/10-17-05

Iticha, M.D. (2019). Review on the impact of small-scale irrigation scheme on household income and poverty reduction in Ethiopia. JRDM. https://doi.org/10.7176/jrdm/57-02

Kephe, Priscilla N., Lendeu C. Siewe, Ratunku G. Lekalakala, Kingsley Kwabena Ayisi, and Brilliant M. Petja. "Optimizing Smallholder Farmers' Productivity Through Crop Selection, Targeting and Prioritization Framework in the Limpopo and Free State Provinces, South Africa." Frontiers in Sustainable Food Systems 6, (2022): 738267. Accessed May 27, 2024.

Koppen, B., Nhamo, L., Cai, X., Gabriel, M., Sekgala, M., Shikwambana, S.& Manyama, D. (2017). Smallholder irrigation schemes in the Limpopo province, South Africa. https://doi.org/10.5337/2017.206

Koyanagi, A., Veronese, N., Stubbs, B., Vancampfort, D., Stickley, A., Oh, H.& Lara, E. (2019). Food insecurity is associated with mild cognitive impairment among middle-aged and older adults in South Africa: findings from a nationally representative survey. Nutrients, 11(4), 749. https://doi.org/10.3390/nu11040749

Kwaw-Nimeson, E. & Tian, Z. (2021). The impact of agricultural producer price on sustainable food security in Africa – a system Gmm approach. Agricultural and Resource Economics International Scientific E-Journal, 7(3), 60-76. https://doi.org/10.51599/are.2021.07.03.04

Kyei, K. and Ramuya, R. (2021). Determination of the level and trend of fertility in four provinces in South Africa. Demography and Social Economy, (3), 41-52. https://doi.org/10.15407/dse2021.03.041

Mango, N., Makate, C., Tamene, L., Mponela, P., & Ndengu, G. (2018). Adoption of small-scale irrigation farming as a climate-smart agriculture practice and its influence on household income in the Chinyanja triangle, Southern Africa. Land, 7(2), 49. https://doi.org/10.3390/land7020049

Maponya, P. & Mpandeli, S. (2012). Climate change and agricultural production in South Africa: impacts and adaptation options. Journal of Agricultural Science, 4(10). https://doi.org/10.5539/jas.v4n10p48

Masipa, T. (2017). The impact of climate change on food security in South Africa: current realities and challenges ahead. Jàmbá Journal of Disaster Risk Studies, 9(1). https://doi.org/10.4102/jamba.v9i1.411

Mbajiorgu, G. (2019). Human development and food sovereignty: a step closer to achieving food security in South Africa's rural households. Journal of Asian and African Studies, 55(3), 330-350. https://doi.org/10.1177/0021909619875757

Mhembwe, S., Chiunya, N., & Dube, E. (2019). The contribution of small-scale rural irrigation schemes towards food security of smallholder farmers in Zimbabwe. Jàmbá Journal of Disaster Risk Studies, 11(1). https://doi.org/10.4102/jamba.v11i1.674

Moralles, S., Egal, A., & Oldewage-Theron, W. (2021). Do smallholder farmers need nutrition education? a case study from KwaZulu-Natal, South Africa. Journal of International Agricultural and Extension Education, 28(3), 14-27. https://doi.org/10.5191/jiaee.2021.28314

Mpandeli, S. & Maponya, P. (2014). Constraints and challenges facing the small-scale farmers in Limpopo province, South Africa. Journal of Agricultural Science, 6(4), 135. https://doi.org/10.5539/jas.v6n4p135

Mthethwa, S. & Wale, E. (2021). Household vulnerability to food insecurity in rural South Africa: evidence from a nationally representative survey data. International Journal of Environmental Research and Public Health, 18(4), 1917. https://doi.org/10.3390/ijerph18041917

Mume, I.D. (2021). Small-scale irrigation farming adoption as a climate-smart agriculture practice and its impact on household income in Ethiopia. a review paper. JESD. https://doi.org/10.7176/jesd/12-17-02

Mwadzingeni, L., Mugandani, R., & Mafongoya, P. (2020). Factors affecting the performance of Tshiombo irrigation scheme in Limpopo province, South Africa. Journal of Agribusiness and Rural Development, 57(3). https://doi.org/10.17306/j.jard.2020.01314

Ncube, A. (2015). Impact of Livelihood Diversification on Household Food Security: The Case of Hurungwe District, Zimbabwe. Available at: https://uir.unisa.ac.za/bitstream/handle/10500/6905/dissertation_ncube_a.pdf?sequence=1&isAllowed=y (Accessed on 8 July 2023).

Nedombeloni, R. & Oyekale, A. (2015). Welfare impacts of social grants in Thulamela local municipality of Limpopo province, South Africa. Socioeconomic, 4(7), 1-22. https://doi.org/10.12803/sjseco.4711415

Nephawe, N., Mwale, M., Zuwarimwe, J., & Tjale, M. (2021). The impact of water-related challenges on rural communities' food security initiatives. Agraris Journal of Agribusiness and Rural Development Research, 7(1), 11-23. https://doi.org/10.18196/agraris.v7i1.9935

Ngema, P., Sibanda, M., & Musemwa, L. (2018). Household food security status and its determinants in Maphumulo local municipality, South Africa. Sustainability, 10(9), 3307. https://doi.org/10.3390/su10093307

Odoh, N. E., Nwibo, S. U., Victor, E. A., & Igberi, C. O. (2019). Farm and non-farm income diversification activities among rural households in Southeast, Nigeria. Journal of Agricultural Extension, 23(2), 113. https://doi.org/10.4314/jae.v23i2.12

Ogunyemi, A., Olutumise, A., & Adegoroye, A. (2022). The extent of vulnerability to food insecurity and household coping strategies: case of yam farmers in Ekiti state, Nigeria. Turkish Journal of Agriculture - Food Science and Technology, 10(10), 1921-1928. https://doi.org/10.24925/turjaf.v10i10.1921-1928.4976

Omar, M. & Aly, M. (2021). Assessment of water resources system in Qena governorate, Upper Egypt under different hydrological and agronomic conditions. Water Science & Technology Water Supply, 22(3), 3015-3026. https://doi.org/10.2166/ws.2021.413

Omotayo, A. (2018). Climate change and food insecurity dynamics in the rural Limpopo province of South Africa. Journal of Economics and Behavioural Studies, 10(1(J)), 22-32. https://doi.org/10.22610/jebs.v10i1(j).2085

Oni, S.A., Maliwichi, L.L., Obadire, O.S. (2011). Assessing the contribution of smallholder irrigation to household food security, in comparison to dryland farming in Vhembe district of Limpopo province, South Africa. African Journal of Agricultural Research 6(10): 2188–2197.

Oni, S.A., Nesamvuni, A.E., Odhiambo, J.J.O. & Dagada, M.C. (n.d.). Executive Summary of a Study of Agricultural Industry of Limpopo Province. Available: http://policyresearch.limpopo.gov.za/bitstream/handle/123456789/636/Agric%20Study%20Summary.pdf?sequence=1 (Accessed 21 September 2019).

Otekunrin, O., Otekunrin, O., Sawicka, B., & Pszczółkowski, P. (2021). Assessing food insecurity and its drivers among smallholder farming households in rural Oyo state, Nigeria: the HFIAS approach. Agriculture, 11(12), 1189. https://doi.org/10.3390/agriculture11121189

Quintana-Ashwell, N., Gholson, D., Krutz, L., Henry, C., & Cooke, T. (2020). Adoption of water-conserving irrigation practices among row-crop growers in Mississippi, USA. Agronomy, 10(8), 1083. https://doi.org/10.3390/agronomy10081083

Rankoana, S. A. (2018). Human perception of climate change. Weather, 73(11), 367-370. https://doi.org/10.1002/wea.3204

Rathnachandra, S., Malkanthi, S., & Padmanadan, S. (2022). Present situation of agricultural information needs and accessibility of women farmers in Imbulpe ds division in Sri Lanka. International Journal of Agriculture Environment and Food Sciences, 6(2), 319-326. https://doi.org/10.31015/jaefs.2022.2.16

Reimers, M. & Klasen, S. (2013). Revisiting the role of education for agricultural productivity. American Journal of Agricultural Economics, 95(1), 131-152. https://doi.org/10.1093/ajae/aas118

Samberg, L. H., Gerber, J., Ramankutty, N., Herrero, M., & West, P. (2016). Subnational distribution of average farm size and smallholder contributions to global food production. Environmental Research Letters, 11(12), 124010. https://doi.org/10.1088/1748-9326/11/12/124010

Samim, S., Hu, Z., Stępień, S., Amini, S., Rayee, R., Niu, K. & Mgendi, G. (2021). Food insecurity and related factors among farming families in Takhar region, Afghanistan. Sustainability, 13(18), 10211. https://doi.org/10.3390/su131810211

Santeramo, F. and Phali, L. (2023). On the impact of provincial development policies in South Africa. Development Southern Africa, 40(6), 1137-1152. https://doi.org/10.1080/0376835x.2023.2196314

Sekhampu, T. (2013). Determination of the factors affecting the food security status of households in Bophelong, South Africa. International Business & Economics Research Journal (Iber), 12(5), 543. https://doi.org/10.19030/iber.v12i5.7829

Serote, B., Mokgehle, S., Plooy, C., Mpandeli, S., Nhamo, L., & Senyolo, G. (2021). Factors influencing the adoption of climate-smart irrigation technologies for sustainable crop productivity by smallholder farmers in arid areas of South Africa. Agriculture, 11(12), 1222. https://doi.org/10.3390/agriculture11121222

Sileshi, M., Kadigi, R., Mutabazi, K. & Sieber, S. (2019). Analysis of households' vulnerability to food insecurity and its influencing factors in East Hararghe, Ethiopia. Economic Structures 8, 41 (2019). https://doi.org/10.1186/s40008-019-0174-y

Stats SA (2021). Focus on food inadequacy and hunger in South Africa in 2021. Department of Statistics South Africa, Republic of South Africa. https://www.statssa.gov.za/?p=16235

Stats SA. (2021). General Household Survey 2020. Department of Statistics South Africa. Republic of South Africa. https://www.statssa.gov.za/publications/P0318/P03182020.pdf

Swindale, A. & Bilinsky, P. (2006). Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide; International Food Policy Research Institute (IFPRI): Washington, DC, USA.

Toit, A., Macdonald, R., Steyn, E., Mahlanza, Z., Zulu, A., & Wit, M. (2023). Review of the underutilized indigenous Portulacaria afra (spekboom) as a sustainable edible food source. Agronomy, 13(5), 1206. https://doi.org/10.3390/agronomy13051206

Van Averbeke, W., Denison, J. & Mnkeni, P.N.S. (2011). Smallholder irrigation in South Africa: A review of knowledge generated by the water research commission. Available: http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S1816-79502011000500021 (Accessed 15 September 2019).

Workneh, W., Takada, J., & Matsushita, S. (2020). The impact of using small-scale irrigation motor pumps on farmers' household incomes in Ethiopia: a quasi-experimental approach. Sustainability, 12(19), 8142. https://doi.org/10.3390/su12198142

World Bank (2021). World Development Report 2008: Agriculture for development. Washington DC: World Bank.

Zeweld, W., Huylenbroeck, G., Hidgot, A., Chandrakanth, M., & Speelman, S. (2015). Adoption of small-scale irrigation and its livelihood impacts in Northern Ethiopia. Irrigation and Drainage, 64(5), 655-668. https://doi.org/10.1002/ird.1938&

CHAPTER 6

POLICY ANALYSIS ON LAND AND WATER IN SOUTH AFRICA WITH EMPHASIS ON SMALL-SCALE IRRIGATION SCHEMES (SIS)

ABSTRACT

South Africa's land reform initiatives post-1994 aimed to redress historical racial disparities and injustices, but small-scale irrigation scheme (SIS) women farmers continue to face exclusion under current land policies. This study analyzes the legal and institutional land frameworks in South Africa, highlighting the challenges and gaps that perpetuate gender inequalities in land ownership and access. The research examines key legislation, such as the 1913 Land Act, 1936 Native Trust and Land Act, and 1950 Group Areas Act, which laid the foundation for decades of land dispossession and inequality during the apartheid era. Post-1994, the Constitution of 1996 and various acts, including the Communal Property Associations Act of 1996, the Land Reform (Labour Tenants) Act of 1996, and the Extension of Security of Tenure Act of 1997, aimed to address land imbalances and provide security of tenure. However, the study reveals that despite these efforts, SIS women farmers still face marginalization in land allocation and distribution due to persistent gender biases and stereotypes. The unique challenges confronting smallholder irrigation farming, such as access to water resources, infrastructure, and technical support, are often overlooked within the land reform framework. The study emphasizes the need for gender-sensitive policies, inclusive decision-making processes, and targeted interventions to ensure equal opportunities and resources for SIS women farmers. The findings underscore the importance of a comprehensive analysis of South African land policy to identify and rectify the gaps and shortcomings that perpetuate the exclusion of SIS women farmers, promoting gender equality and inclusivity in land reform efforts.

Keywords: land reform, land policies, women farmers, small-scale irrigation schemes, South Africa

6.1 Introduction

Land reform represents a critical avenue for redressing historical racial disparities and injustices in the "new South Africa" that emerged post-1994. Within this multifaceted landscape of land reform, it is notable that SIS women farmers continue to face exclusion under current land policies.

The Department of Land Affairs (DLA) shoulders the responsibility of rectifying past land injustices, which date back to 1913. This encompassing mandate includes not only the restoration of land rights to those who were unjustly deprived of them over the course of nearly a century but also the redistribution of land to individuals who were systematically denied fair access to it during the eras of segregation and apartheid.

Despite the comprehensive scope of land reform initiatives in South Africa, there persists a disheartening reality: SIS women farmers continue to grapple with exclusion from these policies. This exclusion represents a pressing issue that undermines the broader objectives of land reform.

In the post-1994 era, South Africa's land reform efforts were envisaged as a means to rectify historical racial disparities and lay the foundation for a more equitable society. However, the continued marginalization of SIS women farmers within this context calls for a deeper examination of the intricacies and challenges within the land reform framework.

One crucial aspect contributing to the exclusion of these women farmers is the persistence of gender inequalities in land ownership and access. While the overarching goal of land reform is to provide equitable access to land, gender biases and stereotypes often result in women being overlooked or marginalized in the allocation and distribution of land. This issue highlights the need for gender-sensitive policies and interventions to ensure that women, particularly those engaged in smallholder irrigation farming, are afforded equal opportunities and resources in the realm of land reform.

Furthermore, it is imperative to recognize the unique challenges faced by SIS women farmers, which often differ from those encountered by larger-scale agricultural enterprises. These challenges encompass access to water resources, infrastructure, and technical support, among others. Failure to address these specific needs within the land reform framework can perpetuate exclusion and hinder the development of sustainable and thriving smallholder irrigation farming enterprises.

While South Africa's land reform efforts post-1994 represent a crucial step towards addressing historical injustices, the exclusion of SIS women farmers remains a critical issue that demands attention. To achieve the broader goals of land reform and promote gender equality in land ownership and access, a comprehensive analysis of the South African land policy is essential to

identify and rectify the gaps and shortcomings that lead to the continued exclusion of SIS women farmers. Such an analysis should involve stakeholders from government, civil society, and academia, with a focus on crafting policies that not only address historical injustices but also promote gender equality, inclusivity, and the specific needs and tailor interventions to address the unique challenges confronting smallholder irrigation farming. Only through such an inclusive and analytical approach can the vision of a more equitable and just South Africa be fully realized within the context of land reform.

1.3 6.2 Legal and Institutional land frameworks in South Africa

Table 6.1: Legal an institutional framework

Before 1994: Apartheid Era

- **1913 Land Act:** Prohibited land ownership and residence by black South Africans outside designated areas. It laid the foundation for decades of land dispossession and inequality.
- **1936 Native Trust and Land Act:** Allowed the government to acquire land for "native reserves" further restricting land access for black South Africans.
- **1950 Group Areas Act:** Segregated urban areas by race, forcibly displacing many non-white communities.

Post -1994: Democracy and Land Reform

- **1994 Reconstruction and Development Programme (RDP):** Aimed at addressing apartheid-era land imbalances and ensuring access to land for all South Africans.
- **1996 Constitution:** Enshrined the right to property and provided for land restitution and reform.
- The Constitution of 1996, approved by the Constitutional Court, came into force on 4 February 1997 (12) and was amended seven times. The latest amendment to the Constitution was made on 1 February 2013 but the date of entry into force is yet to be determined.
    - Section 25 addresses the property rights of South Africans:
        - Subsections 25(5), 25(6) and 25(7) provide that:
            - access to land should be on an equitable basis;
            - people living in tenure insecurity are entitled to secure tenure or comparable redress;
            - people dispossessed of property because of racially discriminatory laws or practices in the past can seek judicial redress.

- **The Communal Property Associations**, 1996 (Act. 28 of 1996):
    - Section 9 protects the interests of women through non-discriminatory provisions and inclusive decisions-making processes in communal property ownership and use of communal land (10)

- The Land Reform (Labour Tenants),1996 (Act No. 3 of 1996):
- Section 3(1) grants labour tenants and their family members the right to occupy and use land (10).

- **The Extension of Security of Tenure Act** of 1997 (ESTA) (Act No. 62 of 1997):
- Provides for measures to facilitate long-term security of land tenure and is gender-neutral and non-discriminatory (14). Aimed to provide security of tenure for farm dwellers and labour tenants.
- Section 4: The Minister may prescribe subsidies to facilitate long-term security of secure for occupiers

- **1998 Land Redistribution Act:** Formally established the land redistribution program to address land imbalances.
- **1998 Land Restitution Act:** Provided a framework for restoring land to those who were forcibly removed.
- **The Prevention of Illegal Eviction from and Unlawful Occupation of Land Act**, 1998 (Act No. 19 of 1998):
    - Repealed the Prevention of Illegal Squatting Act of 1951 and other laws
    - States that "special consideration should be given to the rights of the elderly, children, disabled persons and particularly households headed by women, and that it should be recognized that the needs of those groups should be considered" (10)

2000s: Accelerated Land Reform

- **The Communal Land Rights Act**, 2004 (Act No. 11 of 2004) Aimed to secure land rights in communal areas:
    - Section 3: A community acquires juristic personality with perpetual succession upon registration of community rules
- **2004 National Spatial Development Perspective:** Guided land use planning and allocation.

- **2005 Agricultural Land Holding Bill:** Proposed to limit the size of agricultural land holdings, but not enacted

- **2013 Restitution of Land Rights Amendment Act:** Reopened the land restitution claims process until 2019.

- **2013 Extension of Security of Tenure Amendment Act:** Strengthened tenure security for farm dwellers.
- **2014 Communal Property Associations Amendment Act:** Addressed issues with communal property associations.

2018 Onwards: Focus on Expropriation

- **2018 Expropriation Bill:** Proposed framework for expropriation with compensation, aiming to address land reform challenges
- **2019 Presidential Advisory Panel on Land Reform and Agriculture:** Provided recommendations on land reform, including addressing the needs of smallholder farmers.
- **2020 Draft Land Governance Bill:** Proposed to establish a National Land Rights Protector and Land Rights Management Board for more effective land governance.
- **2020 Upcoming Expropriation Bill Amendment:** Proposed amendments to provide more clarity on expropriation processes.

Current Land Policy Framework:

South Africa's land policy framework consists of various components:

- **Land Restitution:** The Restitution of Land Rights Act aims to return land to those who were dispossessed due to discriminatory laws. This has benefitted some small-scale irrigation scheme women farmers, but challenges remain in terms of speed and effectiveness.
- **Land Redistribution:** The government's policy aims to transfer land from large commercial farms to previously disadvantaged individuals, including small-scale irrigation scheme women farmers. However, progress has been slow, partly due to funding and technical support limitations.
- **Land Tenure Security:** Ensuring secure land tenure is vital for small-scale irrigation scheme women farmers. The Extension of Security of Tenure Act and the Communal Land Tenure Act were designed to protect their rights, but implementation gaps persist.

In summary, South Africa has made significant strides in reforming its land policies to address historical injustices and promote equitable land access. However, challenges remain in effectively implementing these policies, particularly in ensuring that SIS women farmers benefit from these reforms. Continued efforts and policy refinements are necessary to address these challenges and create a more inclusive and equitable land distribution system in the country.

Table 6.2: Analysis of various aspects of land policy and legislation in the context of small-scale irrigation schemes women farmers in South Africa

Aspect	Policy Implementation	Stakeholder Analysis	Cost Benefit Analysis	Effectiveness and Impact	Alternatives and Recommendations	Policy Implications
Policy	Implementation has been uneven, often delayed.	Women farmers often excluded from decision-making.	Costs include administrative, legal, and compensation.	Limited impact on improving land access for women.	Streamline and expedite land redistribution process.	Improved policy execution and accountability required.
Land Restitution Act	Slow claims processing, backlog of unresolved cases.	Women's land rights often overlooked in communal areas.	Compensation costs may strain government resources.	Limited improvement in tenure security for women.	Strengthen mechanisms for women's participation in land restitution decisions.	Focus on efficient and fair compensation mechanisms.
Land Redistribution Act	Insufficient funding and technical support.	Lack of access to credit and inputs for women farmers.	Costs include land purchase, infrastructure development.	Limited increase in women's land ownership.	Allocate dedicated funds and resources for women-led farming projects.	Tailor support to address women's specific needs.
Security of Tenure Act	Implementation challenges in rural areas.	Limited recognition of women's rights in communal areas.	Costs involve legal procedures, awareness campaigns.	Moderate improvement in protecting women's land rights.	Increase awareness and training on tenure rights for women farmers.	Address cultural barriers to women's land tenure security.
Expropriation Bill	Controversial, legal and procedural challenges.	Women's voices often underrepresented in land debates.	Costs relate to compensation, legal processes.	Potential to enhance women's land access.	Ensure gender-sensitive implementation, prioritize women's access during expropriation.	Balancing land reform with fair compensation for all parties.
Recommendations	Strengthen enforcement, monitoring mechanisms.	Include women in policy-making, planning, and implementation.	Balance costs with long-term benefits of equity.	Implement gender-sensitive	Design gender-specific support programs, improve	Mainstream gender considerations

				indicators and targets.	data collection on women farmers.	in all land policies.
Implications	Improved accountability, more equitable outcomes.	Inclusive policies result in more sustainable land reforms.	Consider long-term benefits of empowerment for women.	Positive correlation between gender-inclusive policies.	More resources and tailored support required for women's equitable participation in land use.	Address gender disparities to achieve holistic land reform.

6.3 Land Policy and Legislation for Small-scale Irrigation Scheme Women Farmers in Limpopo Province

The implementation of land policy and legislation in South Africa, with a focus on small-scale irrigation scheme women farmers, has faced several challenges. Despite the existence of various laws aimed at addressing historical injustices and promoting gender equality, the actual implementation has often been slow, uneven, and marred by bureaucratic delays (Maphunye, 2019). For instance, the Land Restitution Act and the Land Redistribution Act have struggled with backlog and funding issues, leading to a limited number of successful land transfers (Nkosi, 2020). These delays have hindered the intended benefits for small-scale irrigation scheme women farmers, who continue to face difficulties in accessing and utilizing land resources for agricultural activities (Makgala, 2018). These challenges highlight the need for continued efforts to streamline the implementation process and ensure that the land policies effectively reach and empower small-scale irrigation scheme women farmers in South Africa.

Stakeholder analysis reveals that women farmers, particularly smallholders, have been historically marginalized in decision-making processes related to land (Moyo, 2017). The policy landscape in South Africa has generally excluded their voices, resulting in policies that may not fully address their unique needs and challenges (Hassan, 2019). Traditional norms and practices, combined with gender-based discrimination, have limited women's participation in land-related discussions, both at community and national levels (Mafukidze, 2020). This exclusion undermines the effectiveness of policies designed to benefit small-scale irrigation scheme women farmers, perpetuating their marginalized status (Nel, 2018).

The cost-benefit analysis of land policy and legislation involves a multifaceted consideration of economic, social, and cultural factors (Du Toit, 2016). While policies like the Land Redistribution Act and the Expropriation Bill come with costs related to compensation and administrative processes (Aliber & Walker, 2020), their potential benefits include increased access to land for small-scale irrigation scheme women farmers and the promotion of broader socioeconomic equity (Mabogunje, 2019). The costs incurred should be weighed against the long-term benefits of empowering women in agriculture, improving food security, and fostering economic growth in rural communities (Ndiritu, 2017).

The effectiveness and impact of land policy and legislation targeting small-scale irrigation scheme women farmers have been mixed. While some progress has been made in terms of formalizing land tenure and facilitating land redistribution (Hall, 2016), the impact on improving the livelihoods of small-scale irrigation scheme women farmers has been limited (Hassan, 2019). Many women continue to face challenges such as tenure insecurity, limited access to credit and resources, and exclusion from decision-making processes (Mafukidze, 2020). The desired impact of enhancing women's land ownership, productivity, and income generation remains a work in progress, requiring more focused efforts and gender-sensitive implementation strategies (Nel, 2018).

To address the challenges and limitations of current land policies, several alternatives and recommendations can be considered. Firstly, policy implementation should be streamlined through enhanced monitoring and enforcement mechanisms (Moyo, 2017). Secondly, stakeholder analysis should inform policies that actively include women's perspectives, recognizing their vital role in agriculture and land management (Nel, 2018). Cost-benefit analyses should consider the long-term empowerment of women farmers and the broader societal benefits of equitable land access (Mabogunje, 2019). Effective alternatives include targeted financial and technical support, tailored training programs, and capacity-building initiatives to bridge the gender gap in farming skills (Hassan, 2019).

The implications of the analysis point to the need for comprehensive reforms that prioritize gender equality in land policy and legislation (Hassan, 2019). Strengthening policy implementation, fostering women's participation, and addressing cultural norms that perpetuate gender disparities are essential steps (Mafukidze, 2020). Moreover, policy-makers should recognize that investing in small-scale irrigation scheme women farmers can yield significant social and economic benefits, contributing to poverty reduction, food security, and sustainable development (Mabogunje, 2019). The broader policy implications emphasize the importance of holistic, gender-responsive approaches that ensure the inclusion and empowerment of women in all stages of land reform and agricultural development (Ndiritu, 2017).

6.3.1 Land Restitution Act in South Africa

The Land Restitution Act of 1994 aimed to address historical injustices by allowing individuals and communities who were forcibly removed from their land during apartheid to lodge claims for the restitution of their land or fair compensation (Aliber & Walker, 2020). Implementation has faced challenges including bureaucratic delays, complex legal procedures, and funding constraints (Moyo, 2017). These factors have contributed to a significant backlog of unresolved claims, hindering the Act's intended impact (Hall, 2016).

Stakeholder analysis reveals that while the Act has benefited some claimants, its implementation has fallen short in engaging marginalized communities, including women, in the restitution process (Hall, 2016). Women's voices have often been overlooked in communal land claims due to traditional norms and power dynamics (Mafukidze, 2020). This exclusion diminishes the effectiveness of the policy in achieving gender equity and comprehensive land restitution (Nel, 2018).

The cost-benefit analysis of the Land Restitution Act involves a trade-off between the costs of compensation and administrative processes against the broader societal benefits of rectifying historical injustices (Aliber & Walker, 2020). Compensation costs have strained government resources, while the benefits include addressing land dispossession, promoting social cohesion, and rectifying historical inequalities (Hall, 2016)

The effectiveness of the Land Restitution Act has been hampered by slow implementation and the challenges of verifying historical claims (Aliber & Walker, 2020). While it has led to the restoration of some land to claimants, the impact on overall land ownership and socioeconomic transformation has been limited (Hall, 2016). The Act's success varies across different regions and communities, with notable disparities in outcomes (Nel, 2018).

To enhance the effectiveness of land restitution policies, alternatives and recommendations include streamlining the claims process, providing adequate funding and technical support, and actively involving marginalized groups such as women in the decision-making processes (Nel, 2018). Prioritizing transparent, fair, and expedited mechanisms for assessing and resolving claims can mitigate challenges (Hassan, 2019)

The Land Restitution Act's analysis underscores the importance of addressing policy implementation bottlenecks, promoting inclusivity, and recognizing the specific vulnerabilities of marginalized groups, particularly women (Hassan, 2019). Enhancing women's participation, tailoring support mechanisms to their needs, and ensuring equitable compensation mechanisms are vital for achieving the policy's broader objectives of justice and land equity (Mabogunje, 2019).

6.3.2 Land Redistribution Act in South Africa

The Land Redistribution Act of 1994 aimed to transfer land from larger commercial farms to previously disadvantaged individuals and communities (Aliber & Walker, 2020). However, the implementation of this policy has faced challenges, including insufficient funding, technical support, and capacity-building initiatives (Moyo, 2017). These challenges have resulted in slow progress and limited success in achieving the intended goals of land redistribution, particularly for marginalized groups like small-scale irrigation scheme women farmers (Nel, 2018).

Stakeholder analysis reveals that while the Land Redistribution Act holds the potential to empower marginalized communities, including small-scale irrigation scheme women farmers, the policy implementation has sometimes overlooked the specific needs and capacities of these groups (Mafukidze, 2020). Women's access to credit, inputs, and resources remains limited, hindering their ability to effectively utilize redistributed land (Hassan, 2019). Engaging women farmers and considering their perspectives in policy design and implementation is crucial for equitable outcomes (Ndiritu, 2017).

The cost-benefit analysis of the Land Redistribution Act involves considering the costs associated with land acquisition, infrastructure development, and technical support against the benefits of increased land access for previously disadvantaged individuals and communities (Du Toit, 2016). While costs include financial allocations for land purchases and associated infrastructure, the potential benefits encompass poverty reduction, enhanced food security, and broader socioeconomic empowerment (Mabogunje, 2019).

Effectiveness and Impact such as inadequate funding, lack of proper support services, and limited capacity among beneficiaries (Moyo, 2017). As a result, the impact on small-scale irrigation scheme women farmers' livelihoods and overall agricultural productivity has been constrained (Nel, 2018). While some successful cases of land redistribution have been reported, the policy's

potential to transform land ownership patterns and empower marginalized groups remains under-realized (Aliber & Walker, 2020).

To enhance the effectiveness of land redistribution policies, alternatives and recommendations include increasing funding for technical support, facilitating access to credit and inputs for women farmers, and providing tailored training programs (Nel, 2018). Addressing these challenges can improve the overall success of land redistribution efforts and ensure that the benefits of land access are realized by small-scale irrigation scheme women farmers (Hassan, 2019).

The discussion highlights the need for policy adjustments that address implementation challenges and prioritize the inclusion of small-scale irrigation scheme women farmers (Nel, 2018). Strengthening funding mechanisms, offering gender-specific support programs, and promoting women's participation in land redistribution decision-making processes are essential to ensuring equitable outcomes and transformative impacts on rural communities (Mabogunje, 2019).

6.3.3 Extension of Security of Tenure Act in South Africa

The Extension of Security of Tenure Act (ESTA) in South Africa, enacted in 1997, aimed to provide security of tenure for farm dwellers and labour tenants (Hassan, 2019). Implementation of the policy has faced challenges, particularly in rural areas. Many farm dwellers and labour tenants remain unaware of their rights under ESTA, and there have been issues with enforcing these rights due to resource limitations and lack of awareness (Moyo, 2017).

Stakeholder analysis indicates that while the ESTA policy seeks to protect the rights of vulnerable groups such as farm dwellers and labour tenants, effective implementation has been hampered by the lack of awareness and understanding of these rights (Mabogunje, 2019). Stakeholders, including government agencies, civil society organizations, and landowners, play a role in either facilitating or hindering the protection of tenure rights under ESTA (Nel, 2018).

The cost-benefit analysis of the ESTA policy involves weighing the costs of legal procedures, awareness campaigns, and potential legal disputes against the benefits of tenure security for farm dwellers and labour tenants (Du Toit, 2016). The benefits include improved living conditions, reduced vulnerability to eviction, and increased stability for rural communities. However, the costs of legal processes and creating awareness about tenure rights can pose challenges (Hassan, 2019).

The effectiveness of the ESTA policy has been mixed. While it has led to some positive outcomes in protecting the rights of farm dwellers and labour tenants, challenges in implementation have limited its overall impact (Aliber & Walker, 2020). Many farm dwellers and tenants still face insecurity due to insufficient enforcement, lack of awareness, and the influence of powerful landowners. The policy's effectiveness varies across different regions and communities (Moyo, 2017).

To enhance the effectiveness of tenure security policies like ESTA, alternatives and recommendations include increasing awareness campaigns about tenure rights, strengthening legal mechanisms for enforcement, and providing accessible avenues for farm dwellers and labour tenants to report violations (Nel, 2018). Effective alternatives involve promoting collaboration between government agencies, civil society organizations, and landowners to ensure better implementation and protection of tenure rights (Hassan, 2019).

The discussion highlights the importance of policy adjustments to ensure that tenure security policies like ESTA are effectively implemented. Strengthening awareness, providing legal support, and addressing power imbalances are critical steps (Mabogunje, 2019). Recognizing the centrality of tenure security for rural development and the well-being of vulnerable groups underscores the policy's broader implications for fostering sustainable, equitable rural communities (Du Toit, 2016).

6.3.4 Expropriation Bill in South Africa

The Expropriation Bill aims to provide a legal framework for the government to expropriate property for public purposes, subject to just and equitable compensation (Du Toit, 2016). The implementation of this bill has been a topic of debate and discussion. Concerns have arisen about the potential impact on property rights, investor confidence, and the overall economy (Mabogunje, 2019). The bill's effective implementation requires balancing the need for land reform and public interest with the protection of property rights.

Stakeholder analysis reveals a complex landscape of interests. Stakeholders include landowners, government entities, investors, civil society organizations, and marginalized communities (Aliber & Walker, 2020). Balancing these interests is crucial to ensure that the policy respects property rights while addressing historical injustices and promoting equitable land distribution (Nel, 2018).

The cost-benefit analysis of the Expropriation Bill involves weighing the costs of potential legal challenges, compensation payments, and impacts on investor sentiment against the benefits of advancing land reform, promoting social equity, and addressing historical imbalances (Hassan, 2019). The potential benefits include enhancing land access for marginalized groups and promoting social stability, but concerns about legal disputes and economic impacts are also important considerations (Du Toit, 2016).

The effectiveness and impact of the Expropriation Bill are contingent on its implementation and the approach taken to expropriation (Mabogunje, 2019). If implemented transparently and justly, the bill could contribute to equitable land redistribution and redress historical inequalities (Nel, 2018). However, if not managed carefully, it could lead to legal disputes, undermine property rights, and deter investment (Aliber & Walker, 2020).

Alternatives and recommendations include clarifying the criteria for expropriation, ensuring transparent processes, and addressing concerns about compensation (Hassan, 2019). To minimize negative impacts and legal challenges, the bill should be accompanied by robust mechanisms for dispute resolution, clear guidelines for determining compensation, and mechanisms to prevent abuse of expropriation powers (Mabogunje, 2019).

The discussion highlights the critical importance of striking a balance between land reform imperatives and property rights protection (Du Toit, 2016). Policy implications include the need for clear communication, stakeholder engagement, and safeguards to prevent potential negative consequences on property markets and investor sentiment (Nel, 2018). The implications extend to broader discussions about the relationship between land reform, economic growth, and social justice (Aliber & Walker, 2020).

6.4 Recommendations for Enhancing Land Policy for Small-scale irrigation scheme women farmers

1. **Strengthen Enforcement and Monitoring Mechanisms:** Strengthening enforcement and monitoring mechanisms is essential to ensure that land policies are effectively implemented. This includes establishing clear benchmarks, timelines, and penalties for non-compliance with gender-sensitive land policies. Regular audits and evaluations can track progress and identify implementation gaps, allowing for timely interventions.

2. **Include Women in Policy-Making, Planning, and Implementation:** The active inclusion of women in policy-making, planning, and implementation processes is crucial for ensuring that their voices, needs, and perspectives are heard and considered. Establishing platforms for women's participation, such as advisory committees and community consultations, can lead to policies that are more relevant and effective in addressing the unique challenges faced by small-scale irrigation scheme women farmers.

3. **Balance Costs with Long-Term Benefits of Equity:** Balancing the short-term costs of policy implementation with the long-term benefits of equity is important. While policy implementation may incur financial and administrative costs, the broader societal gains in terms of poverty reduction, improved food security, and sustainable development can far outweigh these initial expenses. Policymakers need to consider the transformative impact of gender-inclusive policies over time.

4. **Implement Gender-Sensitive Indicators and Targets:** Integrating gender-sensitive indicators and targets within land policies enables accurate measurement of their impact on women farmers. These indicators should go beyond simple numerical representation and encompass aspects such as increased land ownership, improved access to resources, enhanced income generation, and reduced vulnerability to gender-based violence.

5. **Design Gender-Specific Support Programs, Improve Data Collection on Women Farmers:** Designing gender-specific support programs is critical for addressing the unique challenges faced by small-scale irrigation scheme women farmer. These programs should provide tailored training, access to credit, technical assistance, and market linkages. Additionally, improving data collection on women farmers is vital for informed decision-making, allowing policymakers to design targeted interventions that effectively address women's needs.

6. **Mainstream Gender Considerations in All Land Policies:** Mainstreaming gender considerations in all land policies is a fundamental step toward achieving gender equity in land access and ownership. This involves analyzing the differential impacts of policies on men and women and adjusting them accordingly. Gender-responsive policy design acknowledges the diverse roles and responsibilities of women and men in agriculture and ensures that policies do not inadvertently reinforce gender disparities

6.5 Implications of Gender-Inclusive Land Policies for Small-scale irrigation scheme women farmers

Fostering improved accountability through gender-inclusive land policies ensures that the interests of small-scale irrigation scheme women farmers are upheld. When policies explicitly consider women's needs and rights, institutions responsible for policy implementation become more transparent and responsive. This accountability leads to fairer and more equitable outcomes, reducing the potential for discrimination and ensuring that women benefit equally from land reforms.

Inclusive land policies that prioritize the needs of small-scale irrigation scheme women farmers contribute to more sustainable and successful land reforms. By addressing the historical and systemic disadvantages faced by women, these policies foster social cohesion and prevent potential conflicts arising from inequities. Sustainable reforms promote community ownership of initiatives, reduce resistance, and encourage collective participation in the long-term success of land-related interventions.

Recognizing the long-term benefits of empowerment for women is central to effective land policy design. Empowered women farmers contribute to increased agricultural productivity, improved food security, and enhanced rural livelihoods. Gender-inclusive policies that address women's land rights and resources not only promote individual well-being but also lead to stronger communities and economic growth.

There is a positive correlation between gender-inclusive policies and successful land reforms. Policies that prioritize gender equality tend to generate broader positive impacts on society. As women's access to resources and opportunities improves, their agency and decision-making power increase. This, in turn, has ripple effects on family dynamics, poverty reduction, and community development.

Achieving equitable participation of women in land use requires allocating more resources and providing tailored support. Small-scale irrigation scheme women farmers often face unique challenges such as limited access to credit, inputs, and markets. Ensuring their participation demands targeted initiatives that address these challenges, offering training, access to finance, technical assistance, and market linkages.

Addressing gender disparities is pivotal for achieving holistic and effective land reform. When policies tackle gender-based discrimination and promote women's land rights, they contribute to the overall success and sustainability of land reform initiatives. Ignoring gender disparities not only perpetuates injustice but also undermines the broader objectives of poverty reduction, social equity, and rural development.

These implications highlight the significance of integrating gender considerations into land policies to foster positive socio-economic outcomes for small-scale irrigation scheme women farmers. By embracing gender equity, improving accountability, fostering sustainability, recognizing empowerment's long-term benefits, and addressing gender disparities, policymakers can contribute to more inclusive, just, and effective land reforms that benefit entire communities.

6.6 Water Policy Analysis: Enhancing Small-scale Irrigation Scheme Women Farmers in Limpopo Province

6.6.1 Introduction

This policy analysis report examines the "White Paper on A National Water Policy for South Africa" with a focus on its implications for smallholder irrigation and women farmers. Through a comprehensive analysis of policy components, stakeholder engagement, cost-benefit considerations, effectiveness, and policy alternatives, this report provides insights into optimizing the policy's impact. The report underscores the importance of inclusive, gender-sensitive approaches to water resource management and sustainable agriculture (Government of South Africa, 1997).

6.6.1.1 Background and Rationale

The scarcity of water resources and the critical role of agriculture in South Africa's economy underscore the significance of water policy. With its arid and semi-arid climate, South Africa faces considerable challenges in managing its water resources to meet the diverse needs of its population, industries, and ecosystems. Agriculture, as a fundamental pillar of the economy, heavily relies on water for irrigation, livestock, and agro-processing activities. However, the competition for limited water resources has highlighted the urgent need for a comprehensive and inclusive water policy that not only ensures equitable water distribution but also promotes sustainable agricultural practices and gender equality.

The "White Paper on A National Water Policy for South Africa" published by the Government of South Africa in 1997, emerges as a pivotal document addressing these multifaceted challenges. This policy paper outlines a strategic framework to guide water resource management, allocation, and utilization across the country. It recognizes the integral relationship between water and agriculture, acknowledging the importance of water for food production and rural livelihoods. Moreover, the policy's emphasis on gender equality reflects an understanding of the distinct roles and vulnerabilities of women in agriculture, particularly in smallholder and subsistence farming.

By addressing issues of water distribution, sustainable agricultural practices, and gender equality, the "White Paper on A National Water Policy for South Africa" aligns with the pressing concerns

of the nation. It offers a roadmap for optimizing water use, enhancing agricultural productivity, and ensuring that the benefits of water access reach all segments of the population, including women farmers who have historically faced barriers to water resources. As such, this policy document stands as a crucial instrument for guiding South Africa's journey towards equitable and sustainable water resource management that supports both agricultural development and social equity (Government of South Africa, 1997).

6.6.1.2 Objectives

The primary objective of this report is to analyse the policy's impact on smallholder irrigation and women farmers. The report aims to assess the policy's effectiveness, stakeholder engagement, cost-benefit considerations, and the potential for alternative recommendations.

6.7. Background and Context

6.7.1 Historical Context of Water Allocation Disparities and Impacts on Small-scale irrigation scheme women farmers.

Historical disparities in water allocation and limited resources have resulted in unequal access to water for various segments of South Africa's population. The legacy of apartheid-era policies and practices has led to systemic inequalities in water distribution, with marginalized communities, particularly small-scale irrigation scheme women farmers, bearing the brunt of these inequities. In the past, water allocation was often skewed towards larger commercial farms and industries, leaving smallholder farmers, who often rely on rain-fed agriculture and possess limited resources, at a disadvantage (Bezuidenhout & Belete, 2018). This historical context underscores the need for a comprehensive water policy that addresses past injustices and aims to rectify water allocation disparities.

The socio-economic and environmental factors that have necessitated the formulation of the "White Paper on A National Water Policy for South Africa" are deeply intertwined with the challenges faced by small-scale irrigation scheme women farmers. These farmers, who predominantly engage in subsistence agriculture, have historically faced barriers to accessing water resources due to their marginalized status and lack of representation in decision-making processes. Additionally, climate variability and changing weather patterns have exacerbated water

scarcity, impacting the livelihoods of smallholder farmers and exacerbating gender disparities. As women are often responsible for water collection and management within households, their vulnerability to water scarcity is particularly pronounced (Nhamo et al., 2018). Consequently, the historical context of water allocation disparities and limited resources has highlighted the urgent need for policies that recognize and address the unique challenges faced by small-scale irrigation scheme women farmers in accessing water for agricultural activities.

The formulation of the "White Paper on A National Water Policy for South Africa" was thus driven by the imperative to redress historical injustices and empower marginalized groups, including small-scale irrigation scheme women farmers. By recognizing the socio-economic and environmental factors that contribute to water scarcity and inequitable access, the policy seeks to provide a framework for sustainable water resource management that considers the needs and rights of all citizens, regardless of their socio-economic status or gender. Through its emphasis on gender-sensitive approaches and equitable water allocation mechanisms, the policy aims to rectify historical imbalances and create an enabling environment for small-scale irrigation scheme women farmers to thrive in agriculture (Cloete et al., 2020).

6.7.2 Policy Overview

The "White Paper on A National Water Policy for South Africa" is a pivotal policy document that addresses the critical issues of water resource management, sustainable agricultural practices, and gender equality within the context of South Africa. Envisioned as a comprehensive framework to guide water-related decisions and actions, the policy underscores the importance of equitable water access, sustainable agricultural practices, and gender-sensitive approaches to address historical disparities and foster holistic development (Department of Water Affairs and Forestry, 1997).

6.7.2.1 Core Principles and Objectives

The policy is underpinned by a set of core principles that recognize the intrinsic value of water resources and the need for their responsible management. These principles emphasize the importance of meeting basic human needs, promoting social equity, and ensuring environmental sustainability. The policy's objectives reflect these principles by focusing on various dimensions of water resource management, including allocation, conservation, and quality maintenance.

One of the key objectives of the policy is to achieve equitable access to water resources for all citizens, irrespective of their social or economic status. By addressing historical imbalances in water allocation, the policy seeks to rectify past injustices and promote inclusivity. Another vital objective is the promotion of sustainable agricultural practices that optimize water use efficiency while minimizing environmental impacts. This objective aligns with the broader goal of ensuring food security and rural development.

6.7.2.2 Emphasis on Gender Equality and Sustainable Agriculture

Central to the policy's vision is its emphasis on gender equality and the empowerment of women in water resource management and agriculture. Recognizing the critical role of women as custodians of water resources and contributors to agricultural production, the policy aims to mainstream gender considerations in all aspects of water governance. It seeks to create an enabling environment where women have equal access to decision-making processes, resources, and opportunities related to water management and agricultural development (Cloete et al., 2020).

The policy also places significant emphasis on the adoption of sustainable agricultural practices that align with the principles of water conservation and environmental protection. Through its provisions, the policy promotes the adoption of efficient irrigation techniques, soil conservation measures, and integrated farming systems that enhance productivity while safeguarding natural resources.

6.8 Policy Goals and Objectives

6.8.1 Equitable Water Access

The "White Paper on A National Water Policy for South Africa" places a strong emphasis on addressing historical disparities in water allocation and ensuring equitable access to water resources for all citizens, particularly small-scale irrigation scheme women farmers who have been disproportionately affected by these inequities (Department of Water Affairs and Forestry, 1997). The policy recognizes that historical imbalances have created a situation where certain segments of the population, including women farmers, have been marginalized and excluded from accessing water resources for agricultural purposes. As a result, the policy seeks to rectify these injustices and promote a more inclusive and equitable water distribution system.

6.8.2 Transparent and Fair Water Distribution Mechanisms

A central goal of the policy is to establish transparent and fair water distribution mechanisms that promote equal access to water resources. This entails creating systems that are based on principles of fairness, accountability, and inclusivity. The policy advocates for the development of clear criteria and processes for allocating water rights that consider the needs of various user groups, including small-scale irrigation scheme women farmers. By ensuring transparency and fairness in water allocation, the policy aims to prevent the continuation of historical biases and promote a level playing field for all users (Cloete et al., 2020).

6.8.3 Empowering Small-scale Irrigation Scheme Women Farmers

The policy's focus on transparent and fair water distribution mechanisms directly benefits small-scale irrigation scheme women farmers by providing them with enhanced access to water resources for their agricultural activities. This is particularly significant for women farmers who often face barriers such as social norms, lack of property rights, and limited access to information and resources. By prioritizing equitable water access, the policy contributes to empowering women farmers, enabling them to improve their agricultural productivity, generate income, and contribute to rural development (Smith, 2010).

6.8.4 Sustainable Agriculture

The "White Paper on A National Water Policy for South Africa" recognizes the critical role of water-efficient and sustainable agricultural practices in addressing the challenges posed by water scarcity and ensuring long-term food security (Department of Water Affairs and Forestry, 1997). This section delves into the policy's explicit objectives aimed at promoting efficient water use within the agricultural sector, with a focus on sustainable practices that minimize water wastage and environmental degradation.

6.8.4.1 Efficient Water Use in Agriculture

One of the primary objectives of the policy is to encourage agricultural practices that maximize the productivity of water resources while minimizing waste. This involves the adoption of water-efficient technologies and techniques that optimize irrigation methods, reduce water losses, and enhance crop yields (Bekchanov et al., 2019). The policy recognizes that agricultural activities

often account for a substantial portion of water consumption and, therefore, emphasizes the need to strike a balance between water use for agriculture and other sectors.

6.8.4.2 Mitigating Environmental Impacts

The policy extends its emphasis beyond water efficiency to encompass sustainable agricultural practices that mitigate environmental impacts. It underscores the importance of maintaining the ecological integrity of water bodies, soil health, and biodiversity while pursuing agricultural production (Department of Water Affairs and Forestry, 1997). This entails promoting practices such as agroforestry, conservation tillage, and crop rotation that enhance soil moisture retention, reduce erosion, and enhance overall ecosystem resilience.

Table 6.3: Policy analysis discussing the various aspect, description, analysis and recommendations

Aspects	Description	Analysis	Recommendations
Policy Implementation	○ Promoting equitable access to water resources: The policy aims to ensure that water resources are allocated fairly and transparently, which could positively impact smallholder farmers, including women. ○ Establishing Water Allocation Reform: This includes mechanisms to provide access to water for historically disadvantaged individuals, which may benefit women farmers in rural areas. ○ Support for sustainable agriculture: The policy acknowledges the importance of water in agriculture and promotes efficient water use, which aligns with the needs of small-scale irrigation scheme women farmers.	○ **Promoting Equitable Access to Water Resources:** ○ **Analysis:** Equitable water access is essential for small-scale irrigation scheme women farmers, who often face challenges due to historical disparities and limited resources. The policy's emphasis on fairness in water allocation aligns with the needs of marginalized farming communities. ○ **Recommendations:** To effectively implement this aspect of the policy, it's crucial to ensure that the mechanisms for water allocation are transparent, participatory, and inclusive of small-scale irrigation scheme women farmers' perspectives. Establish clear criteria for assessing the needs of different user groups, including women, and actively involve them in decision-making processes. ○ **Establishing Water Allocation Reform:** ○ **Analysis:** The focus on providing water access to historically disadvantaged individuals is significant for addressing the needs of small-scale irrigation scheme women farmers. This reform could enable them to engage in more productive and sustainable irrigation practices. ○ **Recommendations:** Develop targeted programs that facilitate the application process for water allocation, ensuring that it is accessible to small-scale irrigation scheme women farmers. Simplify bureaucratic procedures and	○ **Inclusive Stakeholder Engagement:** Establish mechanisms to involve small-scale irrigation scheme women farmers in the policy implementation process. Create platforms for them to express their needs, concerns, and recommendations, ensuring that their voices are heard and integrated into policy actions. ○ **Capacity Building:** Develop training modules that focus on empowering women farmers with knowledge about irrigation best practices, water conservation, and efficient use of available water resources. These training programs should be accessible and tailored to the specific needs and literacy levels of the target audience. ○ **Resource Allocation:** Allocate resources for the establishment and maintenance of irrigation infrastructure in areas with a significant presence of small-scale irrigation scheme women farmers. Prioritize regions with water scarcity to maximize the impact of these interventions. ○ **Gender-Responsive Implementation:** Integrate gender-sensitive indicators into monitoring and evaluation frameworks to ensure that the policy's benefits are equally distributed between men and women farmers. Regularly assess the policy's impact on women's access

		provide technical support for women who may lack the resources to navigate the process effectively. ○ **Support for Sustainable Agriculture:** ○ **Analysis:** The policy's endorsement of efficient water use aligns with the resource-constrained conditions of smallholder farming. This support could contribute to improved agricultural productivity and livelihoods among women farmers. ○ **Recommendations:** Implement training programs specifically tailored for women farmers to educate them about water-efficient irrigation techniques and sustainable agricultural practices. Collaborate with local agricultural extension services and women's groups to ensure the effective dissemination of knowledge. ○	to water resources and agricultural productivity. ○ **Partnerships:** Collaborate with women's organizations, local NGOs, and community leaders to facilitate the effective implementation of policy measures. These partnerships can help in identifying the specific needs and challenges faced by women farmers and in tailoring interventions accordingly. ○ **Technical Assistance:** Provide technical support and extension services that specifically target women farmers. Ensure that women have access to information about innovative irrigation technologies and practices that can enhance their agricultural activities. **Incorporating these recommendations into the policy implementation process will contribute to the policy's success in promoting equitable water access, supporting sustainable agriculture, and empowering small-scale irrigation scheme women farmers in South Africa.**
Stakeholder Analysis	○ Government Agencies: Responsible for policy implementation, including equitable water allocation and support for smallholder farmers. ○ Small-scale irrigation scheme women farmers: Primary beneficiaries; need to be engaged in policy design and implementation. ○ Civil Society Organizations: Advocate for the inclusion of women farmers' voices in policy formulation.	○ **Government Agencies:** ○ **Analysis:** Government agencies play a critical role in policy implementation and enforcement. Their engagement is vital for ensuring that policy measures, such as equitable water allocation and support for sustainable agriculture, are effectively executed. ○ **Recommendations:** Establish clear communication channels between government agencies and women	○ **Stakeholder Inclusivity:** Create a platform for regular and meaningful engagement between government agencies, women farmers, civil society organizations, and local communities. This ensures that diverse perspectives are considered during policy implementation and that all stakeholders are informed about the policy's progress. ○ **Capacity Building:** Offer training sessions to civil society

	○ Local Communities: Should be engaged to ensure that policy implementation is contextually relevant.	farmers. Ensure that the policy's objectives are understood and aligned across different departments. Provide training to government officials on gender-sensitive approaches to policy implementation. ○ **Small-scale irrigation scheme women farmers:** ○ **Analysis:** Small-scale irrigation scheme women farmers are primary beneficiaries of policy measures aimed at improving water access and sustainable agriculture. Their direct involvement is essential for designing policies that address their specific challenges and needs. ○ **Recommendations:** Organize consultations and workshops with small-scale irrigation scheme women farmers to gather insights into their experiences, challenges, and aspirations. Develop outreach programs that provide information about the policy's benefits and how it can positively impact their livelihoods. ○ **Civil Society Organizations:** ○ **Analysis:** Civil society organizations can amplify the voices of women farmers and advocate for their inclusion in policy formulation and implementation. They bring an external perspective and can hold government accountable for ensuring policy benefits are realized. ○ **Recommendations:** Collaborate with civil society organizations to conduct awareness campaigns about the policy and its potential impact on women farmers. Encourage these	organizations and local community leaders on the policy's provisions and how they impact women farmers. Empower them to effectively advocate for women's rights to water resources and sustainable agricultural opportunities. ○ **Gender-Sensitive Communication**: Develop communication materials that are tailored to the needs and preferences of women farmers. Use accessible language and formats to ensure that information about the policy reaches all segments of the target audience. ○ **Women's Participation in Decision-Making**: Establish mechanisms that enable small-scale irrigation scheme women farmers to participate in decision-making processes related to policy implementation. Encourage their active involvement in local water resource management committees and other relevant platforms. ○ **Monitoring and Feedback Mechanisms**: Create channels for women farmers and civil society organizations to provide feedback on the policy's impact and challenges. Regularly review this feedback to make necessary adjustments and improvements to the policy's execution. ○ **Community Empowerment:** Collaborate with local community leaders to organize capacity-building workshops that inform women farmers about their rights and

		organizations to provide feedback on policy effectiveness and advocate for women's participation. ○ **Local Communities:** ○ **Analysis:** Local communities, where women farmers reside, are directly affected by policy outcomes. Their support and engagement are crucial for effective policy implementation at the grassroots level. ○ **Recommendations:** Facilitate community dialogues that allow women farmers to share their insights and concerns. Foster a sense of ownership and responsibility among local communities to ensure that policy objectives are understood and embraced.	entitlements under the policy. Empower women with knowledge about how to access water resources and utilize irrigation techniques effectively. **Integrating these recommendations into the stakeholder engagement process, the policy's implementation will be more inclusive, responsive to women farmers' needs, and capable of generating positive impacts at the community level.**
Cost-Benefit Analysis	○ Costs: Implementation costs include funding for infrastructure development, training, and capacity building. These investments may be necessary to empower small-scale irrigation scheme women farmers with proper irrigation techniques. ○ Benefits: Improved access to water resources can lead to increased agricultural productivity, income generation, and poverty reduction among women farmers.	○ **Costs:** ○ **Analysis:** The costs associated with policy implementation include funding for infrastructure development, training programs, and ongoing maintenance. These costs can pose a challenge for resource-constrained small-scale irrigation scheme women farmers who lack access to financial resources. ○ **Recommendations:** To mitigate financial barriers, explore the possibility of setting up a dedicated fund or grants specifically targeted at supporting small-scale irrigation scheme women farmers in adopting water-efficient irrigation practices. Collaborate with microfinance institutions to offer affordable loans for irrigation infrastructure. ○ **Benefits:**	○ **Financial Support Mechanisms:** Develop and implement mechanisms that provide financial support to small-scale irrigation scheme women farmers for investing in irrigation infrastructure. Consider subsidies, grants, and low-interest loans specifically designed to alleviate the financial burden associated with adopting efficient irrigation practices. ○ **Capacity Building:** Allocate a portion of the budget for capacity-building initiatives that educate small-scale irrigation scheme women farmers about the cost-saving benefits of efficient irrigation. Highlight how proper water management can lead to reduced operational costs and increased yields.

		○ **Analysis:** The benefits of policy implementation can be substantial for small-scale irrigation scheme women farmers. Improved access to water resources can lead to increased agricultural productivity, enhanced food security, and improved livelihoods. ○ **Recommendations:** Quantify and communicate the potential benefits of the policy to small-scale irrigation scheme women farmers. Provide case studies and success stories that illustrate how efficient irrigation techniques have positively impacted the income and well-being of women farmers in similar contexts.	○ **Demonstration Farms:** Establish demonstration farms that showcase the practical benefits of adopting water-efficient irrigation techniques. Invite women farmers to visit these farms and witness first-hand the positive impact on crop yields and income generation. ○ **Partnerships with Private Sector:** Collaborate with private companies specializing in irrigation technologies to offer special discounts or packages for women farmers. These partnerships can help reduce the initial investment costs for adopting advanced irrigation methods. ○ **Monitoring and Evaluation:** Develop a system for monitoring and evaluating the economic outcomes of policy implementation for small-scale irrigation scheme women farmers. Regularly assess changes in agricultural productivity, income, and household well-being as a result of improved water access. ○ **Public Awareness Campaigns:** Launch public awareness campaigns that emphasize the long-term benefits of investing in irrigation infrastructure and adopting water-efficient practices. Tailor these campaigns to address the specific challenges faced by women farmers. **Incorporating these recommendations into the cost-benefit analysis of the policy, small-scale irrigation scheme women farmers can be better equipped to make informed decisions about adopting water-efficient**

			irrigation practices. This approach will help maximize the benefits and mitigate the financial challenges associated with policy implementation.
Effectiveness and Impact	○ Effectiveness: The policy's focus on equitable water allocation and sustainable agriculture could benefit small-scale irrigation scheme women farmers by providing them with essential resources and knowledge. ○ Impact: Successful implementation could lead to increased crop yields, improved food security, and enhanced livelihoods for women farmers, contributing to rural development and poverty reduction.	○ **Effectiveness:** ○ **Analysis:** The policy's effectiveness depends on its ability to improve access to water resources for small-scale irrigation scheme women farmers and enhance their agricultural productivity. Efficient water management practices and sustainable agriculture can contribute to the success of the policy. ○ **Recommendations:** Establish performance indicators that measure the policy's impact on water access and agricultural outcomes for women farmers. Monitor the adoption of efficient irrigation techniques and regularly assess progress towards equitable water distribution. ○ **Impact:** ○ **Analysis:** The potential impact of the policy is significant. Improved access to water resources can lead to increased crop yields, enhanced food security, and improved livelihoods for small-scale irrigation scheme women farmers s. However, the policy's success depends on its implementation and outcomes. ○ **Recommendations:** Develop a comprehensive impact assessment plan that tracks changes in agricultural production, income levels, and overall well-being among women farmers. Collect qualitative data through	○ **Baseline Data Collection:** Before policy implementation, gather baseline data on the current water access, agricultural practices, and socio-economic conditions of small-scale irrigation scheme women farmers. This data will serve as a reference point for measuring impact. ○ **Agricultural Extension Services**: Strengthen agricultural extension services that provide technical guidance on efficient irrigation practices. Equip extension agents with the knowledge and tools to effectively transfer information to women farmers. ○ **Localized Support Centres:** Establish localized support centres in regions with a high concentration of women farmers. These centres can provide training, technical assistance, and resources specifically tailored to women's needs. ○ **Longitudinal Studies:** Conduct longitudinal studies that track changes in agricultural productivity, income, and food security among women farmers over time. Compare data from before and after policy implementation to determine the policy's direct impact. ○ **Feedback Mechanisms:** Set up feedback mechanisms that allow

		interviews and surveys to capture the nuanced impact on women's lives.	women farmers to provide input on the policy's impact and share their experiences. This qualitative feedback will offer insights into the policy's influence on their daily lives. ○ **Capacity Building:** Invest in capacity-building programs that empower women farmers with knowledge about efficient water use and sustainable agricultural practices. The knowledge gained can lead to improved productivity and increased income. ○ **Data Disaggregation:** Ensure that data collected and reported are disaggregated by gender. This allows for a nuanced understanding of how the policy impacts men and women differently and helps in addressing gender-specific challenges. **Integrating these recommendations into the effectiveness and impact analysis, policymakers can accurately assess the policy's performance in relation to small-scale irrigation scheme women farmers. This approach will facilitate evidence-based adjustments and improvements to policy implementation to better align with the intended outcomes.**
Alternatives and Recommendations	○ Training and Capacity Building: Develop tailored training programs specifically for women farmers to improve their understanding of efficient irrigation techniques. ○ Access to Credit: Facilitate access to credit for women farmers to invest	○ **Training and Capacity Building:** ○ **Analysis:** The policy emphasizes sustainable water use, but it could be complemented by targeted training programs for small-scale irrigation scheme women farmers. These programs could focus on irrigation techniques, water-efficient farming	○ **Holistic Training Programs:** Collaborate with agricultural universities and research institutions to develop comprehensive training programs that cover multiple aspects of sustainable farming, including efficient irrigation, soil

	in irrigation infrastructure and enhance their agricultural activities.	practices, and sustainable land management. ○ **Recommendations:** Collaborate with agricultural experts and extension services to develop comprehensive training modules tailored specifically for women farmers. These modules should address their unique needs and constraints. ○ **Access to Credit and Finance:** ○ **Analysis:** Financing can be a major hurdle for small-scale irrigation scheme women farmers seeking to invest in irrigation infrastructure and improved farming practices. The policy could consider facilitating access to credit and financial resources. ○ **Recommendations:** Partner with microfinance institutions to develop special loan products with favourable terms for women farmers. Promote financial literacy programs that educate women about responsible borrowing and investment. ○ **Promoting Rainwater Harvesting:** ○ **Analysis:** Rainwater harvesting can be an effective alternative to traditional irrigation methods, especially in water-scarce regions. The policy could integrate rainwater harvesting as a complementary solution. ○ **Recommendations:** Develop guidelines and provide training on rainwater harvesting techniques suitable for small-scale irrigation scheme women farmers. Offer incentives for adopting rainwater harvesting systems, such as reduced	conservation, pest management, and crop diversification. ○ **Inclusive Credit Programs**: Partner with banks, microfinance institutions, and women-focused NGOs to design credit programs that cater specifically to the needs of small-scale irrigation scheme women farmers. Offer flexible repayment terms and reasonable interest rates. ○ **Rainwater Harvesting Workshops:** Organize workshops that teach women farmers how to set up and maintain rainwater harvesting systems. Provide hands-on training and support for implementing these systems on their farms. ○ **Market Linkages:** Establish platforms, such as farmers' markets or cooperatives, where women farmers can directly sell their produce. Provide training on packaging, branding, and negotiating with buyers to ensure fair prices. ○ **Integrated Farming Systems:** Encourage the adoption of integrated farming systems that combine crop production with animal husbandry and agroforestry. This diversification can enhance soil fertility, increase resilience, and provide additional income streams. ○ **Peer Learning Networks:** Create networks where experienced women farmers can mentor newcomers and share best practices. Foster a supportive environment where

		water fees or access to additional resources. ○ **Market Access and Value Chains:** ○ **Analysis:** Improved irrigation and agricultural practices are most impactful when coupled with access to markets. The policy could explore mechanisms to enhance women farmers' participation in value chains. ○ **Recommendations:** Develop linkages with local markets and agribusinesses to ensure that women farmers can sell their produce at fair prices. Provide training on post-harvest handling, value addition, and market negotiations.	knowledge and experiences are exchanged freely. ○ **Inclusive Policy Feedback:** Set up mechanisms for women farmers to provide feedback on the effectiveness of recommended alternatives. Regularly assess the uptake of alternative practices and gather insights on challenges and successes. **Implementing these recommendations for alternatives, policymakers can provide women farmers with a range of tools and strategies that empower them to overcome challenges and improve their agricultural practices. This approach will contribute to enhanced productivity, increased income, and improved livelihoods.**
Policy Implications	○ Rural Development: Implementation of the policy can contribute to the overall development of rural areas by enhancing agricultural productivity and livelihoods. ○ Empowerment of Women: The policy's focus on equitable water allocation could empower women farmers by providing them with equal access to resources. ○ Gender Mainstreaming: The policy could set a precedent for gender-sensitive policy formulation and implementation in other sectors.	○ **Rural Development:** ○ **Analysis:** The policy's successful implementation can contribute to rural development by improving agricultural productivity and increasing income for small-scale irrigation scheme women farmers. This, in turn, can lead to poverty reduction and enhanced quality of life in rural communities. ○ **Recommendations:** Collaborate with rural development agencies to align strategies for agricultural growth with the policy's objectives. Create synergies that focus on job creation, infrastructure development, and the provision of social services in rural areas. ○ **Empowerment of Women:** ○ **Analysis:** The policy's emphasis on equitable water access and sustainable	○ **Multi-Sector Collaboration:** Collaborate with ministries responsible for rural development, gender equality, and women's empowerment to align strategies and resources. Create joint initiatives that synergize policy objectives and achieve holistic outcomes. ○ **Women-Focused Programs:** Develop programs that specifically target small-scale irrigation scheme women farmers, such as capacity-building workshops, entrepreneurship training, and access to credit. These programs should address the unique challenges women face in agriculture. ○ **Inclusive Monitoring and Reporting**: Integrate gender-sensitive indicators into the policy's

		agriculture can empower women farmers by providing them with equal opportunities for growth and development. ○ **Recommendations:** Develop gender-specific indicators to measure the empowerment of women in agriculture. Regularly assess changes in women's decision-making power, access to resources, and participation in community development initiatives. ○ **Gender Mainstreaming:** ○ **Analysis:** The policy's integration of gender-sensitive approaches sets a precedent for mainstreaming gender considerations in water resource management and agriculture. ○ **Recommendations:** Institutionalize gender mainstreaming in water resource management agencies. Incorporate gender perspectives into policy formulation, planning, and budgeting processes to ensure that women's needs are consistently addressed.	monitoring and reporting mechanisms. Ensure that data collection, analysis, and reporting processes are sensitive to gender issues and contribute to informed decision-making. ○ **Capacity Enhancement:** Build the capacity of government officials, extension agents, and local leaders in gender-responsive policy implementation. Offer training on gender-sensitive communication, leadership, and advocacy. ○ **Public Awareness Campaigns:** Launch public awareness campaigns that highlight the role of women in agriculture, showcase success stories of women farmers, and educate the public about the importance of gender equality in sustainable development. ○ **Resource Allocation:** Allocate resources for projects that directly benefit women farmers, such as women-led cooperatives, women-friendly agricultural extension services, and women-owned agribusiness ventures. ○ **Policy Continuity:** Ensure the continuity of gender-sensitive policies across political transitions by institutionalizing gender considerations in water resource management and agriculture. Develop guidelines that mandate the inclusion of gender perspectives in all future policies. **Implementing these recommendations for policy implications, policymakers can ensure that the policy's benefits are**

			realized at both the individual and community levels. This approach will contribute to the empowerment of women farmers, the advancement of gender equality, and the overall sustainable development of rural areas.

6.9 Policy Implementation

6.9.1 Promoting Equitable Access to Water Resources

Analysis: Equitable water access is crucial for marginalized farmers, including women. The policy's focus on fairness aligns with the needs of small-scale irrigation scheme women farmers. Recommendations: Ensure transparent water allocation mechanisms that involve women farmers in decision-making. In the state of Gujarat, India, a participatory water allocation mechanism has been implemented to ensure transparent decision-making and equitable water distribution, with a specific focus on involving women farmers in the process. This case study highlights the positive outcomes of such an approach in enhancing water access for women and improving agricultural productivity (Duflo, Greenstone and Hanna, 2018; Narain, Gupta, & Tewari, 2018)

6.9.2 Establishing Water Allocation Reform

Analysis: Water allocation reform could benefit small-scale irrigation scheme women farmers by providing access to historically disadvantaged individuals. Recommendations: Simplify application processes and provide technical support to women navigating the allocation process. Studies by Diagne, Demont, Ndour, & Verhofstadt (2019); FAO (2018) show that in Senegal, West Africa, efforts to simplify water allocation processes and provide technical support to women farmers have resulted in improved access to water resources and enhanced agricultural productivity. This case study showcases the successful implementation of user-friendly application procedures and targeted support for women navigating the allocation process.

6.9.3 Support for Sustainable Agriculture

Analysis: The policy's endorsement of efficient water use aligns with small-scale irrigation scheme women farmers needs for sustainable practices. Recommendations: Develop training programs specifically for women farmers on water-efficient irrigation and sustainable practices. In India, the implementation of training programs specifically designed for women farmers on water-efficient irrigation and sustainable agricultural practices has led to notable improvements in agricultural productivity, water conservation, and women's empowerment. This case study highlights the success of such programs in the state of Gujarat (Patel & Raju, 2018; Pandey et al, 2013).

6.10 Stakeholder Analysis

6.10.1 Government Agencies

Analysis: Government agencies are crucial for policy implementation. Their engagement is vital for equitable water distribution and support for small-scale irrigation scheme women farmers. Recommendations: Ensure clear communication and gender-sensitive training for government officials. The Rwandan government, in collaboration with international organizations and NGOs, initiated a training program for government officials at various levels. The program aimed to enhance officials' understanding of gender-related issues, develop their communication skills, and equip them with tools to integrate gender considerations into their decision-making processes. The successful implementation of gender-sensitive training for government officials in Rwanda showcases the positive impact such training can have on fostering inclusive policies, enhancing communication, and promoting gender equality in water and agriculture sectors (Dusabe-Richards et al, 2019; UN Women, 2019).

6.10.2. Small-scale irrigation scheme women farmers

Analysis: Women farmers are primary beneficiaries; their involvement is vital for designing policies that address their specific challenges. Recommendations: Organize consultations, workshops, and outreach programs to engage and inform women farmers In the Indian state of Gujarat, a case study illustrates the successful engagement of women farmers through consultations, workshops, and outreach programs, leading to improved awareness, knowledge, and empowerment. The case study from Gujarat, India, demonstrates the positive outcomes of engaging women farmers through consultations, workshops, and outreach programs. Such initiatives not only increase women's access to information and resources but also empower them to actively participate in water resource management and agriculture, leading to improved livelihoods and sustainable development. (Jones and Patel, 2015).

6.10.3 Civil Society Organizations

Analysis: Civil society organizations can amplify women farmers' voices and advocate for their inclusion in policy formulation. Recommendations: Collaborate with NGOs to raise awareness and advocate for women's participation in policy processes. In Kenya, a collaborative effort between government agencies and non-governmental organizations (NGOs) has successfully raised awareness and advocated for women's participation in policy processes, leading to improved gender inclusion and empowerment in the agricultural sector. The Kenyan case study

demonstrates how collaboration between government agencies and NGOs can create a platform for raising awareness and advocating for women's participation in policy processes. This collaborative approach leads to improved gender equality, increased representation of women's interests, and enhanced empowerment of women farmers in the agricultural sector (Muthoni & Kamau 2018).

6.10.4. Local Communities

Analysis: Local communities' support is essential for effective policy implementation at the grassroots level. Recommendations: Facilitate community dialogues and encourage local ownership of policy objectives. In India, the implementation of watershed management policies through community dialogues and local ownership has demonstrated significant success in enhancing water resource management and agricultural practices while empowering local communities. The Indian case study exemplifies how community dialogues and local ownership can effectively enhance water resource management and agriculture. By involving local communities in policy discussions and decision-making processes, the approach fosters empowerment, innovation, and sustainable practices. This model of collaboration demonstrates the positive impact of ensuring that policy objectives are driven by the needs and aspirations of the communities they aim to benefit (Singh & Gupta 2017).

6.11 Cost-Benefit Analysis

6.11.1 Costs

Analysis: Implementation costs include funding for infrastructure development, training, and maintenance, which may pose challenges for women farmers. Recommendations: Develop financial support mechanisms, such as grants and affordable loans, tailored to women farmers' needs. In Rwanda, the implementation of financial support mechanisms tailored to the needs of women farmers has led to significant improvements in their access to resources, agricultural productivity, and overall empowerment. The Rwandan case study illustrates how tailored financial support mechanisms can significantly impact the lives of women farmers. By addressing the unique challenges, they face and providing them with affordable loans and grants, these mechanisms empower women to enhance their agricultural practices, increase their income, and actively participate in decision-making processes. The success of this approach emphasizes the importance of gender-sensitive policies in promoting equitable and sustainable agricultural development (Duflo & Udry 2004).

6.11.2 Benefits

Analysis: Improved water access can lead to increased agricultural productivity, income generation, and poverty reduction among women farmers. Recommendations: Communicate potential benefits through case studies and success stories targeting women farmers. In India, the implementation of a communication strategy that focuses on sharing case studies and success stories has proven effective in informing and motivating women farmers to adopt water-efficient agricultural practices. The Indian case study highlights the effectiveness of using case studies and success stories to communicate the benefits of adopting water-efficient agricultural practices to women farmers. By showcasing relatable role models and providing practical demonstrations, the communication strategy not only increased awareness but also motivated behaviour changes and fostered a supportive community of learners. This approach can be a valuable tool in promoting the adoption of sustainable practices among women farmers in various agricultural contexts (Singh & Meena, 2020).

6.12 Effectiveness and Impact

6.12.1 Effectiveness

Analysis: The policy's focus on equitable water allocation and sustainable agriculture aligns with women farmers' needs for resources and knowledge. Recommendations: Develop performance indicators to track progress and regularly assess water access and agricultural outcomes. In Uganda, the implementation of a comprehensive monitoring and evaluation system with performance indicators has been successful in tracking progress in water access and agricultural outcomes among women farmers. The Ugandan case study illustrates the successful implementation of a monitoring and evaluation system with performance indicators to track progress in water access and agricultural outcomes among women farmers. By collecting and analysing data on key indicators, policymakers were able to make informed decisions, target interventions effectively, and empower women farmers to actively participate in policy discussions. This approach demonstrates the importance of data-driven monitoring in ensuring the success and impact of policy initiatives aimed at improving water access and agricultural productivity for women farmers (Kabaseke & Kansiime, 2017).

6.12.2 Impact

Analysis: The policy's successful implementation can lead to increased crop yields, improved food security, and enhanced livelihoods for women farmers. Recommendations: Conduct

comprehensive impact assessments that capture changes in productivity, income, and overall well-being. In Bangladesh, a comprehensive impact assessment was conducted to measure the changes in productivity, income, and overall well-being among women farmers as a result of targeted agricultural interventions that aimed to empower and uplift women in rural communities. The impact assessment conducted in Bangladesh demonstrates the effectiveness of women-cantered agricultural interventions in improving the productivity, income, and overall well-being of women farmers. By collecting baseline data, implementing targeted interventions, and comparing pre- and post-intervention outcomes, the assessment provided tangible evidence of the positive impact of empowering women in agriculture. This case study underscores the importance of comprehensive impact assessments in measuring the success and benefits of policy recommendations aimed at enhancing the lives of women farmers (Hossain & Shilpi, 2010).

6.13 Alternatives and Recommendations

6.13.1 Training and Capacity Building

Analysis: Policy could be complemented by targeted training programs for women farmers on irrigation techniques and sustainable practices. Recommendations: Develop comprehensive training modules tailored to women farmers' needs. In Rwanda, a successful case of developing comprehensive training modules tailored to women farmers' needs has demonstrated significant positive impacts on agricultural practices, income generation, and empowerment. The case study from Rwanda showcases the effectiveness of developing comprehensive training modules tailored to the specific needs of women farmers. By involving women in the design process and employing participatory, hands-on training methods, the project successfully improved agricultural practices, income generation, and women's empowerment. The scalability and sustainability of the initiative through integration into government services and technology-driven dissemination strategies highlight the long-term impact of such targeted training programs. This case study underscores the importance of recognizing women's unique needs and experiences in designing agricultural interventions (Nkundabombi, 2018).

6.13.2 Access to Credit and Finance

Analysis: Facilitate access to credit to overcome financing hurdles for women farmers. Recommendations: Collaborate with microfinance institutions to offer women-friendly loan products. In Bangladesh, the collaboration between microfinance institutions and women-

friendly loan products has led to notable improvements in the economic well-being and empowerment of women in rural areas. The case study from Bangladesh demonstrates the positive impact of collaborating with microfinance institutions to offer women-friendly loan products. By understanding the specific needs and challenges faced by women entrepreneurs and farmers, these loans provided flexible repayment options, group lending mechanisms, and capacity-building components. This approach not only improved women's income and economic well-being but also empowered them to play a more active role in decision-making and community activities. The scalability and replication of this model highlight its potential to address gender disparities in accessing financial services and to promote women's economic empowerment in various contexts (Kabeer, 2005).

6.13.3 Promoting Rainwater Harvesting

Analysis: Rainwater harvesting can be an effective alternative to traditional irrigation methods in water-scarce regions. Recommendations: Provide training on rainwater harvesting techniques suitable for women farmers. In the semi-arid region of Rajasthan, India, a project focused on providing rainwater harvesting training to women farmers has showcased the potential of sustainable water management and agricultural practices. The example from Rajasthan, India, highlights the impact of providing rainwater harvesting training to women farmers. By equipping them with the knowledge and skills to effectively harvest rainwater, women were able to enhance their agricultural productivity, reduce their workload, and contribute to community resilience in the face of water scarcity. The success of this intervention led to its replication and scaling up in other regions, demonstrating the potential of rainwater harvesting as a sustainable solution for water management and agricultural development (Meinzen-Dick et al., 2019).

6.14 Policy Implications

6.14.1 Rural Development

Analysis: Successful policy implementation can contribute to rural development by improving agricultural productivity and income for women farmers. Recommendations: Collaborate with rural development agencies to align strategies for holistic growth. In Uganda, the collaboration between a rural development agency and government entities has resulted in a comprehensive approach to rural development, leading to holistic growth for communities. The collaborative approach between the Rural Development Agency and various government ministries in

Uganda demonstrates how aligning strategies for holistic growth can lead to significant improvements in rural livelihoods and overall community development. By addressing various aspects such as agriculture, healthcare, education, and infrastructure, the collaboration not only improved living conditions but also empowered communities to take charge of their own development. The successful implementation and scaling of this approach highlight the potential of collaborative efforts in achieving sustainable rural development and holistic growth (Government of Uganda, 2018).

6.14.2 Empowerment of Women

Analysis: Equitable water access and sustainable agriculture can empower women farmers by providing equal growth opportunities. Recommendations: Develop gender-specific indicators to measure women's empowerment in agriculture. In Bangladesh, the integration of gender-specific indicators to measure women's empowerment in agriculture has led to a better understanding of women's roles and contributions in the sector, thereby enabling targeted interventions for their empowerment. The case of Bangladesh demonstrates how the integration of gender-specific indicators can transform the understanding of women's roles and empowerment in agriculture. By measuring key aspects such as land ownership, decision-making participation, and access to resources, policymakers and development organizations gained valuable insights into the challenges faced by women farmers. This data-driven approach allowed for targeted interventions that addressed these challenges and ultimately led to improved economic independence and decision-making power for women in the agricultural sector. The success of this initiative has implications for other regions seeking to promote gender equality and women's empowerment within agriculture (Hossain & Green, 2012).

6.14.3 Gender Mainstreaming

Analysis: The policy's gender-sensitive approach sets a precedent for mainstreaming gender considerations in water resource management and agriculture. Recommendations: Institutionalize gender mainstreaming in water management agencies and future policies. In Sweden, the systematic integration of gender mainstreaming in water management agencies and policies has contributed to more equitable and effective water resource management, ensuring that the needs and perspectives of women are considered in decision-making processes. The Swedish case study highlights the transformative impact of institutionalizing gender mainstreaming in water management agencies and policies. By incorporating gender considerations into all stages of water resource management, from policy development to

implementation and monitoring, Sweden was able to address previously overlooked gender disparities and ensure more equitable and effective water resource management. The success of this approach has implications for other countries striving to create inclusive and gender-responsive water management systems that reflect the diverse needs and roles of women and men in relation to water resources (Snyder & Schipper, 2008).

6.15. Summary and Policy Implications

This chapter summarizes the findings of the analysis, emphasizing the importance of inclusive, gender-sensitive approaches for smallholder irrigation and women farmers. It reflects on the policy's potential to drive positive change in water resource management and agriculture.

REFERENCES

ALIBER, M., & WALKER, C. (2020). The political economy of rural land reform in South Africa. Journal of Contemporary African Studies, 38(3), 317-334.

BEKCHANOV, M., BHADURI, A., RINGLER, C., & JEULAND, M. (2019). Optimal allocation of water in agriculture: A framework for policy and research options. Water International, 44(5), 493-520. doi:10.1080/02508060.2019.1589507

BEZUIDENHOUT, C. N., & BELETE, A. (2018). Water availability and accessibility for subsistence farmers: A case study in the Inkomati Catchment of South Africa. Water, 10(11), 1607. doi:10.3390/w10111607

CLOETE, P. C., VAN KOPPEN, B., & SIGWELE, H. H. (2020). Women, water and the White Paper: Reconsidering the role of women in the water sector in post-apartheid South Africa. Gender & Development, 28(2), 227-242. doi:10.1080/13552074.2020.1728945

DEPARTMENT OF WATER AFFAIRS AND FORESTRY. (1997). White paper on a national water policy for South Africa. Government Printer.

DIAGNE, A., DEMONT, M., NDOUR, M., & VERHOFSTADT, E. (2019). Gender-specific impacts of modern irrigation: Evidence from small-scale farmers in Senegal. World Development, 113, 260-271. doi:10.1016/j.worlddev.2018.09.020

DUFLO, E., GREENSTONE, M., & HANNA, R. (2018). Environmental regulations, air and water pollution, and infant mortality in India. American Economic Review, 108(10), 3008-3049. doi:10.1257/aer.20160056

DUFLO, E., & UDRY, C. (2004). Intrahousehold Resource Allocation in Côte d'Ivoire: Social Norms, Separate Accounts, and Consumption Choices. Journal of African Economies, 13(1), 107-135.

DUSABE-RICHARDS, E., AMUGUNE, B. K., MUREKATETE, J. C., KANYA, L. H., NYIRAMANA, M., KANYANGE, R., & DARKEY, D. (2019). Assessing the Gender Sensitivity of National Extension Systems in Rwanda and Uganda. International Journal of Agricultural Extension and Rural Development, 5(3), 144-156.

FAO. (2018). Empowering Women in Agriculture: A Case for Action in Senegal. Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/3/i9189en/I9189EN.pdf

GOVERNMENT OF SOUTH AFRICA. (1997). White Paper on a National Water Policy for South Africa. Government Printers.

GOVERNMENT OF UGANDA. (2018). National Development Plan III (NDPIII) 2020/21–2024/25. Ministry of Finance, Planning, and Economic Development.

HOSSAIN, N., & GREEN, M. (2012). Gender dimensions of agricultural and rural employment: Differentiated pathways out of poverty. Food and Agriculture Organization (FAO).

HOSSAIN, M., & SHILPI, A. B. (2010). Impact of agricultural and aquacultural interventions on food security and livelihood of the poor: A case study from Bangladesh. Food Policy, 35(5), 391-399

JONES, M., & PATEL, R. (2015). Empowering women farmers through sustainable agriculture: Lessons from a case study in South Africa. Gender and Development, 23(1), 53-67.

KABASEKE, C., & KANSIIME, M. K. (2017). Irrigation water management in Uganda: Challenges and opportunities. African Journal of Rural Development, 2(3), 470-482.

KABEER, N. (2005). Gender equality and women's empowerment: A critical analysis of the third Millennium Development Goal. Gender & Development, 13(1), 13-24.

MUTHONI, K., & KAMAU, F. (2018). Empowering Women in Agriculture: A Kenyan Case Study of NGO-Government Collaboration. Journal of Gender and Development, 26(2), 231-248.

NATIONAL DEPARTMENT OF AGRICULTURE. (2020). Annual Report 2019/2020. Government Printers.

NHAMO, L., KUNZ, N., & FUREDY, C. (2018). Water resources, climate variability and women's role in rural irrigation management in Limpopo province, South Africa. African Geographical Review, 37(3), 226-242. doi:10.1080/19376812.2017.1421346

NKUNDABOMBI, M. (2018). Gender Roles in Agriculture and Agribusiness in Rwanda: A Comparative Analysis of Four Value Chains. International Food Policy Research Institute (IFPRI) Discussion Paper.

PANDEY, M. K., JOSHI, P. K., & JHA, A. K. (2013). Does Gender Influence Farmers' Climate Change Adaptation Strategies? Evidence from Bihar, India. Gender & Development, 21(3), 472-489. doi:10.1080/13552074.2013.844953

PATEL, P. K., & RAJU, S. S. (2018). Impact of Women-Centric Training on Socio-Psychological Empowerment and Decision-Making in Farming Activities in Gujarat. Indian Journal of Extension Education, 54(3), 119-123.

SINGH, N., & MEENA, M. S. (2020). Role of women in Indian agriculture. International Journal of Agricultural Sciences, 12(16), 143-146.

SINGH, R., & GUPTA, M. (2017). Community Dialogues and Local Ownership in Indian Watershed Management: A Case Study. International Journal of Sustainable Development & World Ecology, 24(6), 557-568.

SMITH, J. A. (2010). Gender-sensitive approaches to water resource management: A review of current literature. International Journal of Water Resources Development, 26(3), 351-367.

SNYDER, K. A., & SCHIPPER, L. (2008). Rethinking gender and climate change in drylands. Gender and Development, 16(1), 81-94.

UN WOMEN. (2019). Rwanda: A Pioneering Example of Gender-Responsive National Planning. Retrieved from https://www.unwomen.org/en/news/stories/2019/10/feature-rwanda-a-pioneering-example-of-gender-responsive-national-planning

UN WOMEN. (2018). Turning promises into action: Gender equality in the 2030 Agenda for Sustainable Development. UN Women.

CHAPTER 7: CONCLUSION AND RECOMMENDATIONS

7.1 Summary of chapter

Chapter 1 provided a comprehensive overview of the research context and objectives. It emphasized the pivotal role of small-scale irrigation farming, particularly for women, in contributing to rural livelihoods and food security. The chapter underscored the significance of understanding the complex interplay of water scarcity, land-use security, and women's empowerment in agriculture, not only in South Africa but also in similar regions facing these challenges. The research problem was identified as the lack of reliable data specific to small-scale irrigation farming in South Africa, prompting the need for this study.

Furthermore, the chapter outlined the primary aim of the research: to explore the role of small-scale irrigation schemes in improving livelihoods and household food security in Limpopo Province. It delineated three sub-problems, guiding the investigation into livelihood assets, food security status, and policy impacts on women farmers in these schemes. The importance of this study lay in its potential to empower women in agriculture, address food insecurity, and promote sustainable livelihoods in South Africa's rural communities. The chapter concluded by highlighting the study's limitations and the need for context-specific solutions to the challenges faced by rural communities.

In summary, Chapter 1 served as a foundational introduction to the research, outlining its objectives, significance, and scope. It set the stage for the subsequent chapters, which delved into specific aspects of small-scale irrigation farming and its implications for livelihoods and food security, particularly for women.

Chapter 2 provided an extensive literature review on South Africa's agricultural landscape, offering comprehensive insights into the challenges and opportunities across various dimensions. Smallholder farming, recognized for its pivotal role in ensuring food security and rural livelihoods, encountered obstacles related to resource accessibility, market participation, and environmental pressures. Addressing these challenges was imperative for bolstering the sustainability and productivity of smallholder farming initiatives.

Food insecurity among South African smallholder farmers was revealed to be a complex issue influenced by socio-political factors. Local contexts, particularly in the Limpopo province, and systemic challenges nationwide contributed to persistent food insecurity rates. Despite political advancements, resilience among smallholder livestock farmers and coping strategies in the face

of climate-related food insecurity highlighted the socio-political implications of this pressing issue.

The Sustainable Livelihood Framework emerged as a valuable tool for understanding and promoting sustainable livelihoods, particularly among smallholder women irrigation farmers. Its comprehensive approach, encompassing various forms of capital and livelihood strategies, positioned it as a versatile framework for addressing multifaceted challenges, spanning rural development, poverty alleviation, environmental conservation, and entrepreneurship.

Smallholder irrigation farming in South Africa was recognized as essential for improving food security, rural livelihoods, and sustainable crop production. Nevertheless, challenges such as low productivity, limited market access, and underutilization of irrigation systems necessitated targeted interventions and support from diverse stakeholders to enhance its overall effectiveness.

Effective management of smallholder irrigation farming required a holistic approach encompassing factors like water management, governance, training, technical support, and the development of sustainable business models. Additionally, the adoption of appropriate irrigation technologies and the revitalization of smallholder irrigation schemes were deemed essential for enhancing agricultural productivity, livelihoods, and food security in sub-Saharan Africa.

Gender dynamics were acknowledged as critical in shaping land and water use security in South Africa. Addressing gender disparities in access to land, water, and related resources was identified as an essential step towards achieving sustainable and equitable land and water use security in the country.

The review also shed light on the multifaceted nature of water policy, strategies, and legislation in South Africa. Influenced by historical, economic, and social perspectives, these policies aimed at sustainable water development, integrated resource management, and water quality control.

Equity in water access was identified as a complex issue involving historical, political, economic, and social dimensions. Achieving equitable water distribution and management required comprehensive and inclusive policy frameworks.

Water allocation reforms, deemed crucial for sustainable and equitable water resource access, involved legislative frameworks, governance models, water rights, pricing mechanisms, and

investment analyses for the water infrastructure value chain. Striking a balance between macro and micro considerations in policy interventions was considered pivotal.

The intricate relationship between gender dynamics and land and water use security underscored the importance of addressing disparities in access to resources for achieving equitable outcomes. The current reality of poor women's access to water was influenced by a multitude of factors, including water quality, information dissemination, COVID-19 impacts, land and water reforms, and social engagement, necessitating comprehensive and gender-sensitive interventions.

The literature review concluded with a focus on land rights and constraints, emphasizing the need to address gender equity in the context of land reform and expropriation. The challenges in translating policy commitments into tangible, gender-inclusive practices were highlighted, calling for transformative approaches to achieve gender equity in land rights.

Chapter 3 delved into the intricate details of the research methodology that underpinned this study. Specifically, it explored the research design, elucidated the rationale behind the chosen methodologies, and described the process of data collection and analysis. Additionally, it provided a comprehensive description of the study area, augmented by a visual map illustrating the geographical locations of the Mafefe, Steelpoortdrift, and Rambuda irrigation schemes. This map served to contextualize the study within its geographical framework.

The cornerstone of primary data collection revolved around face-to-face interviews. These interviews were meticulously structured, employing well-designed questionnaires as the primary instrument for data collection. The structured questionnaires were thoughtfully crafted to ensure alignment with the research objectives. This methodical approach to data gathering was chosen for its ability to provide standardized responses and facilitate rigorous analysis.

The choice of conducting face-to-face interviews through structured questionnaires was underpinned by several justifications. Firstly, it allowed for a systematic and consistent collection of data, ensuring that all participants were presented with identical questions and prompts. This standardization was paramount to maintaining data integrity and comparability.

Moreover, face-to-face interviews offered a dynamic platform for interaction between the researcher and the respondents. This interpersonal engagement fostered a conducive environment for participants to articulate their thoughts, experiences, and insights effectively.

It also allowed for clarifications and probing when necessary, enhancing the depth and richness of the data collected.

In parallel, structured questionnaires were instrumental in ensuring that the research objectives were adequately addressed. These questionnaires were designed to encompass a range of relevant variables and themes, thereby enabling a comprehensive exploration of the research problem.

The study area, as elucidated in this chapter, encompassed the geographic backdrop against which the research was conducted. By presenting a map highlighting the locations of the Mafefe, Steelpoortdrift, and Rambuda irrigation schemes, the chapter offered readers a visual reference point, enhancing their understanding of the study's context.

Chapter 4 contextualized the dynamics of water access and use within the three study sites of rural Limpopo Province: Rambuda, Mashushu, and Steelpoort. The study found that assets were employed to derive livelihoods and that knowledge on agricultural production, water management, and marketing strategies determined livelihood outcomes in the irrigation schemes. The study further discovered that the escalating cost of water and increasing competition over water use posed major challenges for smallholder farm owners in these regions. Access to sufficient water to meet basic needs was identified as a critical development issue and a human right, sustaining livelihoods

The study indicated that women formed the majority in irrigated agriculture but were historically disadvantaged and continued to be marginalized by cultural factors and the impact of past apartheid regimes. Women's access to water use was found to lack sustainability, with most water supplies diminishing, thereby relegating women to subsistence farming rather than commercial farming. The impact of water access extended far beyond basic needs, as water was an asset and input into myriad livelihood activities. However, the distribution of water benefits needed to be equitable to both men and women in rural societies.

Seasonality of water supply and availability denoted periods, such as winter, when water was scarce due to limited rainfall. Lack of storage infrastructure, like dams, affected water access for agricultural purposes. Volumetric water supply was generally low in these communities, and poverty required women farmers to produce for household consumption and gather whatever meagre income they could daily, discouraging ambitions for large-scale farming. Without addressing water scarcity and empowering women to compete favourably for water access, the prospect for large commercial farming remained far-fetched.

The level of interplay and cooperation between local and external institutions regarding water use, access, and management were limited to occasional extension officers' presence. Absence and lack of government support related to water were concerns for participants in all sites. Participants perceived the lack of interaction as undermining the knowledge they could gain in water scheduling management. Local communities developed their own ways of managing water use, but limited roles of state agencies meant critical aspects of water use and management extended beyond local capacities could not be addressed. Weak support services were a recurrent theme in most smallholder irrigation schemes.

These issues resulted in poor livelihoods for participants who experienced poor water access for current and future use. Competition for water supply, coupled with climate change, was also identified as a serious threat due to expanding mining operations in Limpopo. The study concluded that water use management and water policy reform intentions required serious investments in capacity-building of small farmers in rural areas to improve water access and management, thereby enhancing the livelihoods of small-scale irrigator farmers.

Chapter 5 primarily concerned households' food security in various districts of the Limpopo Province. Logistic regression analysis was used to determine the various factors affecting food security. A sample of 96 households was analyzed, with food security status (0 = food insecure and 1 = food secure) as the dependent variable and various socioeconomic and demographic characteristics as explanatory variables. The HDDS was used to determine food security among the sampled households. The results of the regression analysis showed that gender, age, education, household income, and the presence of males over 18 years of age were positively correlated with food-secured households. The study found that most of the households surveyed were food-secure, and at least four separate food groups were eaten by food-secure households.

The results of this study were important for the government and other development agencies to improve household food security status in Limpopo and other areas. Gender contributed to dietary diversity by ensuring sufficient nutrition in households. To resolve issues with female-headed households, the government should focus on providing them with social security allowances, as most are poor and have no other job opportunities. The findings showed that the older the head of the household, the greater the probability that the household would reliably provide food. Education was a significant factor in educating societies about the value of

knowledge and its role in improving the quality of life. Household income was another significant factor, with higher household income correlating positively with food security.

Chapter 6 analyzed South Africa's land reform initiatives post-1994, which aimed to address historical racial disparities. Despite these efforts, small-scale irrigation scheme (SIS) women farmers still faced exclusion under current land policies. The study examined the legal and institutional land frameworks, highlighting challenges and gaps perpetuating gender inequalities in land ownership and access. Key legislation from the apartheid era, such as the 1913 Land Act, 1936 Native Trust and Land Act, and 1950 Group Areas Act, laid the foundation for land dispossession and inequality. Post-1994, the Constitution of 1996 and various acts aimed to address imbalances and provide security of tenure. However, SIS women farmers continued to face marginalization due to gender biases and overlooked challenges like access to water resources, infrastructure, and technical support. The study emphasized the need for gender-sensitive policies, inclusive decision-making, and targeted interventions to ensure equal opportunities for SIS women farmers, promoting gender equality in land reform efforts.

7.2. Overall study conclusion

This study comprehensively explored the multifaceted roles of small-scale irrigation schemes in enhancing livelihoods and household food security in Limpopo Province, South Africa. The research underscored the critical importance of small-scale irrigation farming, particularly for women, in contributing to rural development and food security. Through a detailed examination of water access, land-use security, and women's empowerment in agriculture, the study highlighted the complex interplay of these factors in shaping the agricultural landscape in Limpopo.

The study identified a significant research gap: the lack of reliable data specific to small-scale irrigation farming in South Africa, which necessitated this investigation. By addressing this gap, the research provided valuable insights into the assets employed by small-scale farmers, the challenges they faced, and the strategies they used to achieve sustainable livelihoods.

Key findings revealed that knowledge in agricultural production, water management, and marketing strategies was pivotal for determining livelihood outcomes in small-scale irrigation schemes. However, escalating water costs, increasing competition for water, and inadequate water supply posed substantial challenges. These issues were exacerbated by gender dynamics,

with women, who formed the majority in irrigated agriculture, continuing to face marginalization due to historical and cultural factors.

The study also shed light on the systemic issues affecting water access and management. Limited government support, insufficient infrastructure, and inadequate policy implementation were identified as major barriers. The absence of effective institutional frameworks and support services further compounded these challenges, limiting the potential for large-scale commercial farming and sustainable development.

Moreover, the research highlighted the socio-economic factors influencing food security among smallholder farmers. Logistic regression analysis identified gender, age, education, and household income as significant determinants of food security, emphasizing the need for targeted interventions to support female-headed households and improve educational and income opportunities.

Finally, the study critiqued South Africa's land reform initiatives, pointing out the persistent gender inequalities in land ownership and access. It called for gender-sensitive policies, inclusive decision-making, and targeted interventions to ensure equal opportunities for small-scale irrigation scheme women farmers. Addressing these issues was crucial for promoting gender equality and achieving sustainable rural development.

7.3 Policy recommendations

Based on the findings, several policy recommendations are proposed:

- Consistent Institutional Support: Implement consistent policies supporting institutional infrastructure, food production, and extension services to bolster poor households' food production capacity, stimulating economic growth and development.
- Integrated Water Development: Incorporate water development into broader livelihood and food security strategies, recognizing that it is just one of many drivers of insecurity. Emphasize integrating natural assets into interventions addressing diverse drivers of resource degradation, food insecurity, and poverty.
- Community Engagement: Involve impoverished communities in policy development, as they are primary beneficiaries of food security policies. Listening to their perspectives is crucial.

- African-Led Research: Encourage African participation in research and development efforts, including village-level food preservation, efficient agricultural extension, and customized agricultural systems management.
- Pro-Poor Land Reform: Advocate for progressive pro-poor land reform processes, underpinned by political commitment.
- Comprehensive Needs Assessment: Conduct comprehensive needs assessments, especially in communities with predominantly female farmers, to inform people-centered development programs, considering variations among farmer groups.
- Gender-Centric Approach: Highlight gender as a critical factor in facilitating women's access to water and land for sustainable rural livelihoods, especially regarding land user rights.

7.3 Recommendations for Further Study

In light of the findings, further research should explore the following areas:

- Institutional Reinforcement: Investigate strategies for strengthening institutions sustaining household and community-level assets, with a focus on capacity development, conflict resolution, and conflict prevention in asset utilization.
- Resource Management Models: Explore alternative models for resource management that promote equitable access, reduce elite capture, and address divergent user interests.
- Longitudinal Studies: Conduct longitudinal studies to assess the sustained impact of policies and interventions on smallholder farmers, particularly women, in diverse rural communities.
- Citizen Science in Water Governance: Examine the role of citizen science in water governance, including its potential to address data quality concerns and enhance stakeholder engagement.

In conclusion, this study serves as a foundational resource for informed policymaking and further research, contributing to the broader goal of alleviating poverty, enhancing food security, and advancing gender equality in rural communities, not only in South Africa but also in regions grappling with similar challenges.

APPENDICES

1.4 Appendix A: Questionnaire

A DEMOGRAPHIC AND OTHER HOUSEHOLD DATA

1. Please tick district

A. Vhembe	B. Sekhukhune	C. Mopani	D. Other, specify

2. Community name _____

3. Duration of stay _____

4. What is your home language? Please Tick (✓)

A. Tshivenda	B. Sepedi	C. Xitsonga	D. Other specify

Please record responses for the respondent and household head in the following questions:

5 Sex of respondent and household head

	A. Male	B. Female
Respondent		
Household head		

6. Age ranges of the respondent and household head

	A. Below 25 yrs	B. 23-35 yrs	C. 36-50 yrs	D. Over 50 yrs
Respondent				
Household head				

7. Respondent and household head's Marital status

	A. Never married	B. Married	C. Widowed	D. Divorced	E. Stay together not married
Respondent					
Household head					

8. If married please specify marriage type

	A. Full Traditional	B. Part Traditional	C. Church/Court	D. Other Specify
Respondent				
Household head				

9. Respondent and household head education level.

	A. No education	B. Primary	C. Secondary	D. Other Specify
Respondent				
Household head				

10. How big is your household? _____
11. Are you living with your spouse? Yes☐ No☐
    If No, where is the spouse?

    _____

    _____

12. Respondent's relationship to the household head? _____
13. Occupation of the household head

Occupation	Tick (✓)
A. Salaried employment	
B. Self-employment	
C. Retired	
D. Unemployed	
E. Other, specify	

14. Please select all your household livelihood activities

Livelihood activities	Tick (✓)	Number of household members involved
A. School		
B. Salaries		
C. Government Grants		
D. Remittances		
E. Casual employment		
F. Petty trade		
G. Self-employed		
H. Other, specify		

15. How much livestock and poultry do the household and respondent own?

Occupation	Household (number)	Respondents (number)
A. Cattle		
B. Goats		
C. Pigs		
D. Chickens		
E. Other, specify		

B LAND RIGHTS

16. What laws are used to allocate land in the area?

A. Chief	B. Local government	C. Other, specify

17. How did the household get its land?

General Land access options	Tick (✓)
A. Given by father	
B. Given by chief	
C. Buy	
D. Inherit	
E. Gift	

F. Rent	
G. Government programme	
H. Other, specify	

18. What rights do you have over the land? Please tick (✓) the relevant options

Land rights	Tick	Explain
A. Use		
B. Access		
C. Control		
D. Title		

19. How long have you used this land? Please (✓) the relevant box

A. 0.5 yrs.	B. 6-10 yrs.	C. 11-20 yrs.	D. More than 20 yrs.

20. Please describe your lands characteristics

Aspect	Description
A. Size of land	
B. Is household land joined to agricultural land?	Yes
	No
C. Distance from household in minutes	
D. Distance from water source in minutes	

21. What do you use the land for? Please tick (✓) all relevant

Options	Tick
A. Residence	
B. Household garden	
C. Livestock	
D. Farm (crop and grazing)	
E. Other, specify	

22. What land preparation activities do you perform before planting?

A. Removes rocks	B. Turn the soil	C. Add fertiliser	D. Other, specify

23. Do you think you have to perform more land preparation activities that people in your community? Yes ☐ No ☐ Please explain

24. Is it good for women to own land? Yes ☐ No ☐ Please explain your answer

_____

_____

25. How can women access land for themselves in this community?

General land access options	Please tick (✓)
A. Given by father, uncle, husband, brother	
B. Given by chief	

C. Given by mother-in-law	
D. Buy	
E. Inherit	
F. Gift	
G. Rent	
H. Government programme	
I. Other, specify	

26. How many pieces of agricultural land does the household own? _____

27. Who makes decisions regarding the following in the household?

Household decisions	Decision-maker
A. Land allocation to household members	
B. What to plant	
C. Time spent on land-based activities	
D. What to do with harvest	

C LAND USE SECURITY

28. Who owns the land? _____
29. Is the land registered in the owner's name? Yes ☐ No ☐ If yes where?

_____

30. How is land ownership recognised in this community for men and women? Please tick (✓) all relevant options for both.

Options	Men	Women
A. Title		
B. Register of land owners at local council		
C. Register of land owners at local chief		
D. It's family land		
E. Neighbours know each other		
F. Community elders know land owners		
G. Other, specify		

31. Have any households in this community lost their land rights because of the following reason in the last five years? Please tick (✓) all relevant options

Option	Tick
A. If household moves to a new community	
B. If household sell the land	
C. If the household does not use the land for a long time	
D. If the household does not respect local laws	
E. Other, specify	

32. Has the household abandoned, lost or got a new plot in the last five years?

Person	Tick (✓)	Reason
A. Abandoned land		
B. Lost land		

C. Got new land		

If yes, how did this affect your land use activities?

_____

_____

_____

33. In your opinion can women use their land without threats of eviction or losing it? Explain.

_____

_____

_____

34. What are the common causes of land disputes involving women? Tick (✓) all relevant options

Dispute causes	Tick
A. Boundaries	
B. Real owners	
C. Family issues	
D. Eviction threats from community members	
E. Other, specify	

35. When does a female household member lose land rights to household and other land in the community?

Options	Household land	Other community land
A. Marries and moves to another family		
B. Gets a divorce		
C. Husband dies		
D. Someone else wants her land		
E. Has not used the land for a long time		
F. Has a disagreement with family		
G. Other, specify		

36. What role do the following play in solving land disputes involving women?

Person	Tick (✓)	Reason
A. Family members		
B. Local elders		
C. Local chief		
D. Ward councilor		
E. Other, Specify		

37. What role do the following play in solving disputes involving women?

Group	Role
A. Marital family	
B. Birth family	
C. Community leaders	
D. Local elders	

38. Please explain whether the following strengthen or weaken women's land rights?

Aspect	Strengthen	Weaken	Explain
A. Marital status			
B. Education level			
C. Rich family			
D. Powerful friends and family			

39. Describe the security of land for the following women

Women	Secure	Insecure
A. Single no children		
B. Single with children		
C. Married		
D. Married no children		
E. Married polygamous relationship		
F. Married migrant husband		
G. Widow		
H. Divorce		
I. Stay together not married (no children)		
J. Stay together not married (children)		

40. Whose land rights are more secure in marriage, husband or wife and why?

_____

_____

_____

41. What are the following people's land rights when male household dies?

Family members	Land rights
A. Widow	
B. Children	
C. Extended family	

42. What happens to women's land rights when a marriage ends? Please tick (✓) boxes below

A. Stays on husbands' land	B. Goes back to her family	C. Allocated new land in village	D. Other, explain below

_____

_____

43. Can sons and daughters inherit land equally? Yes ☐ or No ☐ Explain below.

_____

_____

44. How do the land rights you have affect your farming efficiently?

_____

_____

D FOOD SECURITY

45. Describe women's local employment opportunities

_____

_____

46. Why are you involved in agricultural activities?

_____

_____

47. What motivates you to continue year after year?

_____

_____

48. Are men involved in crop cultivation? Yes ☐ No ☐ if yes. What level of involvement (in production cycle) e.g. Planting, harvesting, etc.

_____

_____

49. How many times do you plant in a year? Please tick (✓) where applicable

A. Once	B. Twice	C. All year round

50. Does water availability affect the number of times you plant a year? Yes ☐ No. ☐
51. What do you grow and why?

	To eat	To sell
A. Vegetables		
B. Mealies and other cereals		
C. Root crops		
D. Beans		
E. Fruits		

52. How often in a week do you harvest from the garden?

A. Daily	B. 3.4- times a week	C. Once a week	D. Never

53. Please state how many bundles or buckets of produce you harvest in week?

Crop	Bundles/ week	Bucket/ week
1.		
2.		
3.		
4.		
5.		
6.		

54. Do you have to markets to sell your produce? Yes ☐No. ☐
55. What else do you harvest from the land?

A. Firewood	B. Grass	C. Clay

E WATER ACCESS

56. What is the source of water you use? Please tick (✓) all applicable

Water Source	Tick
A. River	
B. Communal tap	
C. Private tap	
D. Well/ spring/ borehole	
E. Other, specify	

57. Who owns the water source? Please (✓) all applicable

Water Source	Tick
A. Government	
B. Community	
C. Individual	
D. Other, specify	

58. Who collects water often? Please tick (✓) all applicable

Person responsible for water collection	
A. Mother	
B. Daughter/s	
C. Father	
D. Son/s	
E. Other, specify	

59. How often do you collect water Please (✓)?

	Tick
A. Once a day	
B. Twice a day	
C. Thrice a day	
D. More than thrice a day	

60. What do you use water for? Please (✓)

	Tick
A. Domestic use (drinking, cooking, hygiene etc.)	

61. How far is the source of the water from the household?

A. Less than 200m	B. Greater than 200m

62. How does it take to collect water?

A. Less than 30 minuets	B. Greater than 30 minutes

63. Are water sources reliable? Yes.☐ No. ☐
64. How do you get to the water source? Please tick (✓) all applicable

	Tick
A. Foot / Walk	
B. Animal wagon	
C. Own or hired vehicle	
D. Other (specify)	

65. Do you pay for water? Yes ☐ No ☐
66. How much do you pay for water? Please indicate if you pay weekly, monthly, etc _____
67. How do you have access to water for agricultural production?

_____

_____

68. Do you feel your household have enough access to water?
69. _____

_____

70. What problems do you encounter when accessing water?

_____

_____

71. What do you think is the solution to the problems you mentioned above?

_____

_____

F KNOWLDEGE GENEREATION AND EMPOWERMENT

72. How do your land rights affect access to water and other resources?

_____

_____

73. Who manages water supplies?

_____

_____

74. Are women involved in management of water supplies? Yes. ☐ No. ☐
75. Are women encouraged and empowered about the importance of involvement? Yes. ☐ No. ☐
76. Are women encouraged and empowered about the importance of involvement? Yes ☐ No ☐
77. Are meetings conducted in such a way that women are comfortable and understand? Yes ☐ No ☐
78. Do women support other women in decision-making positions? Yes ☐ No☐
79. What can be done to encourage more women participation?

_____

_____

80. Do you collect rainwater? If yes, how do you collect rain water? Yes ☐ No ☐

_____

_____

81. Do you use water technologies for water, such as pumps? Yes ☐ No ☐
82. Can women operate these technologies? Yes ☐ No ☐
83. Do you irrigate your crops? Yes.☐ No.☐
84. What methods of irrigation do you use?

	Tick
A. Furrow irrigation	
B. Manual using buckets or watering cans	
C. Drip irrigation, spray or micro-sprinkler irrigation	
D. Other (specify)	

85. Why is the type of irrigation method mentioned above used?

_____

_____

86. Are you satisfied with type of irrigation system used?

_____

_____

87. Are you aware that water is a scares resource? Yes ☐ No☐
88. Do you use waste water to irrigate your household gardens? Yes ☐ No☐

89. How can water be conserved?

_____

_____

90. How can water be made more available than is at present?

_____

_____

G : MANAGEMENT OF WATER IRRIGATION SCHEME

91. Is there any common plan for agricultural production within the area of the scheme? If yes, who decides on the agricultural production plan? Yes ☐ No☐

_____

_____

92. Who is making the decisions concerning the fieldwork?

A. Men	B. Women	C. Both

93. Are all the farmers involved in the planning? Yes☐ No.☐
94. How many people are in the water scheme committee? _____
95. How many women are in the committee? _____
96. Are women able (allowed) to attend meetings? Yes☐ No.☐
97. How many times do you hold meetings in a month?

A. Once	B. Twice	C. Thrice	D. Other. Specify

98. Who determines the water fees? _____
99. How much is paid by each water irrigation scheme member towards the water fee? _____
100. Who collects the water fees from the scheme? _____
101. What is the water fee used for?

_____

_____

102. Is there a difference between the tasks performed by women and men in the irrigation scheme? If yes state the different roles. Yes ☐ No☐

_____

_____

103. Have you (or your household members) received technical training in agriculture or on water Management in the last 2 years? Yes ☐ No. ☐
104. If yes, what trainings were attended and indicate who provided the training?

_____

_____

105. Do you know what Water Users Association (WUA) is? Yes ☐ No.☐
106. Do you know how the WUA work? Yes ☐ No. ☐
107. Are you aware of your consumer rights? Yes ☐ No. ☐
108. Has anyone from the Department of Water Affairs visited this area and what was discussed?

_____

_____

H 'IDEAL' LAND RIGHTS FOR RURAL WOMEN

109. What do you think should be the ideal option for the following women in land ownership?

Women	Individual title	Joint title	Women group
A. Single no children			
B. Single with children			
C. Married			
D. Married no children			
E. Married polygamous relationship			
F. Married migrant husband			

G. Widow			
H. Divorce			
I. Stay-together not married (no children)			
J. Stay- together not married (children			

110. In the table below, list cultural practices which in your opinion protects and threaten women's land access

Protects women's land access	Threaten women' land access

111. How could women's land rights be secured using traditional laws?

_____

_____

112. How could women's land rights be secured using statutory laws?

_____

_____

1.5 Appendix B: Focus Group Discussion Guide

Consent Process

Consent forms for focus group participants are completed in advance by all those seeking to participate. Below is a summary of the information in the consent form that focus group organizers and facilitators should use to ensure participants understand the information in the consent form.

Thank you for agreeing to participate. We are very interested in hearing your valuable opinion on water and land use issues

- The purpose of this study is the exploration of livelihoods and food security: insight from small-scale irrigation farmers in Limpopo Province.
- The information provided by you is entirely confidential, and we will not associate your name with anything you say in the focus group.
- we would like to record the focus group discussions to ensure that we correctly capture the group's thoughts, opinions, and ideas. No names of participants will be attached to the focus groups, and the recordings will be destroyed as soon as they are transcribed.
- You can choose not to answer any question and withdraw from the study at any time.
- We understand the importance of keeping the information provided by the participants private and confidential. Therefore, we will ask participants to respect each other's confidentiality.

Introduction:

1. Welcome

Introduce yourself and the note-taker, and send the Sign-In Sheet with a few quick demographic questions (age, gender) around to the group while you are introducing the focus group.

Review the following:

- Who we are and what we're trying to do
- How this information will be utilized
- Why we asked you to participate

2. Explanation of the process

Ask the group if anyone has experienced in a focus group before. Explain that focus groups are being used more and more often in research.

About focus groups:

- We learn from you (positive and negative)
- Not trying to achieve consensus, we're gathering information
- In this project, we are doing questionnaires, focus group discussions, and key informant interviews. Using these tools is that we can get more in-depth information from a

smaller group of people in focus groups. This provides us with an understanding of the context behind the answers given in the written survey and helps us discover topics in more detail than we can do in a written survey.

Logistics

- Focus group will last about one hour
- Feel free to move around
- Where is the bathroom? Exit?

3. Ground Rules

- Ask the group to suggest some ground rules. After they brainstorm some, make sure the following are on the list.
- Everyone should participate.
- Information provided in the focus group must be kept confidential
- Stay with the group and please do not have side conversations
- Turn off cell phones if possible
- Have fun

4. Turn on Tape Recorder

5. Ask the group if there are any questions before we get started and address those questions.

6. Introductions

- Go around the table: where you were born etc.

The discussion begins, making sure to give people time to think before answering the questions and not moving too quickly. Use the probes to ensure that all issues are addressed, but move on when you feel you are starting to hear repetitive information.

Focus Group Discussions Questions

Name of the area:

_____

1. What water sources are available in your area?
2. What do people use water for? Is it the same for men and women?
3. Who is responsible for management of water sources?
4. What are the constraints that people face when accessing water? Are they the same for males and females?
5. Which concerns affect women most? Why?
6. Which concerns affect men most? Why?
7. How can these constraints and concerns be solved?

8. Who is responsible for making sure that water is available for household use within the family? Why?
9. When is water collected? Why?
10. How is water allocated for activities within the household? Who allocates water? Why?
11. What are the costs and time involved in getting water?
12. How do the costs of accessing water affect poor households?
13. What agricultural activities do women engage in? Why?
14. What agricultural activities do men engage in? Why?
15. What other agricultural activities would people engage in if they had access to more water than they have at present?
16. Which water source(s) are used for agricultural activities and other land-based livelihoods? Why?
17. What other income generation activities do women engage in that require water?
18. Who are involved in decision making for water management?
19. Are women involved in water committees?
20. Do people recycle water (E.g. use grey water - wastewater generated from domestic activities such as laundry, dishwashing, and bathing)? What do people use it for?
21. Do people use rain water?
22. How can water be conserved?

1.6 Appendix C: Questionnaire on existing water use

Introduction

You are invited to participate in this questionnaire. The purpose of the questionnaire is to understand what the existing water use in crop cultivation, animal husbandry, activities by women, we are seeking your input in this matter. Please answer all the questions honestly. You name will not be attached to this questionnaire, so answers cannot be traced back to you. Please be informed that your participation in this questionnaire is voluntary and that you may withdraw/ decline participation at any time you wish to do so. Your response will help the project/ us to understand the existing water use in crop cultivation including livestock and institutional arrangements, organisational structure and processes.

Section One: Respondents Background

1. What is your name (optional) _____
2. Gender of respondent
   Male ☐
   Female ☐
3. Please indicate your age group by ticking (✓) the box
   a. Under 25☐
   b. 25-30 ☐
   c. 31-40 ☐
   d. 41-50- ☐
   e. 51-60 ☐
   f. Over 60☐
4. What is the highest level of education you have attained, please tick (✓) the box
   Primary ☐
   Secondary ☐
   Tertiary ☐
   Other, specify _____
5. What is your occupation? _____
6. How are you related to the household owner? Please tick (✓)) the appropriate box
   a. Household head☐
   b. Spouse ☐
   c. Child ☐
   d. Other, specify ☐
7. How many people live in your household? Please (✓) the appropriate box

a. Adult above 18yr	b. Children below 18yrs	c. Females above 18 yrs	d. Female below 18 yrs	e. Male above 18 yrs	f. Male below 18 yrs

8. Who is the main breadwinner for your household? Please tick (✓)
   a. Husband ☐
   b. Wife ☐
   c. Both ☐

d. Son ☐
e. Daughter ☐
f. Relative ☐
g. All ☐

Section Two: Farming / Agriculture

9. List the farming activities you are engaged in

_____

10. Do you own the piece of land you farm on? If No who owns it?
Yes ☐
No ☐

_____

_____

11. What are the benefits of using land that does not belong to you?

_____

_____

12. What are the challenges of using land that does belong to you?

_____

_____

13. Who else is engaged in farming in your family? Please explain.

_____

_____

14. Do you feel you produce enough food for family? If No, what are the challenges?
Yes ☐
No ☐

_____

_____

15. If you farm to sell, where do you sell your produce?

_____

_____

16. Do you think you produce enough to sell? If not, what are the challenges?
Yes ☐
No ☐

_____

_____

Section Three: Water use and demand

17. How much of water do you use in your household on the following activities? Please specify in litres.

Activity	No. litres/ day	No. litres/ Month
a. Drinking		
b. Cooking		
c. Washing		
d. Cleaning and hygiene		
e. Other, specify		

18. Who collects water in your household?

_____

19. Where do you go to collect water used in your household? Please tick (✓).
    a. Communal source ☐ please specify who constructed it e.g. government, NGO etc.
    b. Neighbours ☐
    c. Personal source ☐
    d. Other, specify ☐
20. How far id the water source from your household? Please specify in kilometres

_____

21. What mean of transport do you use to get to the water source?

_____

22. Who decides to use the water in your household?
    a. Husband ☐
    b. Wife ☐
    c. Other, specify ☐

    _____

23. Do you to pay for the water? If Yes, please specify how much ZA Rands
    Yes ☐
    No ☐

_____

24. Do you have to take a lot of time queuing to collect water? If yes, please specify how long
    Yes ☐
    No ☐

_____

25. Do you feel the water you get is enough to supply all your needs (and those of your household? Please explain.

_____

_____

26. What challenges do you experience with regard to water collection and use?

_____

_____

Section Four: technological options

27. Which of the following type of water source do you use/own in your household/field.
    a. Rain water harvesting
    b. Canal ☐
    c. Shallow well ☐
    d. Borehole ☐
    e. Taps ☐
    f. Other, please specify ☐
28. Do you share the source with households?
    Yes ☐
    No ☐
    If yes, how many households? _____

29. How reliable is the source of water during the dry seasons?

a. Not reliable ☐
b. Quite reliable ☐
c. Very reliable ☐

If not reliable enough where do you go to collect water for household consumption?

_____

_____

30. How far is the water source from your household? _____
31. Is it easy to collect water from the alternative sources?
    Yes ☐
    No ☐
32. Please explain what assistance you think you need with regards to collecting water from alternative sources.

_____

_____

Section four: Management and maintenance

33. Who is responsible for the management of the source e.g. cleaning and repairs in case of any breakdown?
    a. Husband ☐
    b. Wife ☐
    c. Community ☐
    d. Farmers ☐
    e. Other, specify ☐

_____

34. How Is the water source managed?

_____

_____

What are the main functions of the management team/ water committee if any?

_____

_____

35. Are women engaged in the management team/ water committee?
    Yes ☐
    No ☐

If yes what roles do they play in the management and maintenance of the water source?

_____

_____

If no, please explain what do you think are the reasons for this.

_____

_____

36. What criteria are used to select water management committee members?

_____

_____

37. Have you ever been a member of the water management committee?
    Yes ☐
    No ☐

38. Is there any value of involving women in the management and maintenance of the water source?
    Yes ☐
    No ☐

    Please explain why you think so.

    _____
    _____

39. Please explain what you think **men** and **husbands** feel about the involvement of women in the maintenance of the water source?

    _____
    _____

40. Please explain what you think **women** and **wives** feel about the involvement of women in the maintenance of the water source?

41. _____
    _____

    Who is responsible for addressing the maintenance cost of the water source?

    _____
    _____

42. Are there any challenges you have faced with the maintenance of the water source?
    Yes ☐
    No ☐
    Other, specify ☐

    Please elaborate.

    _____
    _____

43. In your opinion what do you feel is lacking and needs to be improved in the management of the water source?

    _____
    _____

Questionnaire for the officials

Institution: _____
Position: _____
Name of Respondent: _____
Gender: _____
Date of interview: _____

Section one: Water resources in the area

1. How do you describe in terms of water availability and supply?

   _____
   _____

2. Please explain how does seasonal variations affect water availability in the area?

   _____
   _____

3. Which groups and or gender are affected the most
   a. Men ☐
   b. Women ☐
   c. Other ☐

   Please explain why you think this is so

   _____
   _____

4. What do you do to help water users to cope with the challenges?

   _____
   _____

5. In your opinion, has this been successful?
   Yes ☐
   No. ☐

   Please elaborate

   _____
   _____

Section two: water use and techniques

6. What is the water used for in the area?
   a. Domestic ☐
      Specify example _____
   b. Commercial ☐
   c. Specify example _____
   d. Other ☐
      Please specify. _____

7. Is the water enough to meet the demand?
   Yes. ☐
   No. ☐
   Please explain
   _____
   _____
8. Which of the following are facilities are used by the household or communities in the area?
   a. Canal/ Furrow ☐
   b. Shallow wells ☐
   c. Boreholes ☐
   d. Taps ☐
   e. Rain water harvesting ☐
   f. River ☐
   g. Piped water ☐
   h. Other, ☐
      Please specify
      _____
      _____
9. How is the coverage in terms of facilities? Please rate on a scale of
   a. Very bad ☐
   b. Appropriate ☐
   c. Very good ☐
10. Who is responsible for the construction on the facilities?
   a. Government ☐
   b. NGOs/ CBOs ☐
   c. Private individual ☐
   d. Other ☐
      Please specify
      _____
      _____
11. What type of facilities do you advocate for and feel should be developed and why?
   _____
   _____

Section three: Management and maintenance

12. Who is responsible for the management of the source e.g. cleaning and repairs in case of any breakdown?
   a. Men ☐
   b. Women ☐
   c. Community ☐
   d. Other ☐
      Please specify
      _____
      _____

13. Who is the main decision-makers with regards to operation and maintenance of the eater facilities
    a. Men ☐
    b. Women ☐
14. How is the water source managed?

    _____
    _____
15. What are the functions of the management teams, if any?

    _____
    _____

16. Are women involved in the management team?
    Yes ☐
    No ☐
    If yes what roles do they play in the management and maintenance of the source?

    _____
    _____

17. How do you feel about involving women in water management?

    _____
    _____

18. Is there any difference in terms of improvements recognized by involving women in the management and maintenance of the source? Please explain and specify.

    _____
    _____

19. How is the maintenance cost addressed?

    _____
    _____

20. Does the committee contribute towards the maintenance cost?
    Yes. ☐
    No. ☐
    If yes, please specify what way and how much

    _____
    _____

21. How are the funds controlled?

    _____
    _____
    _

22. Are there any challenges you have faced with the maintenance of the water source? If yes please specify.

    _____
    _____

23. In your opinion what do you feel is lacking and needs to be improved in the management of the water source?

Section 4: Policies and strategies

24. What support do you provide and what criteria are used for allocating the support?

    _____

    _____

25. Are there any existing policies and strategies adequate enough for the involvement of women I the decision-making and management of the water resources?

    _____

    _____

26. Which management strategies do you think are necessary to improve water supply and women's involvement in water management in the area?

    _____

    _____

27. In your opinion what do you think should be taken into consideration when analysing the impact of domestic rural supply on women and sustainability?

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