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IRRIGATION FARMING FOR WOMEN EMPOWERMENT AND POVERTY REDUCTION IN THE TEMPANE DISTRICT

BY

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DECLARATION

DECLARATION

I hereby declare that this work is the result of my own research and has not been presented by anyone for any academic award in this or any other university. All references used in the work have been fully acknowledged. Any shortfalls therein are my sole responsibility.

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DEDICATION

To the almighty Allah, my husband, and parents.

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ABSTRACT

Irrigation farming has become a vital strategy for addressing food insecurity, rural poverty, and gender inequality in sub-Saharan Africa. However, uncertainties persist regarding its capacity to promote women's empowerment and transform livelihoods in contexts shaped by unequal land tenure systems and gendered agricultural governance. This study examines the impact of irrigation farming on women's empowerment and poverty reduction in the Tempane District of Ghana. Drawing on the Gender and Development (GAD) framework, Empowerment Theory, and irrigation-specific models (Bryan & Garner, 2020; Meinzen-Dick et al., 2019), a pragmatic mixed-methods case study design was adopted. Data were collected from 156 survey respondents, 46 in-depth interviews, eight focus group discussions, and field observations. Quantitative data were analysed using SPSS, while qualitative data were thematically coded with NVivo.

The study found that irrigation farming in the Tempane District remains largely male-dominated. Women's participation is visible yet constrained by limited access to key productive resources such as land, credit, and agricultural inputs. Gender norms and traditional tenure systems continue to shape participation, granting men greater control over irrigable land and decision-making processes. Although women actively engage in small-scale and household-level irrigation, their contributions are often undervalued and less supported institutionally.

Participation in irrigation farming, however, significantly enhanced women's empowerment (χ^2 = 21.1725, $p < 0.001^b$, df = 2) and reducing poverty (χ^2 = 27.6247, $p < 0.001$, df = 2). Despite these benefits, constraints such as insecure land tenure, high labour demands, limited capital, restrictive cultural norms, and exclusion from governance structures continue to impede women's full participation.

The study concludes that irrigation farming has immense potential to advance women's empowerment and reduce poverty in the Tempane District. However, realising this potential requires coherent, gender-sensitive reforms in land tenure, financial access, extension support, and irrigation governance. By embedding empirical findings within structured theoretical frameworks, this research contributes to the growing discourse on gender, irrigation, and inclusive rural development in northern Ghana.

LIST OF ABBREVIATIONS

AAGDS – Accelerated Agricultural Growth and Development Strategy

AfDB – African Development Bank

DAWN – Development Alternatives with Women for a New Era

FAO – Food and Agriculture Organisation

FGD – Focus Group Discussion

GAD – Gender and Development

GIDA – Ghana Irrigation Development Authority

GSGDA – Ghana Shared Growth and Development Agenda

IFAD – International Fund for Agricultural Development

IFPRI – International Food Policy Research Institute

IVID – Irrigation, Village Infrastructure, and Development Project

MOFA – Ministry of Food and Agriculture

MTADP – Medium Term Agricultural Development Programme

NCCP – National Climate Change Policy

NGO – Non-Governmental Organisation

SPSS – Statistical Package for the Social Sciences

VSLA – Village Savings and Loan Association

WB – World Bank

WRC – Water Resources Commission

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Agriculture remains a significant sector in many countries, and agricultural activities provide developing countries with food security and revenue (Pawlak & Kołodziejczak, 2020). Irrigation, as a means of enhancing agricultural productivity, has long been recognised as a potential solution to alleviating poverty in rural areas (Mabhaudhi et al., 2018). Other possible advantages of irrigation, such as improved nutrition and health, women's empowerment, and the methods by which irrigation supports these goals, have received less attention until recently (Bryan & Garner, 2020).

Worldwide, over 324 million hectares were equipped for irrigation, of which approximately 85%, or 275 million hectares, were irrigated in 2012. Irrigated agriculture accounts for 20% of the total cultivated land, yet it contributes 40% of the total food produced worldwide (Mensah & Ibrahim, 2017). And irrigation farming makes available more than one-fifth of the world's food. The importance of irrigation globally cannot be overstated, particularly in food crop production, which improves livelihoods and empowers women. Food security, non-farm businesses, income and employment are examples of the importance and positive impacts of irrigation (Akudugu et al., 2016).

Ghana, like most sub-Saharan countries in West Africa, is an agrarian economy that is mainly dependent on rainfed agriculture. The agricultural sector in most African countries, particularly Ghana, serves as the primary source of livelihood for rural populations and employs the most

significant proportion of the workforce (Darko et al., 2020). Approximately 60% of the total employment is in the agricultural sector, which contributes around 19% of Ghana's Gross Domestic Product (Ghana Statistical Service, 2017). It is estimated that growth in Gross Domestic Product originating from agriculture has a greater impact on poverty reduction than growth in any other economic sector (Ghana Statistical Service, 2017). In many developing countries, the informal and agricultural sectors are significant contributors to human capital (Doğan, 2018). An estimated nine out of ten people in Ghana derive their livelihood from agriculture (Ghana Statistical Service, 2017).

The development of productive assets provides women with the opportunity to increase their income and control over it, enhance their influence over decisions, and improve their overall well-being. This is just one of the many routes to women's empowerment. Therefore, irrigation interventions that enhance women's access to irrigation technologies have the potential to further empower women by increasing their influence over decisions related to agricultural production, income, and time management (Bryan & Garner, 2020). If irrigation plays a role in these modifications, this could lead to better outcomes for people's health and well-being, including better diets for women and children. However, when water usage and land values rise, irrigation may occasionally hurt women's control over land and productivity, especially in the context of irrigation projects (Bryan & Garner, 2020).

Empowering women in the agricultural sector is not only a moral imperative but also a practical necessity for achieving sustainable development. Studies have shown that empowering women in agriculture leads to improved household incomes, better nutritional outcomes, and stronger resilience to economic shocks. In the Tempane District, women play a crucial role in farming activities; however, they remain marginalised when it comes to accessing resources, credit, and

irrigation technologies. Their limited involvement in irrigation farming reduces their potential to improve their livelihoods and contribute meaningfully to poverty reduction efforts in the district.

The government of Ghana, along with development partners, has made several interventions aimed at promoting irrigation farming as a means of reducing poverty. Programmes such as the One Village, One Dam initiative are designed to improve access to irrigation facilities in rural communities. However, the impact of these programmes on women's empowerment and poverty reduction remains underexplored.

This research aims to contribute to the existing knowledge on the transformative role of irrigation in poverty reduction, with a specific focus on the Tempene District, located in the dry Guinea Savannah zone of Ghana. By adopting a gendered perspective, the study aims to explore the implications of irrigation farming on women as part of an inclusive development approach. The findings will provide valuable insights for designing effective policies and interventions that leverage irrigation as a panacea to poverty, ensuring a more equitable and sustainable future for the people of Tempene District.

1.2 Statement of the Problem

Agriculture remains the most climate-sensitive sector of Ghana's economy, employing a large proportion of rural households, most of whom are smallholder farmers (Ghana Statistical Service, 2017). Northern Ghana in particular is characterised by erratic rainfall, prolonged dry seasons, and increasing climate variability, making the region highly vulnerable to climate-related shocks (Antwi-Agyei et al., 2018; Yaw, 2016). These climatic constraints limit rain-fed agricultural productivity and have heightened interest in irrigation as a livelihood-enhancing intervention.

In Ghana, irrigation development has long been promoted as a strategy to improve agricultural output, food security, and rural incomes. Empirical studies conducted in northern Ghana such as those by Kuwornu et al. (2013), Naab et al. (2013), and Dittoh et al. (2020) show that irrigation improves yields, stabilises farm incomes, expands dry-season farming, and enhances household food security. However, these studies largely focus on the productivity and economic impacts of irrigation. Much less attention has been paid to how irrigation affects gender dynamics, especially women's access to resources, control over production decisions, and broader empowerment outcomes.

Existing research in Ghana suggests that women face significant structural barriers in agriculture, including limited land ownership, restricted access to water for irrigation, exclusion from irrigation user groups, and socio-cultural norms that constrain their decision-making power (Awal, 2014; Doss et al., 2018). These gendered inequalities often result in women benefiting less from irrigation schemes, despite their heavy involvement in agricultural labour. Studies outside Ghana show similar patterns, with evidence that while irrigation can enhance productivity and nutrition, its benefits are not automatically or equally shared (Bryan & Lefore, 2021; Meinzen-Dick et al., 2019; Bryan & Mekonnen, 2023). Yet, when women are able to access and use irrigation, they can experience improvements in income control, reduced time burdens, and enhanced autonomy (Hirai et al., 2016).

Although a growing global literature is exploring the interaction between irrigation and women's empowerment, Ghana-specific evidence remains limited. Few studies in Ghana examine the pathways through which irrigation influences women's empowerment, or how empowerment defined locally shapes women's ability to adopt and benefit from irrigation technologies (Njuki et

al., 2023). There is also a notable gap in micro-level, district-specific analyses that capture the lived experiences of rural women in irrigation-dependent communities.

In the Tempane District of the Upper East Region, irrigation farming has expanded in recent years, especially through small-scale and community-managed schemes. Despite this expansion, women's participation remains low due to persistent gender inequalities, including limited access to irrigable land, exclusion from resource allocation processes, lack of financial capital, and heavy domestic workloads. These constraints not only restrict women's ability to engage meaningfully in irrigation but also perpetuate poverty and limit the transformative potential of irrigation for household livelihoods.

Given these gaps, there is a critical need for a context-specific study that examines how irrigation farming affects women's empowerment and poverty reduction in the Tempane District, and the factors that enhance or hinder women's ability to benefit from irrigation. Understanding these dynamics is essential for designing gender-responsive irrigation interventions that equitably distribute benefits and contribute to broader goals of rural poverty reduction and gender equality. This study therefore seeks to provide empirical evidence on the relationship between irrigation, women's empowerment, and livelihood outcomes in Tempane District, addressing an important research and policy gap in Ghana.

1.3 Research Objectives

The primary research goal is to examine irrigation farming as a tool for women's empowerment and poverty reduction in the Tempane District. The specific objectives are to:

To achieve this, the study pursues the following specific objectives:

1. Examine gender differences in participation and access to productive resources among farmers in the Tempane District.
2. Assess the association between participation in irrigation farming and women's empowerment in the Tempane District.
3. Determine the relationship between participation in irrigation farming and household poverty reduction in the Tempane District.
4. Identify the major constraints limiting farmers' access to irrigation farming in the Tempane District.

1.4 Research Questions

The study seeks to answer the following research questions:

1. What gender differences exist in farmers' participation and access to productive resources in the Tempane District?
2. How does participation in irrigation farming influence women's empowerment in the Tempane District?
3. What is the relationship between participation in irrigation farming and household poverty reduction in the Tempane District?
4. What constraints limit farmers' access to irrigation farming opportunities in the Tempane District?

1.5 Significance of the Study

The significance of the research is structured under three sub-themes, which are contribution to knowledge, contribution to theory, and contribution to policy and practice.

1.5.1 Contribution to Knowledge

This research produces sex-disaggregated information on irrigated farming in the Tempane District, addressing a significant knowledge gap in the literature about gender, agriculture, and rural livelihoods in Northern Ghana. Although irrigation has been acknowledged as a catalyst for production, less empirical research has methodically examined its gendered dynamics within this particular environment. The research provides substantial empirical evidence for discussions on how irrigation might facilitate inclusive rural change by measuring women's and men's access, restrictions, and results.

1.5.2 Contribution to Theory

This study enhanced gender and development theory by illustrating the mechanisms of women's empowerment across interconnected domains, including decision-making, leadership, resource management, and time allocation, within the framework of smallholder irrigation. It modifies empowerment indicators to reflect the conditions of rural Ghana, therefore enhancing the conceptual implementation of empowerment frameworks. This enhances the analytical efficacy of gendered livelihood methods and facilitates improvements to theories connecting resource access with agency and bargaining power in families and communities.

1.5.3 Contribution to Policy and Practice

The report provides evidence-based insights for politicians, development organizations, irrigation managers and policymakers. It emphasizes the interventions of land allocation regulations, extension services, financial access frameworks, and leadership quotas, that most successfully augment women's engagement and empowerment. The results may assist the Ministry of Food and Agriculture (MoFA), the Ghana Irrigation Development Authority (GIDA), Non-Governmental

Organizations (NGOs), and donor agencies in refining plans for poverty alleviation and gender equality. By synchronizing irrigation practices with empowerment results, the research serves as a crucial policy instrument to guide the design and expansion of pro-poor, gender-sensitive agricultural initiatives.

1.6 Scope of the Study

This study's scope was intentionally limited to guarantee depth and concentration. Geographically, it was restricted to the Tempane area of the Upper East Region, a recently established area (2018) where irrigation systems have been pivotal to agricultural and livelihood policies. The research sample consisted only of smallholder irrigation farmers, who constitute the predominant segment of agricultural families and are most significantly impacted by challenges related to access, gender dynamics, and empowerment within irrigation systems. The study period highlighted the 2024 agricultural season. This enabled the research to document advancements resulting from recent irrigation and agricultural initiatives. The research excluded rain-fed farmers, commercial agribusinesses, and other districts in the Upper East Region, since its aim was not to generalise nationwide but to provide context-specific findings that may guide local practices and larger policy discussions.

1.7 Organization of the Study

The study is structured into eight chapters. Chapter One introduces the research by presenting the background, problem statement, research objectives, research questions, significance, scope, and definitions of key terms. Chapter Two reviews relevant literature and outlines the theoretical and conceptual frameworks underpinning the study. Chapter Three describes the research methodology, including the research philosophy, design, sampling procedures, data collection

methods, and data analysis techniques. Chapter Four presents findings on gender differences in participation and access to productive resources among farmers in the Tempane District. Chapter Five examines the association between participation in irrigation farming and women's empowerment in the district. Chapter Six explores the relationship between participation in irrigation farming and household poverty reduction. Chapter Seven identifies the major constraints limiting farmers' access to irrigation farming. Finally, Chapter Eight summarizes the key findings, draws conclusions, and provides recommendations for policy and practice.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL PERSPECTIVES

2.0 Introduction

This literature review seeks to explore and synthesise existing research on the intersectionality of irrigation as a source of livelihood and women's empowerment. By critically examining the literature, this review aims to elucidate the following key aspects: how irrigation contributes to increased agricultural productivity and food security, generating income and reducing poverty among rural households. It will also provide a comprehensive analysis of women's roles and contributions to irrigation systems, as well as an overview of theoretical frameworks and conceptual models that underpin the relationship between irrigation, livelihoods, and women's empowerment.

2.1 Definition of Key Concepts

2.1.1 Gender

Gender encompasses the social, cultural, and psychological attributes, roles, and behaviours that society deems appropriate for individuals based on their sex (Rudman & Glick, 2021). Unlike sex, which is biologically determined and grounded in physical characteristics such as male or female, gender is a socially constructed and fluid concept that varies across cultures, contexts, and time periods. It shapes societal expectations and norms surrounding masculinity, femininity, and other gender identities (Van Anders, 2024).

In the context of this study, gender is explored through the lens of roles and responsibilities, including decision-making, labour distribution, and access to resources in agricultural activities,

particularly irrigation farming. It also examines access and control, focusing on how men and women navigate irrigation infrastructure, finances, and technologies to enhance farming productivity. Furthermore, gender considers empowerment and participation, analysing the extent to which women are involved in decision-making, leadership, and equitable benefits from irrigation initiatives (Carnegie et al., 2020). Recognising gender as a dynamic concept is essential to understanding its influence on women's empowerment and their capacity to contribute to and benefit from agricultural and poverty-alleviation efforts in the Tempane District.

2.1.2 Irrigation

Irrigation refers to the process of adding a specific amount of water to a given location to meet the crop's requirements at that location, in quantities suitable for the crop's growth stage (Minhas et al., 2020). Ushang et al. (2020) have defined irrigation as the practice of cultivating land through the artificial use of water in locations where rainfall is unpredictable, to ensure both double cropping and a regular water supply. Before planting crops, this may also involve providing water in the quantities necessary to bring the soil up to the required level of moisture. This method consists of maintaining land precipitation by supplying fields with water. For agricultural cultivation, water can be collected through the following methods: running rivers, rainwater collection via the construction of dams and reservoirs, and ground pumping (Minhas et al., 2020).

According to the Food and Agriculture Organisation, irrigation is an artificial method of providing water to crops. It was created to enable farming in dry areas and to lessen the effects of drought in semi-arid countries (Fernández García et al., 2020). By using irrigation water, the water deficit that restricts plant growth is reduced by ensuring that soil moisture levels are sufficient to meet crop water needs (Ushang et al., 2020). From the ideas presented above, irrigation may be thought of as the process of adding water to the soil to provide it with the moisture plants need to thrive.

2.1.3 Livelihoods

According to Chambers and Conway (1992), a person's livelihood encompasses their skills, means of subsistence, such as their homes, income, and food, all of which contribute to their overall well-being. They contend that livelihood is a three-part relationship in which people prosper by making effective use of both their tangible (resources and stores) and intangible (claims and access) assets. Ellis (2000) also defines livelihood as the activities, possessions, and access that determine how well a person or household can live. People's willingness to engage in activities and own assets to improve their living conditions is what unites these notions.

When describing the idea of livelihoods, Wallman (1984) gives a critical perspective. He contends that finding or making a place to live, earning money to prepare food, or engaging in market trades are only a few aspects of existence. Both possessing knowledge and being able to communicate it are essential. This means that livelihoods extend beyond the actions and possessions that ensure good living conditions, and also entail preserving social ties, reaffirming one's value as a person and as a member of the community, and connecting these activities. Chambers and Conway (1992) described that as Capabilities. For Wallman (1984), living is a broader term that implies that social life is in layers and overlaps (both in the way people think about it and how it should be analysed. This is an essential feature for analysing livelihood.

Comparatively, it can be seen that essential components, such as possessions, activities, and entitlements, shouldn't be overlooked when conceptualising livelihood. Communities' assets include natural resources such as land and water, social assets like family and community networks, political assets like access rights and empowerment, and human assets like education, knowledge, and skills (Mulema et al., 2021). Activities, in general, refer to how community members utilise resources to support their livelihoods. While entitlements refer to those associated

with legal or customary rights, such as access to publicly owned property, activities include the selling of products and services (Mulema et al., 2021).

2.2 History of Irrigation Farming

Irrigation is an ancient agricultural practice widely used by early civilisations, including the ancient Egyptians (Ahmed et al., 2020). Irrigation has been practised worldwide for decades, beginning with traditional methods that supplied water for farming. According to Ahmed et al. (2020), as early as 500 BC, Nile River floodwaters made fertile lands that the Egyptians cultivated. The first canal system, which brought water from the Nile to their fields, was built circa 3000 BC. It happened after it was discovered that Egypt had experienced numerous droughts and that many dry areas were unable to store adequate food for the entire year. By that time, large portions of China, India, and Southwest Asia had also constructed extensive irrigation systems. Irrigation has enabled the cultivation of crops in arid regions, thereby increasing food production. Countries now aim to expand their irrigated land on an annual basis, driven by the need to increase crop output. Irrigation use has developed recently in semi-arid regions to sustain agriculture. To supplement the food supply, irrigation has stimulated the growth of crops in the arid areas. Growing crop output has led countries to expand their irrigated acreage on an annual basis.

Historical records in Ghana date back to the introduction of irrigated farming practices, which is less than a century old. The first scheme was conceived by the government as part of the Winneba Water Supply Project back then in 1920 (Agyare et al., 2008). According to Agodzo and Bobobee (1994), in the 1930s, several types of shallow-tube well irrigation systems were identified in Southeastern Ghana. In the 1950s and early 1960s, several water schemes were constructed, comprising approximately 240 earth dams and dugouts in the north and around 66 in the Ho-Keta plains in the south, to provide water for domestic, livestock, and dry-season farming purposes

(Agodzo & Bobobee, 1994). The Asutsuare Irrigation Project was the first to be finished in 1967. The first national irrigation project, Dawhenya, was started shortly after independence in 1959.

2.3 Irrigation Farming in Africa and Ghana

Irrigated farming accounts for approximately 20% of all agricultural land and production, which is responsible for around 40% of the world's total food output. Just over 3% of the agricultural land in Sub-Saharan Africa is irrigated, which is the lowest percentage globally. One-fifth of the irrigation potential in Sub-Saharan Africa, or 7.7 million hectares out of 38 million hectares, has been developed. In South America, one-fourth of the potential has been equipped, or 16 million ha out of the potential 60 million hectares (Nifaakang, 2020). Because the amount of irrigated land in Africa is substantially lower than the global average, irrigation has a relatively minor impact on agriculture compared to other nations.

Low irrigation levels in Africa are a result of high investment costs in irrigation, alleged flaws in previous irrigation plans, inadequate government support, limited rural infrastructure, dispersed farming, and low-water crops (Kadigi et al., 2019). Wealthy farmers have greater access to irrigation technologies, according to Namara et al. (2014). In literature, it is commonly accepted that the Asian Green Revolution could not have occurred without irrigation investments (Nifaakang, 2020). The Green Revolution programme included irrigation as a crucial component, which not only helped many rural Asians escape poverty but also created favourable conditions for economic growth. African nations were encouraged to adopt the same development strategies as those employed by Asian nations. This is assuming that Africa has significant irrigation growth potential (Kadigi et al., 2019).

Many countries in Sub-Saharan Africa, including Ghana, have recognised the vital role of irrigation in food production, and investments in irrigation have increased in the region. Despite some notable irrigation expansion, the developmental impact of irrigation in Africa has been limited and has fallen short of expectations (Wondimagegnhu & Bogale, 2020). Farmers in northern Ghana often focus on yield and overlook good agronomic practices that can help them achieve high yields while maintaining the sustainability of their irrigation facilities (Agula et al., 2019).

2.4 Role of Irrigation Farming

Improved irrigation infrastructure can promote access to water for smallholder farmers. In turn, water access directly influences agricultural production through its impact on seedbed preparation, germination, root growth, fertiliser absorption efficiency, crop growth, and farm economic performance (Li et al., 2020). Therefore, enhancing the construction of irrigation infrastructure is considered a significant way to improve the livelihoods of rural households. From the perspectives of sustainable agricultural production and rural development, policy analysts, governments, and agricultural economists in developing and emerging countries have paid increasing attention to the development of irrigation infrastructure in rural areas (Li et al., 2020).

An increasing number of studies have shown that irrigation development improves farm economic performance and household welfare (Li et al., 2020; Silveira et al., 2020). For example, research has shown that improved irrigation access significantly increases household consumption and asset generation in Mali. Additionally, it has been revealed that irrigation usage tends to enhance farm economic performance by increasing maize yields and crop quality in France. Studies in China and Malawi have demonstrated that irrigation development exerts a positive and significant impact on cereal crop yields, household income and poverty alleviation (Tesfay, 2021).

In addition, irrigation development may affect household income diversification through influencing farm and off-farm activities. Improved irrigation access may indicate that farmers who rely on cereal crop cultivation as their primary source of farm income may shift to cultivating both cereal and cash crops to reduce income uncertainties associated with growing a single crop. Previous studies have shown that farmers with access to irrigation are more likely to shift their cultivation to high-value cash crops (Tesfay, 2021). Moreover, irrigation development can lead to a reallocation of household labour. Kajisa and Payongayong (2011) for Mozambique and Weligamage et al. (2014) for Sri Lanka demonstrated that irrigation development enhances production efficiency, thereby saving farm labour that can be potentially allocated to off-farm work to generate additional income. As a feasible strategy for risk management, income diversification is increasingly prevalent in developing countries. Given the fact that farmers in developing countries are increasingly dependent on income diversification for risk management, understanding the association between access to irrigation and income diversification is of importance (Tesfay, 2021).

2.5 Policy Dimension of Irrigation in Ghana

Irrigation in Ghana has been guided by policies and strategies aimed at enhancing agricultural productivity, ensuring food security, and promoting sustainable water management to reduce poverty and mitigate the impacts of climate variability. Key dimensions include national development plans that prioritise irrigation modernisation, equitable water resource management by the Water Resources Commission, and the National Irrigation Policy, which supports infrastructure development and smallholder farmer participation (Ofosu & Minh, 2022).

Before the adoption of the 2010 National Irrigation Policy (NIP), irrigation development in Ghana was shaped by fragmented policies and strategies, which primarily focused on large-scale

infrastructure development with limited consideration for smallholder farmers, gender inclusion, and sustainability (Ofosu & Minh, 2022). Post-independence efforts in the 1960s and 1970s prioritised large-scale irrigation projects, such as the Kpong Irrigation Scheme and the Tono Irrigation Scheme (Sogfaa, 2023). These projects aimed to increase agricultural production for export and local consumption. These efforts were spearheaded by the Ghana Irrigation Development Authority (GIDA), established in 1977, which oversaw the design and management of irrigation systems (Djangba et al., 2024). While large-scale projects increased irrigation capacity, they were capital-intensive and often failed to account for the needs of smallholder farmers. Many schemes suffered from poor maintenance, inefficient water use, and low farmer participation, which limited their sustainability and long-term impact.

During the 1980s, Ghana aligned with the global "Green Revolution" agenda, which emphasised the use of modern agricultural technologies, including irrigation, to boost production (Alhassan, 2019). However, irrigation development during this period was closely tied to structural adjustment programmes (SAPs) (Nana-Sinkam, 2019), which reduced public expenditure and emphasised privatisation. The emphasis on market-driven irrigation development alienated smallholder farmers who could not afford the high costs associated with irrigation technologies. Furthermore, SAPs led to the underfunding of state-run irrigation projects, resulting in many of them deteriorating (Nana-Sinkam, 2019).

In the 1990s, irrigation policies were geared toward achieving food security. Small-scale and community-based irrigation systems, such as dugouts and boreholes, received some attention under programmes like the Medium-Term Agricultural Development Programme (MTADP) and Accelerated Agricultural Growth and Development Strategy (AAGDS) (Teye & Torvikey, 2018). While the focus on small-scale irrigation was a step forward, implementation was inconsistent,

and the programmes lacked comprehensive frameworks to address water management, equitable access, and environmental sustainability. There was also minimal effort to integrate gender perspectives or address the unique needs of women farmers.

Irrigation development before 2010 heavily depended on donor funding from organisations such as the World Bank, the African Development Bank (AfDB), and the International Fund for Agricultural Development (IFAD) (Harmon, 2022). These projects included infrastructure rehabilitation, capacity building, and the introduction of new technologies. Donor-led initiatives were often short-term and lacked alignment with Ghana's broader agricultural goals. Many projects were abandoned after donor funding ended, and there was limited capacity-building to sustain these systems locally. For example, the Irrigation, Village Infrastructure, and Development Project (IVID) were a key initiative in Ghana during the 1990s, aimed at improving rural livelihoods through small-scale irrigation, infrastructure development, and community involvement. Funded by the African Development Bank and other partners, IVID focused on constructing and rehabilitating reservoirs, feeder roads, and storage facilities, while providing technical training for farmers and promoting community ownership of irrigation systems. It significantly improved access to water for agriculture and enhanced rural infrastructure. However, IVID faced limitations, including limited geographic coverage, maintenance challenges, a short-term donor-dependent approach, gaps in gender inclusivity, and inadequate climate adaptation measures. These shortcomings highlighted the need for a more comprehensive and sustainable irrigation policy, which influenced the development of Ghana's 2010 National Irrigation Policy. The reliance on external funds also reduced national ownership of irrigation development.

Policies prior to 2010 did not adequately consider the impacts of climate change on water resources or the gendered dimensions of irrigation access. Women, who form a significant proportion of

Ghana's agricultural workforce, faced systemic barriers to accessing irrigation infrastructure, resources, and decision-making processes (Ofosu & Minh, 2022). This lack of inclusivity limited the potential for irrigation to empower women and address poverty comprehensively. Additionally, the absence of climate-resilient practices left many irrigation systems vulnerable to droughts, floods, and other climate-related shocks.

The National Irrigation Policy, approved in 2010, aims to enhance sustainable growth and irrigation efficiency in Ghana (Ofosu & Minh, 2022). It covers all sub-sectors and emphasises the need for cooperation between agencies and organisations, such as MoFA and GIDA, as agricultural water management is a complex issue. GIDA manages both public and private irrigation promotion (Drechsel et al., 2014). The National Water Policy in Ghana aims to ensure adequate water availability for farmers for crop cultivation. GIDA has constructed 22 public irrigation schemes in Ghana (see Table 1), covering approximately 14,700 ha, of which 60 per cent was created in 2003 (MOFA, 2011). There are currently 56 GIDA and farmers-run irrigation schemes. The bulk of the schemes were initially operated by GIDA and Upper East Region Irrigation Company (ICOUR) in the northern region of Ghana.

Table 2.1 presents 22 public irrigation schemes in Ghana, along with the irrigation methods employed by each. Many small-scale irrigation systems are practised throughout the country, apart from public irrigation schemes. It is estimated that private, small-scale irrigated land accounts for approximately 1,850,000 hectares, with about 500,000 farmers actively involved. Private, small-scale farmers work on small farms and use basic tools, such as cutlasses, buckets, knives, and hoes (Nifaakang, 2020).

Table 2.1: Irrigation Methods across Notable Public Irrigation Schemes in Ghana

Mode of Irrigation	Name of Scheme
1. Run-of-river diversion and gravity-fed systems	Sata, Annum Valley
2. River pumping-based and gravity-fed systems.	Dawhenya
3. Reservoir-based gravity-fed systems	Libga, Afife, Bontanga, Gollinga, Tono, Vea, Ashaiman, Kpong, Okyereko
4. Lake pumping-based sprinkler irrigation system.	Weija, Kpando-Trokor, Amate, Dedeso
5. River pumping-based sprinkler irrigation system	Subinja, Tanoso, Akumadan
6. Reservoir pumping-based sprinkler irrigation system	Mankessim

Source: Author's Construct, 2024

2.6 Effect of Irrigation on Livelihoods

Irrigation and livelihoods are inextricably linked (Assefa et al., 2022). For rural farmers in emerging nations, irrigation plans are a practical and alluring option. Even on small plots, the returns from irrigated farming may well exceed those from rain-fed agriculture. In many developing nations, irrigation programmes have been credited with increasing growth, minimising unpredictable rainfall droughts, and providing impoverished farmers with access to food and employment. In some situations, irrigation plans provide water to farmers at a cost to generate revenue (Assefa et al., 2022). Through this, farmers can produce yields throughout the year,

providing them with income to meet some of their basic needs. According to Mpala (2016), food output from irrigated farms is a significant source of wealth development, as it serves as the basis of economic growth in several localities.

Improvements in irrigation have made it possible for other rural infrastructure to develop in places where it might not have otherwise been possible to build roads, telephone lines, schools, and clinics. Results of a study conducted in Northern Ethiopia revealed a statistically significant difference in earnings, overall spending, asset accumulation, and expenditure on agricultural inputs between the treated and control households. The study's findings support the idea that extending irrigation schemes is a prudent move in Ethiopia's water-stressed and drought-prone regions, as they demonstrate that participation in small-scale irrigation has a significant and beneficial impact on most livelihood metrics (Zeweld et al., 2015).

It was discovered that small-scale irrigation has a significant influence on farmers' livelihoods, affecting them in both direct and indirect ways, including crop variety, enhanced agricultural growth, household income, job prospects, and community involvement in decision-making. It has been established that the annual average income of the sampled irrigator households has increased. Every year, millions of Ethiopians go hungry due to the country's severe drought and other climate-related risks. Small-scale irrigation systems were implemented as an alternative for scenarios involving productivity and livelihood diversification (Mengistie & Kidane, 2016). With rural households creating jobs, increasing food security, and stabilising food prices in both rural and urban markets, irrigation can reduce poverty and boost livelihoods (Devereux, 2016).

2.7 Challenges to Irrigation in Ghana

Irrigation farming is widespread in most parts of Ghana. According to Namara et al. (2011), Ghana's irrigation system faces several issues, including financial constraints, administrative problems, access to inputs and services, marketing and post-harvest handling, inadequate coordination, and disputes over compensation between the government and landowners. According to a recent analysis by the Food and Agriculture Organisation and the International Finance Corporation in Ghana, the majority of the aforementioned problems are caused by a lack of funds (Mundy & Menashy, 2014). A study conducted by Abdulai et al. (2018) in Northern Ghana revealed that local economic development, improvements in farm productivity, and agricultural modernisation had been hampered in Ghana due to access to credit by smallholder irrigation farmers. Irrigated vegetable farmers cite the high cost of inputs as their biggest production constraint, with as many as 81.8% having no access to any form of credit. The situation is further complicated by the difficulty in accessing credit from formal credit sources.

Appiah-Nkansah (2009) looked at the Upper West region's irrigation systems. He pointed out that irrigation in Ghana is fraught with problems, ranging from poorly managed canals to weeds and mud covering the networks of canals. In a related study, the Government was blamed for poor maintenance of structures. However, the government's inability to engage effectively in the repair and provision of machinery services has contributed to devastating consequences. The government primarily provides the headwork, conveyance, and distribution infrastructure for the country's irrigation development; therefore, if maintenance is left to farmers alone, it will be challenging, given the current problems facing farmers, such as low farm income and production (Nifaakang, 2020). As a result, some of the plans have been completely neglected, leading to their failure.

Information sharing and management are crucial elements of sustainable irrigation farming; unfortunately, the knowledge and skills necessary to manage irrigation farming successfully continue to stagnate (Nifaakang, 2020). Computers are needed to save crucial farm data, but there aren't enough of them, and the ones that exist are either broken or awkward to use. As a result, information such as agricultural records, reports, and documentation will likely be recorded on paper and stored in filing cabinets. They frequently disappear from the shelf or are almost torn apart due to ageing (Ofosu & Minh, 2022).

Drechsel et al. (2014) recognised automation and outdated irrigation equipment as barriers to sustainable irrigated agriculture in Ghana, particularly in the north. The irrigation practices used in modern farming do not protect the soil or the water. For instance, unauthorised dugouts present serious health and environmental problems in most of northern Ghana (Drechsel et al., 2014). Rademacher-Schulz et al. (2014) noted that farmers have constructed wells on riverbeds and rely on rivers that run alongside farms as a source of water for irrigation. Due to the high soil penetration of fertilisers and pesticides during the dry season, these operations reduce water levels and substantially contaminate surface water. Ghana has organisations in place to ensure a safe environment, including the Environmental Protection Agency (EPA), water and sanitation regulatory bodies, and municipal authorities; however, these organisations rarely address these issues. Booker and Trees (2020) claim that several studies in the field support the consequences of insufficient irrigation water management. The majority of farmers are compelled to use shallow wells or groundwater, which raises the demand for labour. Additionally, there aren't enough gates or proper sewage systems to direct and control run-offs in water schemes (Abdulai et al., 2018).

The technical support given by agricultural extension officers has been insufficient. Production and post-harvest operations are hindered by the technical officers' failure to provide farmers with

the necessary assistance. As a result, 38.7% of farmers, or more than one-third of them, are unable to access extension services. As a result, they struggle with crop diseases, pest infestations, and a lack of information about contemporary farming methods (Dinye & Ayitio, 2013). Farmers blame illnesses for a plant's failure. Not only does this lower their production, but it also demoralises them and discourages them from farming certain crop varieties. Agricultural Extension Agents rarely visit farmers to identify their issues and provide essential assistance in finding solutions (Nifaakang, 2020). To achieve optimal water management, the main surface irrigation systems require proper soil preparation. For instance, a levelled field may be able to use water more efficiently and reduce irrigation time. Each row and its plants receive the appropriate amount of water on properly levelled land in this condition when the water is opened for distribution on the land. This would avoid drainage and moisture stress issues that could harm crops by drowning or burning due to an excess of water or a lack of water (Kyei-Baffour & Ofori, 2006). It could be argued that when examining studies on irrigation challenges, the problems can be roughly categorised into four categories: maintenance challenges, financial challenges, human resource challenges, and technical challenges resulting from the construction of irrigation dams, canals, and schemes. This suggests that to address the issues that irrigation agriculture in Ghana is facing, a comprehensive strategy must be employed.

2.8 Irrigation and Women's Empowerment

The relationship between irrigation and women's empowerment has gained increasing attention in development research, as irrigation can significantly shape women's access to productive resources, decision-making power, and economic opportunities. Emerging evidence indicates that when women are able to access and use irrigation technologies, they often experience improvements in agricultural productivity, income, and household bargaining power (Bryan &

Lefore, 2021; Njuki et al., 2023). However, these benefits are not automatically realised, as gender norms and structural barriers continue to shape who participates in irrigation and who gains from it.

In many parts of sub-Saharan Africa, including Ghana, women play a central role in agricultural production yet remain underrepresented in irrigation schemes due to limited land ownership, constrained access to water rights, inadequate financial resources, and exclusion from governance structures (Sakketa, 2018; Theis et al., 2018). These constraints reduce women's ability to adopt irrigation technologies and limit the extent to which irrigation contributes to their empowerment. For instance, water allocation in formal irrigation systems is commonly tied to land ownership, which disproportionately disadvantages women because men are more likely to hold documented land rights. As a result, women may rely on their spouses or male relatives for access to irrigated plots, reducing their control over production decisions and income (Agarwal, 1994; Ray, 2007).

Despite these barriers, research shows that when women do gain direct access to irrigated land or small-scale irrigation technologies such as motor pumps or drip kits, they tend to increase crop diversification, expand dry-season farming, and improve the nutritional quality of household diets (Bryan & Mekonnen, 2023; Hirai et al., 2016). Such improvements can enhance women's economic autonomy and strengthen their role in intra-household decision-making. Small-scale irrigation in particular has been associated with reductions in women's time burden, increased asset ownership, and greater participation in community institutions (Theis et al., 2018).

However, irrigation can also reinforce gender inequalities when not intentionally designed with women's needs in mind. Studies document situations where irrigation increases women's labour demands without corresponding gains in control over income or resources (Nation, 2010). In such cases, irrigation expands women's workload while leaving gendered power relations unchanged

or even exacerbated. These mixed outcomes highlight the need for context-specific analyses of how irrigation interacts with gender norms, resource control, and household dynamics.

In Ghana, research on irrigation and gender has identified persistent inequalities that limit women's participation in irrigated agriculture. Women often cultivate smaller plots, have weaker tenure security on irrigated lands, and face difficulties accessing credit, input markets, and irrigation equipment (Doss et al., 2018; Akurugu et al., 2022). These constraints reduce their potential to benefit from the expanding small-scale irrigation sector. Nonetheless, recent interventions that target women through inclusive water user associations, group-based access to irrigated plots, or subsidized technologies have shown promising results in enhancing women's agency and economic empowerment (Amadu et al., 2021).

2.9 Theoretical and Conceptual Framework

2.9.1 Gender and Development (GAD) Theory

The Gender and Development (GAD) theory surfaced in the 1980s as a response to the shortcomings of the Women-in-Development (WID) frameworks that prevailed during the 1970s. While WID regarded women as a separate and frequently peripheral category to be integrated into prevailing development frameworks, GAD redirected the analytical emphasis towards the more extensive system of social relations (Basu, 2004; Ricker, 2022). Basu and Ricker's assertion was that inequality arises not from the lack of female participation in development initiatives, but from deeply rooted institutions, norms, and power dynamics that consistently allocate disparate roles, expectations, and rights to men and women. In this context, GAD framed gender not merely as a personal characteristic but as a relational construct, intricately woven into the fabric of economic, political, and socio-cultural institutions (Basu, 2004; Ricker, 2022). This evolution signifies a

fundamental transformation. The discourse surrounding development transitioned from merely incorporating women into pre-existing frameworks to critically examining and reshaping those very frameworks. The research acknowledges this theoretical transition, positioning GAD as a crucial structural lens for analyzing irrigation and women's empowerment in the Tempane District.

Basu (2004) and Ricker (2022) have presented diverse yet harmonious interpretations of GAD. Basu (2004) articulates it as a framework that comprehends gender as a network of social relations, delineating access to resources, responsibilities, and opportunities. Comparably, Ricker (2022) underscores that GAD critically examines how both formal and customary institutions either perpetuate or challenge gendered inequalities. In practice, GAD emphasizes the mechanisms through which public policies, legal frameworks, cultural customs, and societal standards allocate or perpetuate benefits and drawbacks in relation to gender (Basu, 2004). Therefore, it necessitates profound interventions that reshape power dynamics, rather than simply supplying material resources (Ricker, 2022). In the context of the irrigation sector, this viewpoint suggests that the exclusion of women cannot be attributed solely to their lack of land or access to technology. Instead, it necessitates an examination of the tenure systems, patriarchal decision-making frameworks, and inequitable governance structures that systematically marginalize them.

The foundational assumptions of GAD are distinctly articulated and resolute. It posits, initially, that distinctions in gender are shaped by social constructs and perpetuated through institutions, rather than being inherently determined by biology (Basu, 2004). Secondly, it asserts that structural constraints, be they legal frameworks, market dynamics, cultural conventions, or governance structures, serve as the fundamental origins of inequality (Ricker, 2022). Third, it posits that significant change in women's lives necessitates interventions at the institutional and relational levels, rather than solely focusing on individual resources (Yeh, 2018). This focus on structures

indicates a theoretical dedication to examining power and inequality as systemic issues, rather than merely as the result of individual shortcomings.

The efficacy of GAD is rooted in its capacity to link structural limitations directly to developmental results. In the current investigation, the documentation of matters such as land tenure insecurity, the predominance of male authority in irrigation governance, and the inequitable distribution of women's plots on less fertile or inadequately irrigated lands, as presented in Chapters Four and Five, underscores the necessity of employing GAD as a critical analytical framework. This approach facilitates a deeper examination of the underlying factors contributing to women's diminished involvement in irrigation, prompting a critical inquiry into the entrenched rules and practices that sustain this marginalization. Certainly, the findings presented in chapter four underscore challenges observed in Tempane, such as the derivative land rights possessed by women, the limitations on their representation within irrigation committees, and the cultural norms that constrain their participation in collective decision-making, which are precisely the structural phenomena that GAD aims to elucidate. By elucidating the mechanisms through which institutions perpetuate inequality, GAD also indicates the necessary policy interventions, including reforms in land tenure, representation quotas, and governance frameworks that are responsive to gender considerations.

Notwithstanding these advantages, GAD faces its share of critiques. Hirshman (2003) argues that it may be excessively structural, consequently diminishing the agency and diversity of women within domestic and communal contexts. Some observers point out the challenges associated with implementing this concept in empirical research, especially within impact evaluation frameworks that necessitate quantifiable indicators (Bell, 2000). Hirshman and Bell indicate that although GAD effectively elucidates structural inequality, it does not consistently furnish the means to

assess micro-level processes of empowerment. Nonetheless, these constraints do not undermine the significance of the theory for the current investigation. Instead, they rationalize the combination of GAD with individual-level frameworks, such as Empowerment Theory, to encompass both the structural and agency aspects of women's involvement in irrigation.

The rationale for its adoption is clear, as GAD integrates harmoniously with the research questions of the study, especially those examining constraints, governance, and policy. The second research question, which examines the limitations affecting women's access to and utilization of irrigation, institutional characteristics and interventions, directly engages with the fundamental tenets of Gender and Development. In the Tempane District, the interplay of customary tenure arrangements, gendered cultural norms, and state-led irrigation governance shapes the opportunities available to women, necessitating the analytical depth that GAD offers. By placing women's empowerment within this expansive institutional framework, the theory enhances the research's potential to transition from mere descriptive findings to actionable policy recommendations. In this manner, GAD transcends its role as a mere background lens and functions as a fundamental theoretical foundation that shapes the comprehensive examination of structural inequalities in irrigation access and outcomes.

2.9.2 Empowerment Theory

Women's Empowerment Theory has its foundations in development scholarship and gained prominence in the late 1990s through the influential work of Kabeer (1999). Kabeer conceptualized women's empowerment as a process through which women particularly those previously constrained by structural and socio-cultural limitations gain the capacity to make strategic life choices. Her framework clarifies empowerment through three interlinked dimensions: resources, agency, and achievements, thereby transforming an abstract idea into a practical

analytical tool for research and policy. Over the years, the theory has been widely applied and expanded within fields such as microfinance, agricultural development, health, and gender studies, reflecting increased recognition that women's disadvantages stem not only from material deprivation but also from entrenched social norms and unequal power relations.

Several scholars have contributed to the evolution of this theory. Kabeer (1999), Alsop et al. (2006), and Joseph (2020) offer complementary interpretations of women's empowerment. Kabeer (1999) emphasises that empowerment involves women's enhanced capacity to exercise choice in contexts where such capacity was previously denied. Alsop, Bertelsen, and Holland (2006) add that empowerment entails strengthening the ability of women to make meaningful decisions and convert those decisions into desired outcomes. Joseph (2020) further argues that women's empowerment is multidimensional and context-specific, extending beyond access to economic assets to include social, political, and psychological dimensions. Taken together, these perspectives reinforce that empowerment is both a process and an outcome, requiring not only access to resources but also the agency needed to translate those resources into visible improvements in women's lives.

According to Kabeer (1999), the key principles underlying Women's Empowerment Theory emphasize that empowerment is inherently multidimensional, encompassing economic, social, political, and personal spheres, and that progress in one domain does not necessarily translate into progress in another. The theory also highlights the central role of agency, asserting that access to resources alone is insufficient unless women possess the autonomy and authority to determine how those resources are used. Additionally, Kabeer underscores the significance of achievements, explaining that the outcomes of women's exercise of choice not only serve as indicators of empowerment but also act as reinforcers that can sustain or enhance women's agency over time.

The adaptability of Women's Empowerment Theory makes it particularly useful for empirical research. Its resources–agency–achievements framework can be operationalised into measurable indicators that align closely with agricultural livelihoods. Within rural farming contexts, *resources* may include access to irrigable land, credit, farming inputs, and irrigation technology; *agency* may be reflected in decision-making over crop choices, labour allocation, income use, and participation in irrigation governance; and *achievements* may manifest through improved household food security, increased income, or enhanced social status. In this study, the theory provides the analytical foundation for examining women's involvement in irrigation farming within the Tempane District. Field indicators such as women's access to land, control over income from irrigation activities, participation in both household and community-level decision-making, and leadership roles within irrigation management all correspond closely with the three dimensions of empowerment.

Empirical studies support the relevance of Women's Empowerment Theory within agricultural development. Bryan and Garner (2020) and Njuki et al. (2023) demonstrate that irrigation can be a catalyst for women's empowerment when interventions intentionally improve women's access to productive resources and strengthen their decision-making power. Theis et al. (2018) similarly found that women's access to irrigation enhanced income stability and bargaining power, although such gains were highly dependent on institutional arrangements and local gender norms. These findings underscore that empowerment outcomes are shaped not only by technological access but also by broader socio-cultural and institutional contexts.

Despite its strengths, the theory is not without critiques. McLaughlin (2016) argues that the measurement of empowerment particularly agency can be subjective and influenced by cultural expectations, making it difficult to capture in quantitative terms. Other scholars caution that

development initiatives sometimes conflate short-term economic gains with deeper structural empowerment. For example, women may experience increased income through irrigation but remain marginalised in land ownership, access to water rights, or leadership positions within irrigation committees. Findings from the Tempane District similarly reflect such tensions, with some women reporting improved household earnings yet expressing concerns about insecure land tenure and limited involvement in governance structures. These contradictions highlight the importance of applying Women's Empowerment Theory critically and contextually.

The rationale for adopting Women's Empowerment Theory in this research is grounded in its strong alignment with the study's purpose and research questions. Research Question Three examines the relationship between irrigation and household economic outcomes, while Research Question Four directly explores how irrigation influences women's empowerment. The theory provides a logically coherent and analytically robust framework for integrating quantitative indicators such as income gains, land access, and productivity with qualitative experiences related to autonomy, decision-making, and perceived empowerment. This dual applicability strengthens the study's mixed-methods design and ensures that empowerment is examined not only as a measurable outcome but also as a lived and context-dependent process.

2.9.3 Irrigation and Women's Empowerment Frameworks

The recent emergence of frameworks for women's empowerment specific to irrigation signifies a significant advancement in development theory and practice. Although the broader Gender and Development (GAD) and Empowerment theories offer significant insights into structural inequality and agency formation, scholars have acknowledged the necessity for frameworks specifically designed for the agricultural and irrigation context. Starting in the mid-2010s and solidified in the research of Bryan and Garner (2020; 2022) and Meinzen-Dick et al. (2019), these

frameworks modified the overarching principles of empowerment to align with the specific conditions of smallholder irrigation. The study aimed to elucidate the influence of interventions in water management, irrigation infrastructure, and agricultural institutions on women's access to resources, decision-making authority, and livelihood outcomes. This approach exemplifies a natural evolution of empowerment theory into a specific sector, effectively linking theoretical frameworks with practical application.

Bryan and Garner (2020) define irrigation as an empowerment pathway based on the resource–agency–achievement model, incorporating irrigation-specific mechanisms, including access to water scheduling, irrigation technology, and cooperative membership. The authors contend that the potential of irrigation extends beyond enhancing agricultural productivity to also transforming intra-household bargaining dynamics and increasing women's involvement in collective action. Bryan and Garner (2022) identify critical pathways by which irrigation influences empowerment, thus, productivity improvements leading to increased income and bargaining power, time savings that alleviate women's labour burdens and improve care work balance, and the enhancement of collective action via water user associations. Meinzen-Dick et al. (2019) highlight the importance of secure land and resource rights in facilitating women's ability to convert irrigation benefits into empowerment. They emphasize that the absence of clear and enforceable rights renders women's access to irrigated land and water precarious, thereby increasing their vulnerability to dispossession, even with the introduction of new technologies. These scholars propose a framework tailored to the institutional and cultural contexts of irrigation farming.

The frameworks' assumptions are grounded in empowerment and institutional theories, yet they exhibit distinct characteristics within irrigation systems. Primarily, it is posited that irrigation interventions directly modify the resource base accessible to smallholder farmers, facilitating

multiple cropping seasons, enhancing yields, and increasing food security. Secondly, it is argued that the mere availability of resources does not guarantee empowerment; women's capacity to assert and manage these resources is contingent upon tenure security, governance structures, and existing gender norms. Third, it is assumed that collective institutions, including irrigation committees and water user associations, serve as essential mediators of empowerment by influencing participation in governance and the distribution of benefits. The assumptions correspond with the actual conditions in the Tempane District, where women's involvement in irrigation farming is influenced by governance regulations and cultural norms, in addition to access to land and water resources.

The efficacy of these irrigation-specific frameworks is rooted in their empirical basis and operational precision. Their provision of causal pathways allows for direct testing in field research, enhancing their practicality for development evaluations. Bryan and Garner's emphasis on the relationship between productivity, income, and bargaining power is supported by empirical studies in Sub-Saharan Africa, demonstrating that women's access to irrigated plots frequently leads to increased household cash income and improved bargaining positions. Similarly, their focus on time-use outcomes is particularly relevant in rural Ghana, where women encounter substantial labour burdens that restrict their ability to participate in productive activities. Meinzen-Dick et al. assert that secure tenure is essential for empowerment, a claim that has been consistently validated in Ghana and elsewhere, where women frequently cultivate land that is borrowed or derived, thereby making their access dependent on male relatives or community leaders. The findings from Tempane reflect these dynamics: 64.1% of women reported gains in empowerment through irrigation; however, many still faced challenges related to secure land tenure and meaningful

representation in governance structures. This empirical resonance highlights the practical utility of these frameworks in elucidating the mixed outcomes of irrigation interventions.

While these frameworks exhibit notable strengths, they also face criticism. Mdee and Harrison (2019) contend that there is a risk of excessive technocracy, as the focus on resource flows and institutional design may neglect broader macro-political and structural inequalities. Irrigation programmes may enhance women's access to water and resources; however, they often do not alter patriarchal land tenure systems that dictate control over valuable irrigated plots. Mdee and Harrison (2019) warn that irrigation may unintentionally increase inequality; as land values increase due to irrigation infrastructure, women lacking secure tenure may completely lose access, thereby heightening their vulnerability. Nation (2010) observed instances where irrigation projects enhanced male control over resources and exacerbated women's workload instead of alleviating it. These critiques emphasize the necessity of integrating these frameworks with GAD and Empowerment Theory, ensuring that analysis avoids a narrow technocratic focus and remains attuned to structural and relational dynamics.

The rationale for implementing these frameworks in this research is evident. The research aims to investigate the gendered dynamics of irrigation farming, the challenges encountered by women, and the empowerment outcomes resulting from their participation. The irrigation-specific frameworks developed by Bryan and Garner, as well as by Meinzen-Dick, offer essential conceptual tools for a detailed analysis of these dynamics. They connect high-level theoretical frameworks with the practical implementation of irrigation schemes in Ghana. This research measures empowerment through the lens of productivity, income, time use, collective action, and tenure, reflecting the concrete, lived experiences of women in Tempane. Their integration

guarantees that the analysis is pertinent to policy and practice, providing insights into the design of irrigation schemes that promote women's empowerment instead of reinforcing inequality.

2.9.4 Integration of Theories

Collectively, the Gender and Development (GAD) theory, the Empowerment Theory, along with the irrigation-specific frameworks proposed by Bryan and Garner (2020; 2022) and Meinzen-Dick et al. (2019), establish a structured and interrelated framework for examining women's involvement in irrigation farming within the Tempane District. At the broader level, GAD explains how systemic inequalities, such as traditional land rights, male-dominated governance, and deeply rooted cultural practices, determine unequal access to resources and opportunities. At the meso level, Empowerment Theory presents a process model that delineates how resources, upon being accessed, are transformed into agency and accomplishments, rendering empowerment both quantifiable and fluid. At the micro level, the frameworks specific to irrigation elucidate these dynamics in sectoral terms, pinpointing tangible pathways, productivity, income, time use, collective action, and tenure by which irrigation interventions influence outcomes related to the empowerment of women.

This intricate configuration guarantees that the analysis encompasses the structural, processual, and practical facets of empowerment. It bypasses the shortcomings of perceiving irrigation merely as a technical solution, instead contextualizing it within the institutional and gendered dynamics of rural Ghana. Significantly, it harmonizes effortlessly with the research objectives and questions of the research. GAD elucidates the limitations and governance challenges (RQ2, RQ5), Empowerment Theory clarifies the connections between access and agency (RQ3, RQ4), while Bryan and Garner, alongside Meinzen-Dick, offer sector-specific frameworks for assessing and interpreting outcomes (RQ1–RQ5). The integrative framework enhances the theoretical

underpinnings of the research while simultaneously offering a practical guide for analysis and policy recommendations, thereby ensuring that the findings maintain both academic rigor and developmental significance.

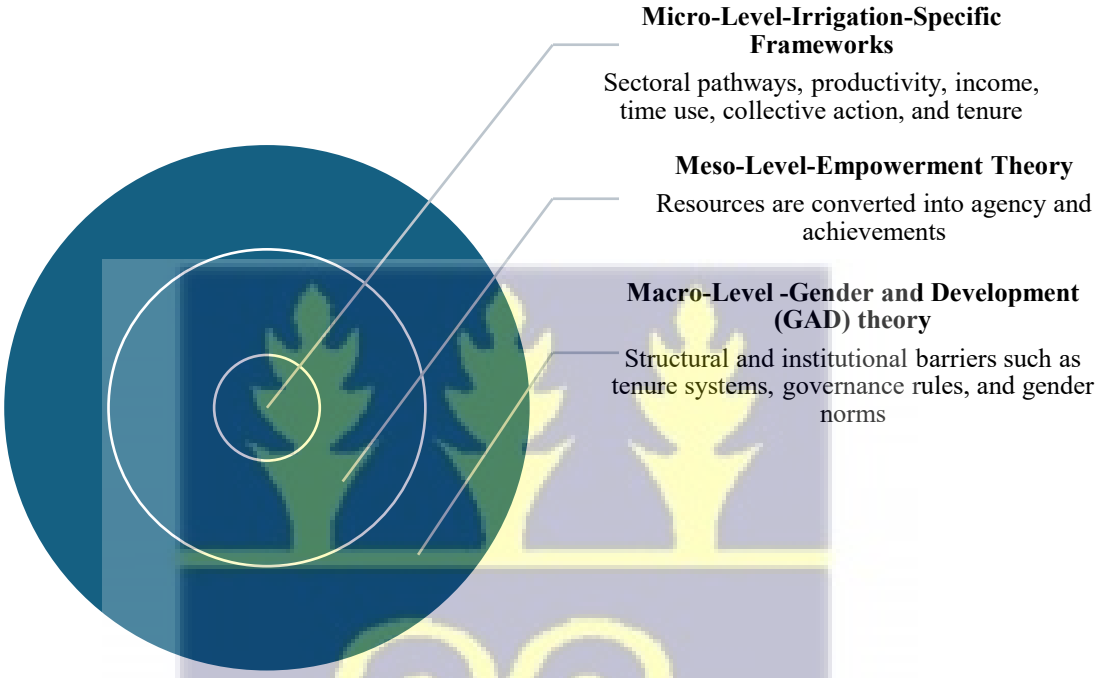
2.10 Conceptual Framework

This framework comprises three theoretical layers: the macro-level Gender and Development (GAD) theory, which elucidates structural and institutional barriers such as tenure systems, governance rules, and gender norms; the meso-level Empowerment Theory, which delineates the process by which resources are converted into agency and achievements; and the micro-level irrigation-specific frameworks of Bryan and Garner (2020; 2022) and Meinzen-Dick et al. (2019), which pinpoint the sectoral pathways, productivity, income, time use, collective action, and tenure, through which irrigation farming influences women's empowerment and household poverty outcomes. The nested configuration situates irrigation interventions within their structural context and delineates the mechanisms connecting access and agency to quantifiable empowerment and livelihood improvements.

Figure 2.1 illustrates that the conceptual framework is organized as a nested model. The GAD perspective emphasizes that institutional arrangements and cultural norms shape women's access to irrigated land, water, and governance roles. Empowerment Theory elucidates how women transform resources into agency and accomplishments within this structural framework, allowing for the measurement of empowerment across various domains, including decision-making, income control, and leadership. The irrigation-specific frameworks developed by Bryan and Garner, as well as Meinzen-Dick, elucidate these dynamics by detailing how irrigation farming establishes tangible pathways for change, including increased productivity and income, reduced time burdens, improved collective action, and secure tenure. The framework, through the integration of these

three lenses, offers a thorough and contextually relevant tool for analyzing women's empowerment and poverty reduction in the Tempane District.

Figure 2.1: Integrating the Theories with Conceptual Framework



Source: Author's Construct, 2025

CHAPTER THREE

METHODOLOGY AND STUDY AREA

3.1 Introduction

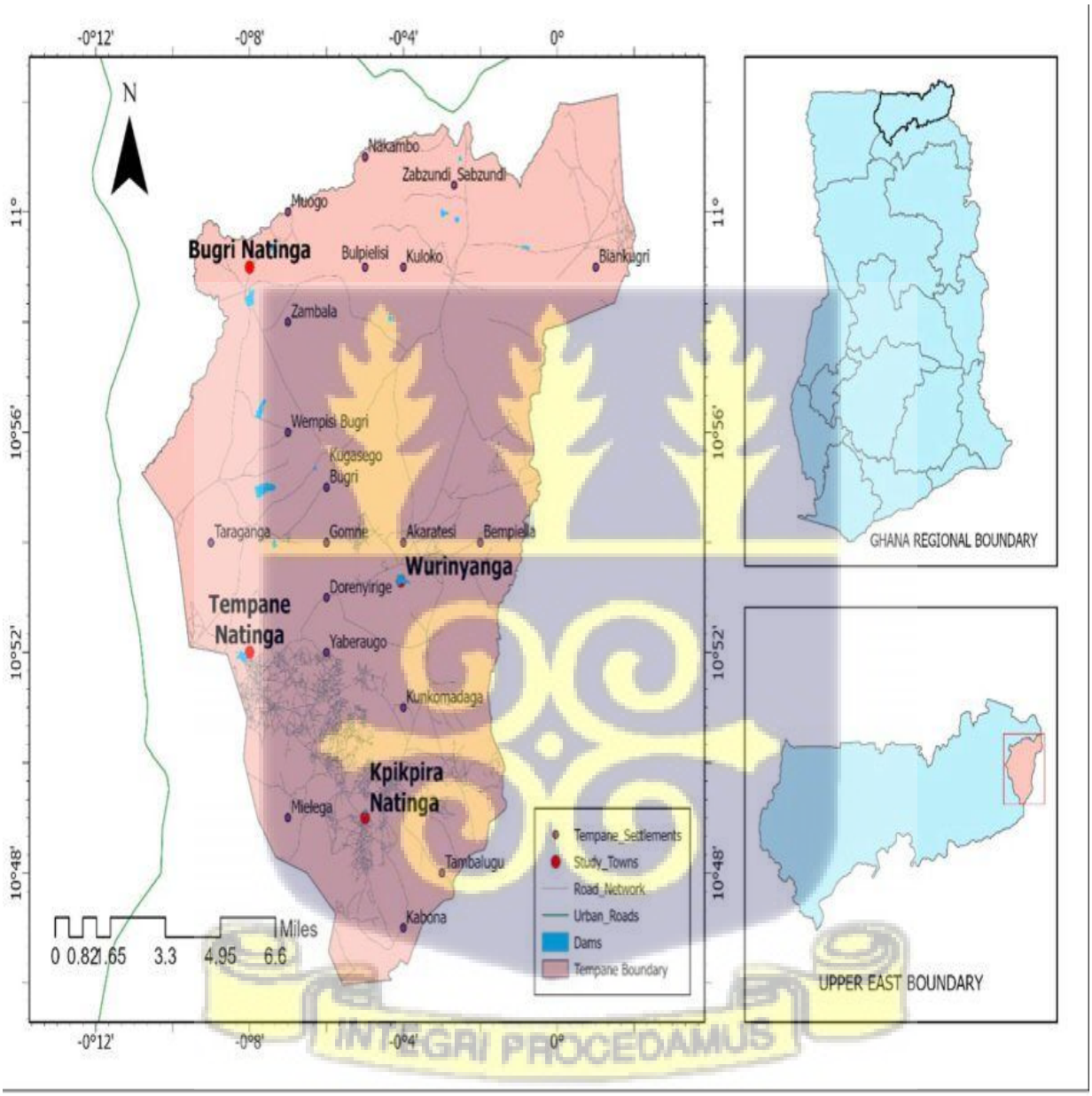
This research used a mixed-methods approach to thoroughly evaluate the effects of irrigated agriculture on livelihoods and the empowerment of women in the Tempane District. The methodology integrated quantitative and qualitative techniques to provide comprehensive and detailed evidence. Quantitative data were collected via questionnaires sent to a stratified random sample of irrigation farmers, enabling statistical analysis of access patterns, productivity, and empowerment results. In addition, qualitative insights were obtained via comprehensive interviews and focus group discussions to capture intricate perspectives and contextual factors sometimes neglected by surveys. The study used the Statistical Package for the Social Sciences (SPSS) for quantitative variables and NVivo for theme coding of qualitative answers, therefore assuring methodological triangulation and the robustness of results.

3.2 Study Area

The Tempane District is one of the 261 Metropolitan, Municipal, and District Assemblies (MMDAs) in Ghana and forms part of the 15 districts in the Upper East Region (GSS, 2021). The district was carved out of the Garu-Tempane District as one of 38 newly created and upgraded districts in 2018. Established by Legislative Instrument (LI) 2352, its capital is Tempane, and it was officially inaugurated on March 15, 2018 (MLGRD, 2018). The Tempane District covers an area of 1,230 km^2, lying approximately between latitudes 10°38'N and 11°N and longitudes 0°06'E and 0°23'E. The farmers were drawn from irrigating communities, namely, Tempane central,

Gumyoko, Tansia, Bugwia, Garu-Tempane , Kpikpira, and Tamale community extension, Gbugumdaar.

Figure 3.1: Map showing the Geographical Area of the Tempane District *in the* Upper East Region



Source: Author's Construct, 2025

It shares boundaries with Garu District to the north, Pusiga District to the northeast, Bunkpurugu Nyankpanduri District to the southeast, and the Republic of Togo to the east (MLGRD, 2018; GSS, 2021). According to the 2021 Population and Housing Census, the population stands at 86,993, comprising 41,268 males and 45,725 females (GSS, 2021).

The district experiences a semi-arid climate with seasonal rainfall, which poses challenges for consistent agricultural production and has historically contributed to food insecurity and poverty (Owusu et al., 2020; Acheampong & Owusu, 2020). The majority of the population relies on subsistence farming, often constrained by limited access to modern agricultural inputs, inadequate infrastructure, and resource limitations (FAO, 2020). Socio-cultural norms and gender roles influence resource distribution, often marginalizing women despite their central role in farming and household management. These conditions have prompted various developmental initiatives, including irrigation projects aimed at enhancing agricultural productivity, improving food security, and alleviating poverty (MoFA, 2021).

3.2.1 Agricultural Productivity

Agriculture forms the backbone of the Tempane District economy, employing the bulk of the population. Farming is primarily subsistence-based, characterized by traditional implements, limited mechanization, and minimal access to inputs such as improved seeds and fertilizers (GSS, 2021; FAO, 2020). The semi-arid environment, marked by brief and unpredictable rainfall, restricts agricultural output to a single season, sustaining a cycle of low yields and household vulnerability (Owusu et al., 2020). Irrigation projects have been introduced to supplement rain-fed agriculture, allowing multiple planting seasons and improved crop yields (MoFA, 2021).

3.2.2 Food Security

Food security remains a significant concern due to rainfall variability, which leads to recurrent food shortages during lean periods (GSS, 2021; FAO, 2020). The district's reliance on a narrow range of staple crops increases vulnerability to climate fluctuations. Women, who typically oversee household nutrition and food preparation, are disproportionately affected (Acheampong & Owusu, 2020). Irrigation interventions have been implemented to mitigate these challenges, enabling households to diversify production, improve food availability, and stabilize access to nutrition throughout the year (MoFA, 2021).

3.2.3 Poverty Alleviation

Poverty in Tempane District remains high, influenced by reliance on agriculture, limited resources, and insufficient economic diversification (GSS, 2021). Many households struggle to meet basic needs, with women facing additional marginalization in property ownership, access to finance, and participation in decision-making (Owusu et al., 2020). Irrigation initiatives are designed to alleviate poverty by increasing income from cash crops, creating employment opportunities, and reducing household vulnerability. Policies increasingly emphasize women's inclusion in irrigation programmes to promote gender equity and broader socio-economic development (MoFA, 2021).

3.3 Research Philosophical Paradigm

This study is grounded in a pragmatic philosophical viewpoint. It contends that researchers should use the methodological and philosophical approach that most appropriately aligns with the subject of inquiry (Aikin & Talisse, 2017; Simpson, 2018). A pragmatic approach asserts that the most efficient research techniques are those that allow researchers to provide evidence-based answers to the research topic. This paradigm asserts that behaviours are inseparable from the contexts and

surroundings in which they manifest (Kaushik & Walsh, 2019). Pragmatism provides adaptability by integrating elements from both constructivist and positivist/post-positivist traditions, aligning research goals with the most appropriate quantitative and qualitative methodologies (Brierley, 2017).

This philosophical perspective is used to comprehend the experiences of women in irrigated agriculture and the constraints they encounter in addressing gender-related concerns, resource limitations, and traditional tenure arrangements. Pragmatism strongly links the researcher to real-world events, making it particularly appropriate for a study that aims to quantify results and evaluate subjective experiences. According to Mitchell and Education (2018), pragmatism asserts that the worth of a notion or statement is determined by its observed practical consequences rather than its theoretical sophistication. Consequently, the focus is not on fidelity to a certain tradition but on selecting what is effective in tackling the research issue within its practical context.

The rationale for embracing pragmatism in this research is threefold. The study goals need both measurable proof of irrigation's effects on production and poverty alleviation, as well as qualitative insights into women's perceptions of empowerment within intricate socio-cultural contexts. No single paradigm could sufficiently meet this dual need. Secondly, pragmatism guarantees that methodological adaptability is reflected in practical study choices at all phases, from design and fieldwork to data analysis and interaction with farmers and stakeholders. This viewpoint validates the mixed-methods strategy used in this investigation. Quantitative surveys produced quantifiable data about access, productivity, and income, while qualitative techniques, including semi-structured interviews and focus group discussions, documented women's perspectives and experiences related to land acquisition, water use, and irrigation governance. Collectively, these methodologies exemplify the primary strength of pragmatism: harmonizing methodological

selections with the practical objective of producing information that is both contextually relevant and applicable to policy and development practices.

3.4 Research Approach

Creswell (2014) posits that a research approach comprises the priorities, objectives, guiding theories, and methodologies that inform the structure of a study. The three principal research strategies accessible to social science researchers are quantitative, qualitative, and mixed methods, each embodying a unique perspective (Bauer et al., 2021; Maxwell, 2016; Creswell, 2014). Qualitative research is characterized by its non-numerical nature, offering profound insights into the meanings, experiences, and perspectives of individuals or groups (Fusch et al., 2018; Guest et al., 2017; Guest et al., 2013). Teye (2012) elucidates that qualitative research is rooted in the interpretative paradigm, acknowledging the intricacies of social reality and asserting that research ought to reveal subjective perspectives and lived experiences. In contrast, the quantitative approach aligns with the positivist paradigm and aims to discern overarching patterns of behaviour that are measurable and can be generalised (Teye, 2012).

This study utilized a mixed-methods approach to effectively capture both quantifiable patterns and nuanced subjective experiences, thereby harnessing the advantages of both quantitative and qualitative strategies. The utilization of mixed-methods research is gaining traction within social and behavioural sciences, as it enables scholars to harness the strengths of both qualitative and quantitative approaches while addressing their respective shortcomings (Guetterman et al., 2020). By integrating post-positivist and interpretivist viewpoints, mixed methods offer a more comprehensive understanding of research issues. Dawadi and Giri (2021) contend that a mixed-methods design integrates philosophical assumptions to steer the collection and interpretation of data from various sources within a singular study, thus guaranteeing analytical depth and validity.

The rationale for embracing a mixed-methods approach in this study resides in its distinctive ability to tackle the complex interplay between irrigation and women's empowerment in the Tempane District. Quantitative surveys provided substantial, generalisable evidence regarding participation levels, productivity improvements, income impacts, and empowerment results. In contrast, qualitative methods, particularly interviews and focus group discussions, yielded profound insights into women's lived experiences, challenges, and perceptions of empowerment within existing gender and tenure frameworks. Each approach, when considered in isolation, proves inadequate: reliance solely on quantitative methods threatens to diminish empowerment to mere numerical indicators, whereas an exclusive focus on qualitative methods may constrain the study's capacity to extrapolate patterns throughout the district. The integration of these elements, aligned with pragmatic foundations, enabled the research to elucidate the interaction among structural constraints, quantifiable results, and personal experiences. The mixed-methods approach thus guaranteed methodological rigor, yielding evidence that is both empirically valid and contextually significant for policy and practice.

3.5 Research Design

The design of a study serves as a strategic framework that links research inquiries to their implementation, directing the methods of data collection and analysis to produce credible results. It provides a systematic approach for setting the parameters within which evidence is gathered and analyzed, ensuring that the process is both efficient and aligned with the study objectives (Abbott & McKinney, 2013; Lewis, 2015).

This investigation employs a convergent parallel mixed-method case study design, which facilitates a thorough examination of complex phenomena within their real-world context. In this type of design, quantitative and qualitative data are collected concurrently, analyzed separately,

and then merged to provide a comprehensive understanding of the research problem (Creswell & Plano Clark, 2018). Case study research entails gathering data from multiple sources and perspectives to achieve a nuanced understanding of the issue under investigation (Kalu, 2019). Yin (2018) characterizes case studies as particularly effective for explaining complex processes and events embedded in their context. Utilizing interviews, focus groups, observations, and document review allows for exploration of the interactions influencing social realities (Bartlett & Vavrus, 2016; Feagin et al., 2016). The strength of this approach lies in its ability to illuminate both outcomes and the underlying processes that generate them, providing detailed and sophisticated explanations (Heale & Twycross, 2018; Yin, 2018).

The rationale for this design is grounded in the contextual and multi-faceted nature of irrigation and women's empowerment in the Tempane District. The study examines not only the impact of irrigation on livelihoods but also the dynamics of women's empowerment as they interact with social capital, customary land tenure, resource accessibility, and institutional interventions. By employing a convergent parallel mixed-method case study, the investigation captures diverse perspectives from farmers, household members, and stakeholders, providing a rich, contextualized, and comprehensive understanding of the research problem.

3.6 Sampling Strategy and Sample Size

This study adopted a sampling strategy consistent with the pragmatic paradigm and the case study design underpinning the research. Given the study's focus on gendered experiences and access to productive resources in irrigation farming, purposive sampling was used across both the quantitative and qualitative components. This approach aligns with qualitative-dominant mixed-

methods research, where sampling is intentionally targeted to individuals with direct experience and relevant knowledge of irrigation practices, land use arrangements, and gender dynamics central to the research objectives.

3.6.1 Quantitative Sampling

For the survey, a total of 160 irrigation farmers were purposively selected. Purposive sampling was deemed appropriate because the study required participants actively involved in irrigation farming, particularly those engaged during the most recent two production seasons. As argued by Etikan et al. (2016) and Palinkas et al. (2015), purposive sampling enables the selection of information-rich cases essential for addressing research questions that demand contextual understanding rather than statistical representativeness. The sample size of 160 farmers was determined based on feasibility considerations, representation across major irrigating communities in the district, and the need for sufficient variability to explore gender differences. This sampling strategy ensured that the quantitative data reflected the variations in irrigation experiences across the district, allowing for meaningful comparisons between men and women farmers.

3.6.2 Qualitative Sampling

The qualitative component also relied entirely on purposive sampling. Consistent with Creswell and Poth (2016) and Thomas (2022), purposive strategies ensured the intentional inclusion of participants with direct and relevant experience in irrigation farming and gendered access to productive resources. Participants included irrigation farmers, community leaders, and officials from the Ministry of Food and Agriculture (MoFA) and the Ghana Irrigation Development Authority (GIDA). A total of 40 participants took part in eight focus group discussions (FGDs)

conducted across four major irrigating communities, with each community hosting separate male and female groups of five participants. This separation ensured a safe disclosure environment, minimised gendered power imbalances, and allowed women to speak freely about their experiences. Participants were selected based on their active involvement in irrigation farming within the last two seasons, as well as variation in age, marital status, farm size, income, and access to resources, to ensure diverse perspectives. Community leaders and MoFA extension officers supported the identification process but did not influence final selection.

Additionally, six key informants comprising four MoFA officials and two GIDA officers were purposively selected for in-depth interviews due to their institutional knowledge of irrigation management, land allocation, extension services, and gender mainstreaming. Overall, purposive sampling enabled the inclusion of information-rich individuals whose insights were essential for understanding the contextual and gendered dimensions of irrigation in the district.

3.7 Methods of Data Collection

In alignment with a pragmatic philosophical approach and a mixed-methods case study design, this study utilized various instruments to thoroughly assess the wide-ranging effects of irrigation on livelihoods and the empowerment of women in the Tempane District. The selection of methods was deliberate and rooted in the logic of the case study: comprehending a complex socio-economic phenomenon necessitated the triangulation of numerical evidence with narratives, group dynamics, and direct observation of practice. The study integrated surveys, semi-structured interviews, focus group discussions (FGDs), and field observations, guaranteeing that the results were both statistically robust and contextually nuanced.

3.7.1 Surveys

Surveys played a crucial role in the quantitative aspect of this study, facilitating the organized assessment of farmers' demographics, access to irrigation resources, financial challenges, training opportunities, and their views on empowerment or exclusion. The use of structured questionnaires enabled the study to identify patterns among a representative sample of 156 irrigation farmers, effectively addressing objectives concerning access (RQ1), constraints (RQ2), and livelihood impacts (RQ3). The implementation of surveys underscores a practical focus on effectiveness: although qualitative methods uncover personal experiences, it is only through a structured survey that one can obtain statistically generalisable data regarding participation rates, resource access, and indicators of empowerment. The survey was conducted using a simple random sampling (SRS) strategy, which ensured methodological rigor by minimizing bias and enabling credible inferences about the broader farmer population in Tempane.

3.7.2 Interviews

The study employed in-depth face-to-face interviews as the primary qualitative method for collecting detailed and context-specific information from participants. These interviews were conducted using a semi-structured interview guide, which served as the instrument that directed the conversation while still allowing flexibility to probe emerging issues. This approach ensured that key themes were covered systematically while giving participants the space to narrate their lived experiences in their own words. A total of 45 interviews were conducted with irrigation farmers, community leaders, and officials from the Ministry of Food and Agriculture (MoFA) and the Ghana Irrigation Development Authority (GIDA). The in-depth interview method was particularly appropriate as it aligned with the case study design and the pragmatic paradigm underpinning the research. It enabled the exploration of complex and sensitive issues—such as

gendered land acquisition processes, irrigation governance, labour roles, and household decision-making that could not be captured adequately through structured surveys.

3.7.3 Focus Group Discussions (FGDs)

To enhance the qualitative evidence base, eight focus group discussions were conducted across four major communities. Every community organized two focus group discussions, one for men and one for women, to address gendered power dynamics and promote candid dialogue. Forty participants took part in these group dialogues, comprising household heads, female farmers, community leaders, and local experts. Focus group discussions played a crucial role in gathering shared viewpoints and comprehending the dynamics of empowerment and resource accessibility within social groups. This aligns with a practical dedication to triangulation and the objective of achieving contextual depth in case studies, as group discussions frequently reveal norms, values, and common challenges that individual interviews might miss. The comparison of male and female FGDs revealed distinct gendered differences in irrigation experiences, enhancing the overall understanding of empowerment processes.

3.7.4 Field Observation

Observation offered a straightforward, modest approach to confirm self-reported data, aligning with the practical emphasis on employing effective methods to enhance results. Systematic observations were conducted on farms, irrigation fields, and dams within the study communities, with careful attention to land use patterns, water management practices, and the spatial distribution of women's plots. According to the arguments presented by Harvey (2021) and Gold (2017), observation serves as a valuable method for revealing practices and dynamics that participants might not express during interviews. This study provided an opportunity to observe directly the physical infrastructure and gendered patterns of land allocation, confirming the findings from

survey responses and interview accounts. Observation thus offered essential evidence for placing irrigation practices within the real context of the case, strengthening the credibility and validity of the findings. The study effectively implemented its pragmatic and case study foundations through the integration of surveys, interviews, FGDs, and field observation. Each method was carefully chosen to highlight various aspects of the research issue: surveys for a broad overview, interviews for in-depth insights, FGDs for shared viewpoints, and observation for contextual confirmation. Collectively, they guaranteed that the evidence produced was strong, intricate, and closely aligned with the objectives and questions steering this dissertation.

3.8 Data Analysis

The analysis of data in this study was informed by a pragmatic philosophical approach and a mixed-methods case study design, highlighting the importance of methodological complementarity. The objective was to analyze the effects of irrigation quantitatively while also understanding the lived experiences and contextual realities of women. In line with this, both quantitative and qualitative analyses were performed simultaneously, and the results were later combined to yield strong, triangulated conclusions. Out of the 160 questionnaires administered, 156 were duly completed and analyzed, representing a response rate of 97.5%. Four questionnaires were excluded due to missing responses on key variables such as women empowerment indicators, poverty status and participation in irrigation farming.

3.8.1 Quantitative Analysis (SPSS)

The survey data were systematically coded and analyzed utilizing the Statistical Package for the Social Sciences (SPSS, version 25). Descriptive statistics, including frequencies, percentages, and means, were employed to outline the demographic characteristics of respondents and their engagement in irrigation farming. Statistical methods, such as chi-square tests were utilized to test

the relationships between two categorical variables such as participation in irrigation farming and women empowerment.

3.8.2 Qualitative Analysis (NVivo)

Transcripts from interviews and focus groups, as well as field notes, were systematically coded by importing them into NVivo 12. A blend of deductive coding, aligned with the research objectives and theoretical framework, alongside inductive coding, which facilitated the emergence of new themes from the data, was utilized. Thematic analysis was employed to uncover patterns in participants' narratives concerning gender differences in access and participation, irrigation and women empowerment, irrigation and poverty reduction, and constraints limiting access to irrigation.

3.8.3 Merging Quantitative and Qualitative Data

In alignment with the pragmatic mixed-methods approach, the analysis was integrated rather than limited to distinct strands. Rather, the results from SPSS and NVivo were synthesised using triangulation and complementarity. For instance, numerical findings regarding women's restricted access to land were juxtaposed with qualitative descriptions of traditional tenure practices, while statistical data on income inequalities were enriched by stories highlighting women's limited decision-making authority within households and irrigation committees. In instances where data seemed inconsistent, the mixed-methods approach facilitated resolution by placing numerical findings within real-life contexts.

This comprehensive analysis improved the robustness and interpretative strength of the study. The analysis conducted with SPSS yielded quantifiable data regarding the effects of irrigation, whereas NVivo offered a framework to understand these effects in relation to the socio-cultural dynamics

of the Tempane District. Their collaboration produced results that are both statistically robust and significant for policy and practice, aligning with the overarching objectives of the study.

3.9 Reliability, Validity, and Trustworthiness

Maintaining rigor was essential to the validity of this mixed-methods study. Based on the practical framework and case study approach, various strategies were employed to improve reliability and validity in the quantitative component and to ensure trustworthiness in the qualitative component, while the use of triangulation across methods further reinforced the overall results.

3.9.1 Quantitative Assessment of Reliability and Validity

To ensure reliability, survey instruments underwent meticulous pre-testing with a select group of irrigation farmers in a nearby district to enhance wording, sequencing, and clarity. Cronbach's alpha coefficients were computed for essential constructs, including empowerment, access to resources, and livelihood outcomes, thereby confirming internal consistency. The design of questions was carefully crafted to ensure alignment with the research objectives, drawing upon established literature concerning irrigation and women's empowerment (Creswell & Creswell, 2018). The application of Yamane's formula for calculating sample size significantly improved statistical validity, guaranteeing representativeness and reducing sampling error.

3.9.2 Qualitative Trustworthiness

To ensure trustworthiness in the qualitative strand, various strategies were employed. Credibility was established through extended involvement in the field, enabling the individual to foster connections and gather genuine narratives. A subset of participants was engaged in member checking to validate the accuracy of the interpretations. The provision of thick descriptions of the research context improved transferability, allowing readers to evaluate the relevance of the

findings in different settings (Lincoln & Guba, 1985). Dependability was enhanced by keeping a detailed audit trail of coding decisions and analytical memos in NVivo, while confirmability was bolstered through reflexive journaling, which recorded the author's positionality and reduced bias in interpreting narratives.

Ultimately, the integration of surveys, interviews, focus group discussions, and field observations established a robust foundation for cross-validation. The quantitative findings were supported by qualitative insights, and in instances of divergence, the practical approach enabled the study to contextualize numerical trends within real-life experiences. This comprehensive approach strengthened the reliability and clarity of the results, guaranteeing that the conclusions reached are both empirically valid and contextually relevant.

3.10 Ethical Consideration

Prior to gathering the data, ethical considerations were taken into account. Prioritising ethical considerations in research involves adhering to rules and regulations that ensure the safety, dignity, and well-being of research participants, while maintaining the validity and reliability of the research procedure (Emami et al., 2019). As a result, all participants provided informed consent before, during, and after the data-collecting procedure, and their names were kept confidential. The participants were allowed to introduce themselves, and the purpose of the study was explained to them before the data-gathering process began. Consent was obtained from the farmers to have a one-on-one meeting with them. They were also informed that they could remain anonymous for the research, opt out, and not answer sensitive questions. Ensuring adherence to ethics is crucial, as it provides moral guidelines for researchers to perform and disclose research findings without deliberate or unintentional dishonesty that could harm study participants or society (Arifin, 2018).

3.11 Limitations of the Study

Throughout the fieldwork, various limitations became apparent, especially those stemming from the socio-cultural context of the Tempane District. The study experienced positive community engagement that aided in the timely completion of data collection; however, challenges still limited the process. A recurring challenge encountered was the hesitance or complete refusal of certain respondents to engage in the study. In numerous cases, this opposition was supported by the belief that investigations into gender-related topics would not change deeply rooted socio-cultural narratives or lead to meaningful improvements in women's situations. These perspectives illustrate a wider community doubt regarding research and development initiatives, which consequently influenced the selection of participants available for involvement.

Moreover, the restricted availability of farmers presented practical challenges. Irrigation farming demands significant time investment, and numerous participants reported challenges in finding time for surveys or interviews, especially during critical agricultural periods. This occasionally resulted in partial participation or a reduction in the scope of the intended respondent group. Although purposive and random sampling strategies were meticulously applied to improve representativeness, the contextual limitations may have narrowed the scope of participation, particularly among farmers who face significant labour demands or harbor doubts regarding gender-focused studies.

While these limitations did not compromise the overall integrity of the findings, they highlight the challenges of conducting studies in contexts where socio-cultural norms, perceptions of gender equity, and livelihood pressures converge. Understanding these challenges not only improves transparency but also offers important insights for future investigations aiming to involve rural communities in delicate and time-consuming research.

CHAPTER FOUR: GENDER DIFFERENCES IN PARTICIPATION AND ACCESS TO PRODUCTIVE RESOURCES AMONG FARMERS IN THE TEMPANE DISTRICT

4.0 Introduction

This chapter presents the socio-demographic characteristics and gender differences in participation and access to productive resources among farmers in the Tempane District. Socio-demographic characteristics such as age, gender, education, income, and marital status are key determinants of women empowerment and poverty reduction (Baig et al., 2020; Hordofa & Badore, 2024). In addition, the chapter explores gender differences in access to key productive resources such as land, credit, agricultural inputs, training, and market opportunities. These dimensions are particularly relevant in the context of the Tempane District, where traditional norms, land tenure systems, and institutional practices continue to shape access and control over productive assets. Evidence from sub-Saharan Africa indicates that women farmers often face systemic constraints in resource access, decision-making, and leadership participation, resulting in lower productivity and limited economic empowerment (Doss & Rubin, 2021; Zakaria et al., 2020). Understanding these gendered disparities provides valuable insights into how irrigation farming can serve as a pathway for inclusive rural development and poverty reduction when supported by equitable policies and institutional arrangements (Kantor et al., 2015; Food Agriculture Organization [FAO], 2022).

Accordingly, this chapter is structured into two main sections. The first section (4.1) describes the socio-demographic characteristics of the respondents, providing a profile of farmers involved in irrigation farming in the district. The second section (4.2) examines gender differences in

participation and access to productive resources, drawing on both statistical evidence and participants' narratives to contextualize observed patterns. Together, these analyses offer a nuanced understanding of the social and gender dynamics that underpin irrigation agriculture in the Tempane District.

4.1 Socio-demographic Characteristics of Respondents

Table 4.1 summarizes the socio-demographic characteristics of the respondents who participated in the survey. The findings indicate that the majority of farmers in the Tempane District were male (62.8%), while females constituted 37.2%. This suggests that irrigation farming is largely male-dominated, consistent with earlier studies that show men often have greater access to land, capital, and irrigation facilities than women in northern Ghana (Doss et al., 2021; Zakaria et al., 2020). However, women's participation remains critical, especially in vegetable production and household-level irrigation, reflecting their vital but often undervalued role in agricultural production systems (FAO, 2022).

Regarding age distribution, a substantial proportion of respondents (59.0%) were aged 26–40 years, followed by 28.2% above 40 years, and 12.8% 25 years and below. This indicates that irrigation farming is primarily practiced by adults in their economically productive years, a pattern consistent with findings by Abdullah & Parvin (2024), who observed that active working-age farmers are more likely to adopt improved irrigation technologies to enhance productivity and income stability.

In terms of education, nearly half (48.7%) of respondents had completed secondary education, while 21.8% had no formal education, 20.5% had tertiary education, and 9.0% had primary education. This relatively moderate educational attainment aligns with evidence from the Ghana

Statistical Service (2021) and Adzawla et al. (2022), which show that literacy levels among farmers significantly influence technology adoption, record-keeping, and participation in agricultural programmes. Educated farmers are generally better positioned to access information on irrigation management and adapt to climate variability.

Concerning occupation, 39.7% of respondents identified farming as their main occupation, followed by teaching (30.8%) and trading (29.5%), indicating diversified livelihoods. Such diversification has been observed across northern Ghana as a key strategy for managing agricultural risk and ensuring food security (Hussein et al., 2022). Marital status data revealed that 66.7% were married, 21.8% single, and 11.5% widowed. This distribution aligns with marital patterns commonly observed in northern Ghana, including Muslim-majority communities where marriage is socially and religiously emphasized. In such settings, marriage often supports farming activities through shared labour, pooled household resources, and cooperative decision-making, which are important for smallholder agricultural livelihoods (Acheampong & Owusu, 2020).

Religious composition showed a predominance of Muslims (74.4%), with Christians (25.6%) forming a smaller share. This mirrors the spatial religious pattern in Ghana, where the northern regions, including Tempane, are predominantly Muslim, while the southern regions have more Christians (Ghana Statistical Service [GSS], 2021). Religious affiliation in rural Ghana is often linked to community organization, social networks, and access to collective resources, including irrigation infrastructure (Abdulai et al., 2023).

Table 4.1: Socio-Demographic Characteristics of Respondents (n = 156)

Variable	Category	Percent (%)	Frequency (n)
Sex	Male	62.8	98
	Female	37.2	58
Age	≤ 25 years	12.8	20
	26–40 years	59.0	92
	> 40 years	28.2	44
Occupation	Farming	39.7	62
	Teaching	30.8	48
	Trading	29.3	46
Marital Status	Married	66.7	104
	Single	21.8	34
	Widowed	11.5	18
Religion	Muslim	74.4	116
	Christian	25.6	40
Education	No formal education	21.8	34
	Primary	9.0	14
	Secondary	48.7	76
	Tertiary	20.5	32
Monthly Income	< GH₵2,000	56.4	88
	GH₵2,000–4,000	35.9	56
	> GH₵4,000	7.7	12
Breadwinner	Yes	62.8	98
	No	37.2	58

Regarding household income, more than half (56.4%) earned less than GH₵2,000 monthly, 35.9% earned between GH₵2,000–GH₵4,000, and only 7.7% earned above GH₵4,000. A majority (62.8%) identified themselves as household breadwinners, while 37.2% were not. These figures are consistent with rural income trends in northern Ghana, where agriculture remains the primary source of livelihood, and poverty levels are generally higher than in the southern parts of the country (World Bank, 2023; GSS, 2022).

Overall, the results reveal a population of predominantly middle-aged, moderately educated, and economically active individuals who engage in both agricultural and non-agricultural activities. This underscores irrigation farming's critical role in enhancing livelihoods and reducing rural poverty in the Tempane District, consistent with findings by Namara et al. (2021) and Akudugu et al. (2021), who highlighted irrigation as a catalyst for rural economic transformation in Ghana's semi-arid zones.

4.2 Gender differences in participation and access to productive resources among farmers in the Tempane District

Table 4.2 presents the gender-disaggregated analysis of participation and access to productive resources among farmers in the Tempane District. The results reveal statistically significant gender differences ($p < 0.05$) across most dimensions of resource access and participation. A higher proportion of men (89.8%) than women (70.7%) participated in irrigation farming ($\chi^2 = 9.2934$, $p = 0.0023$), indicating that irrigation remains a male-dominated activity. These findings were echoed by several female participants during the focus group discussions:

"Most of the land around the dam belongs to men. As women, we can only farm if our husbands or brothers allow us to use a portion. Sometimes, we just help them on their plots." (Female farmer, 36 years, Tansia community)

"Even when water is released, the men get it first because they are the ones in charge of the main plots. By the time it reaches our side, it is not enough for all our crops." (Female farmer, 41 years, Tempane Central)

These narratives illustrate the gendered nature of land access and water allocation, where social norms and ownership patterns systematically privilege men. This finding aligns with Doss et al. (2021) and FAO (2022), who emphasize that gender-based control of land and water resources remains one of the key structural barriers to women's agricultural participation in Sub-Saharan Africa.

Similarly, men reported higher access to agricultural inputs (81.6%) than women (63.8%), a statistically significant difference ($\chi^2 = 6.3714$, $p = 0.012$). Limited access to fertilizers, improved seeds, and pesticides constrains women's productivity and reduces their competitiveness. As one respondent explained:

"We depend on small input dealers who sell on credit, but they prefer to give more to men because they believe men can repay after harvest." (Female farmer, 28 years, Tampala community)

This reflects gendered perceptions of creditworthiness, where men are considered more financially reliable than women, reinforcing unequal access to essential inputs. Studies by Zakaria et al. (2020) have similarly noted that gender bias in the distribution of agricultural inputs perpetuates productivity gaps between male and female farmers.

Access to credit and financial resources also favored men (70.4%) compared to women (39.7%), with a highly significant difference ($\chi^2 = 14.2713$, $p < 0.001$). Female respondents attributed this gap to gendered asset ownership norms that disadvantage women in meeting collateral requirements:

> *"The bank asked for collateral, but all the land documents are in my husband's name, so I couldn't qualify for the loan." (Female farmer, 44 years, Bugwia community)*

> *"The men have more connections with the irrigation officials and the buyers, so they can get money easily. For us, we struggle before getting any support." (Female farmer, 33 years, Gumyoko community)*

Such findings underscore the intersection between financial exclusion and patriarchal property systems, where women's limited control over land and assets translates into reduced access to formal finance. Similar evidence is reported by Namara et al. (2021) and Alaofè et al. (2021), who argue that institutional credit systems often reinforce gender inequality when collateral requirements are linked to male-owned property.

Access to training and extension services also differed by gender, with 66.3% of men having received training compared to 48.3% of women ($\chi^2 = 5.0872$, $p = 0.024$). Female participants emphasized that the scheduling and delivery of extension programmes often excluded them due to domestic responsibilities:

> *"They usually come in the morning when most of us are cooking or taking care of children, so we miss those trainings." (Female farmer, 39 years, Basyonde, community)*

This reinforces evidence from FAO (2022) and Njuki et al. (2020), who observe that gender-insensitive extension services continue to marginalize women by disregarding their time burdens and social roles.

Interestingly, access to market facilities did not differ significantly between men (84.7%) and women (77.6%) ($\chi^2 = 1.0598$, $p = 0.303$), suggesting relatively equal opportunities for both genders to sell their produce. Both men and women noted that the communal nature of markets in the Tempane District fosters inclusivity:

> *"When we harvest, everyone sells at the same market. The traders buy from both men and women, depending on the quality of the crops." (Male farmer, 46 years, Tansia community).*

A female respondent also emphasized this inclusive environment:

> *"As women, we don't face discrimination at the market. We sit alongside the men, and the buyers come to whoever has the good produce. Everyone is treated the same." (Female farmer, 39 years, Kpikpira community).*

This implies that market access is less constrained by gender and more influenced by production levels and crop quality.

However, the most pronounced gender gap was observed in participation in irrigation scheme governance, where only 25.9% of women held leadership or committee roles compared to 66.3% of men ($\chi^2 = 23.6425$, $p < 0.001$). This reflects enduring gender disparities in decision-making and leadership representation within irrigation management structures. Several women expressed concerns about exclusion from leadership processes:

"They say the meetings are for plot owners. Since most women don't own plots, we are not invited." (Female farmer, 35 years, Garu-Tempane boundary community)

"Even when we attend, our opinions are not taken seriously. They just listen and continue with their plans." (Female farmer, 40 years, Tempane Central)

Such exclusion from governance structures limits women's influence on critical decisions regarding water allocation, land distribution, and maintenance schedules. This finding supports Doss et al. (2021) and Osei-Akoto & Abankwah (2023), who argue that women's underrepresentation in local irrigation governance reflects broader gender power asymmetries embedded in rural institutions.

Finally, men reported longer irrigation farming experience (≥5 years: 61.2%) compared to women (27.6%) ($\chi^2 = 19.5884$, $p < 0.001$). This difference indicates that men have had more consistent engagement in irrigation since its introduction in the area. As one male respondent explained:

"I started irrigation about ten years ago when the dam was built. Most of us men have been farming here since then, but the women joined later." (Male farmer, 45 years, Gbugumdaari community)

The relatively shorter engagement period among women may reflect historical exclusion from initial land allocations and resource mobilization processes. Overall, these findings reveal that although women actively participate in irrigation farming, they face systemic barriers in accessing key productive resources particularly land, credit, inputs, training, and leadership opportunities. These constraints not only suppress women's productivity but also limit the transformative potential of irrigation agriculture as a pathway to gender equity, poverty reduction, and rural

resilience in the Tempane District. This evidence aligns with existing literature across Sub-Saharan Africa. Doss et al. (2021) and Zakaria et al. (2020) emphasize that women's restricted access to land, finance, and extension services continues to undermine agricultural growth and empowerment outcomes. Similarly, Namara et al. (2021) and FAO (2022) highlight that inclusive irrigation governance where both men and women enjoy equitable access to resources and leadership roles enhances productivity, household welfare, and community resilience.

Table 4.2: Gender differences in participation and access to productive resources among farmers in the Tempane District

Access/Participation Indicator	Female N=58 (%)	Male N=98 (%)	Total N=156 (%)
Participation in irrigation farming			
No	**17 (29.3)**	**10 (10.2)**	**27 (17.3)**
Yes	**41 (70.7)**	**88 (89.8)**	**129 (82.7)**
$\chi^2 = 9.2934$, $p = 0.004^a$, $df = 1$			
Access to irrigable land			
No	26 (44.8)	12 (12.2)	38 (24.4)
Yes	32 (55.2)	86 (87.8)	118 (75.6)
$\chi^2 = 21.9589$, $p < 0.001^a$, $df = 1$			
Access to irrigation water			
No	23 (39.7)	15 (15.3)	38 (24.4)
Yes	35 (60.3)	83 (84.7)	118 (75.6)
$\chi^2 = 10.8537$, $p = 0.001^a$, $df = 1$			
Access to agricultural inputs (seeds, fertilizers)			
No	21 (36.2)	18 (18.4)	39 (25.0)
Yes	37 (63.8)	80 (81.6)	117 (75.0)
$\chi^2 = 6.3714$, $p = 0.012^a$, $df = 1$			
Access to credit/finance			
No	35 (60.3)	29 (29.6)	64 (41.0)
Yes	23 (39.7)	69 (70.4)	92 (59.0)
$\chi^2 = 14.2713$, $p < 0.001^a$, $df = 1$			
Access to training/extension services			
No	30 (51.7)	33 (33.7)	63 (40.4)
Yes	28 (48.3)	65 (66.3)	93 (59.6)
$\chi^2 = 5.0872$, $p = 0.024^a$, $df = 1$			
Access to market facilities			
No	13 (22.4)	15 (15.3)	28 (17.9)

Yes	45 (77.6)	83 (84.7)	128 (82.1)
$\chi^2 = 1.0598$, $p = 0.303^a$, $df = 1$			
Participation in scheme governance (committees, leadership)			
No	43 (74.1)	33 (33.7)	76 (48.7)
Yes	15 (25.9)	65 (66.3)	80 (51.3)
$\chi^2 = 23.6425$, $p < 0.001^a$, $df = 1$			
Years of irrigation experience			
<5	42 (72.4)	38 (38.8)	80 (51.3)
≥5	16 (27.6)	60 (61.2)	76 (48.7)
$\chi^2 = 19.5884$, $p < 0.001^a$, $df = 4$			

Note: a= Pearson Chi-square Test

4.3 Chapter Summary

The chapter explored the socio-demographic profiles of farmers in the Tempane District and examined gender disparities in participation and access to productive resources. Gender analysis revealed significant differences in access to land, irrigation water, agricultural inputs, credit, training, and leadership roles. Overall, while women actively participate in irrigation, structural and social constraints limit their productivity, leadership, and economic empowerment. The findings underscore the need for gender-sensitive interventions to ensure equitable access to productive resources, enhance women's participation, and maximize the poverty-reduction potential of irrigation farming in the Tempane District. The next chapter presents the effect of participation in irrigation farming on gender empowerment.

CHAPTER FIVE: EFFECT OF PARTICIPATION IN IRRIGATION FARMING ON WOMEN EMPOWERMENT

5.1 Introduction

Women's empowerment is widely recognized as a fundamental driver of sustainable development, poverty alleviation, and gender equality (FAO, 2022; Doss et al., 2020). In agricultural settings, empowerment encompasses economic autonomy, decision-making authority, access to productive resources, confidence and self-efficacy, and social recognition within households and communities (Alaofè et al., 2021; Njuki et al., 2020). Empowered women are better able to contribute to household welfare, food security, and broader community development, while simultaneously challenging existing gender norms that perpetuate inequality (Quisumbing et al., 2021; FAO, 2022).

In semi-arid regions of Ghana, rainfall variability often constrains traditional rainfed agriculture, making irrigation farming a potentially transformative intervention for women farmers (Asare-Nuamah & Owusu, 2021). Irrigation allows for year-round crop production, access to income-generating opportunities, and improved household food security. Beyond the economic benefits, participation in irrigation activities may also enhance women's agency, confidence, and social status in both household and community contexts.

This chapter examines the effect of women's participation in irrigation farming on empowerment outcomes among farmers in the Tempane District. The study utilizes both quantitative survey data and qualitative narratives from interviews and focus group discussions to explore empowerment across five key domains: decision-making power, access to and control over productive resources, economic empowerment, self-efficacy and confidence, and social well-being and recognition.

Furthermore, the chapter investigates the association between irrigation participation and composite empowerment, highlighting the role of irrigation farming as a gender equity enabler.

5.2 Women Empowerment Indicators

Table 5.1 presents the distribution of women empowerment indicators among farmers in the Tempane District. The results indicate that participation in irrigation farming has improved women's autonomy, economic capacity, and social recognition.

5.2.1 Decision-Making Power

Decision-making power reflects women's participation in critical agricultural and household decisions, including land use, crop selection, and allocation of household income. The findings from Table 5.1 indicate that 65.0% of women participated in land-use decisions, 70.8% in household income utilization, and 66.7% in crop selection and other farming decisions, with an average score of 67.5%. These figures illustrate that irrigation farming contributes substantially to women's participation in household and agricultural decision-making. One participant explained:

> *"Before joining the irrigation project, I only helped my husband on the farm. Now, I decide which crops to grow and how to use the money we earn. It has made me feel respected in my own home." (Female farmer, 38 years, Tampala community)*

Another woman emphasized:

> *"I now have a say when my husband decides what to plant. If I suggest a vegetable crop, he listens because he sees the income it brings." (Female farmer, 33 years, Gbugumdaari community)*

These narratives indicate that women's engagement in irrigation not only provides them with practical decision-making power but also challenges entrenched intra-household gender norms. However, some women remain excluded from key decisions due to traditional roles and cultural expectations, echoing findings by Njuki et al. (2020) and Osei-Akoto and Abankwah (2023), who argue that empowerment is often uneven across decision-making domains.

5.2.2 Access to and Control over Productive Resources

Access to productive resources such as land, credit, farm inputs, and training is a critical determinant of women's empowerment (FAO, 2022; Asare-Nuamah & Owusu, 2021). The analysis shows in Table 5.1 that 63.3% of women had access to irrigable land, while 54.2% had access to agricultural credit or savings. Similarly, 60.0% had received irrigation or agricultural training, and 65.0% had access to farm inputs such as seeds, fertilizers, and tools. These findings suggest that while irrigation projects have improved women's access to essential resources, significant gaps persist, especially in access to credit and training opportunities. As one woman expressed:

> *"Even though we now have land to farm, getting money or loans to buy fertilizer is still difficult. The men get more support from the banks and cooperatives."* (Female farmer, 42 years, Gbugumdaari community)

Another participant reflected:

> *"I can plant crops on the shared land, but I cannot sell them freely without my husband's approval. Sometimes it feels like I am working hard but without full control." (Female farmer, 36 years, Tansia community)*

Such experiences highlight that empowerment is not only about access but also about control and ownership, which aligns with findings in Sub-Saharan Africa where women's access to productive resources often does not translate into decision-making power or long-term control (Ali et al., 2021; Doss et al., 2020). Limited control over financial resources and productive assets reduces women's capacity to expand production, invest in improved technologies, and achieve long-term economic independence. The results imply that empowerment efforts must go beyond access to include control and ownership of these resources.

5.2.3 Economic Empowerment

Economic empowerment was the strongest domain observed in this study. A substantial 83.3% of women earned income from irrigation farming, 73.3% had control over their income, 68.3% participated in marketing activities, and 62.5% maintained personal or group savings, indicating that irrigation is a significant source of livelihood. A participant stated:

> *"Now I can sell my vegetables in the market and keep part of the money for my children's school fees. I don't have to wait for my husband before buying household items." (Female farmer, 35 years, Tempane Central)*

Another woman elaborated:

> *"I have joined a women's savings group with the money I earn from my plot. It gives me security and confidence that I can support my family even in difficult times." (Female farmer, 41 years, Bugwia community)*

These findings underscore the transformative economic benefits of irrigation farming for women in the Tempane District. The high proportion of women generating and controlling income signifies improved financial autonomy and reduced dependency on male counterparts. This

financial independence enhances women's bargaining power within households and promotes their participation in community economic activities. It also indicates that irrigation has a direct and measurable impact on poverty reduction and livelihood improvement. These findings align with Doss et al. (2020) and Asare-Nuamah & Owusu (2021), who emphasize that access to irrigated agriculture enhances women's income-generating capacity, reduces dependency on male counterparts, and improves household welfare. Economic empowerment also increases women's bargaining power within households, enabling greater influence over both small- and large-scale household decisions.

5.2.4 Self-Efficacy and Confidence

Psychological empowerment was assessed through women's confidence in agricultural decisions, public expression, and participation in leadership roles. From Table 5.1, the study found that 66.7% of women felt confident in making agricultural decisions, while 60.0% were comfortable expressing their opinions in public or community meetings. Moreover, 54.2% of respondents participated in leadership roles or farmer-based organizations. One woman described how irrigation transformed her confidence:

> *"Before, I used to be quiet during meetings, but now when we discuss farming issues, I speak freely because I know what I'm doing on my farm."*
> (Female farmer, 40 years, Kpikpira community)

Another shared:

> *"I now help organize irrigation schedules for my group. It feels good that my opinion is valued and considered by both men and women." (Female farmer, 37 years, Tampala community)*

These results suggest that participation in irrigation farming contributes positively to women's self-confidence, leadership capacity, and public voice, though sociocultural norms still limit full engagement. Similar patterns were observed by Alaofè et al. (2021) and Njuki et al. (2020), emphasizing that empowerment in agriculture is often stronger in individual agency than in collective or institutional leadership. When women gain experience and recognition through farming, their sense of self-worth and social competence increases. However, the fact that nearly half of the women still lack active involvement in leadership indicates ongoing barriers such as limited education, cultural restrictions, and underrepresentation in farmer associations. Strengthening leadership training and mentorship for women could help close this empowerment gap.

5.2.5 Social Well-Being and Recognition

The social dimension of empowerment recorded comparatively lower scores than economic or decision-making domains. About 56.7% of respondents reported an improvement in social status within their communities, 60.0% gained greater respect from family and peers, and 58.3% participated in community meetings or development projects. A woman explained:

> *"People in the community now respect me because I can contribute money for communal work and help others during the dry season."* (Female farmer, 47 years, Basyonde community)

Another emphasized:

> *"I am now invited to community meetings about farming and water allocation. Even though men still dominate some discussions, I feel my*

presence is noticed." (Female farmer, 39 years, Garu-Tempane boundary community)

These results suggest that social recognition is evolving gradually, constrained by enduring gender norms and cultural perceptions of women's roles in northern Ghana. Cultural and traditional norms often continue to define women's social visibility and influence in rural settings. Osei-Akoto and Abankwah (2023) also argue that social empowerment requires deliberate community sensitization and gender-inclusive policies. Nevertheless, women's growing participation in community life signals a shift toward greater gender inclusion and recognition an important foundation for long-term social change.

Among the five domains, economic empowerment recorded the highest score (71.9%), indicating that irrigation farming plays a central role in improving women's financial independence. Most women reported earning income from irrigation activities, having control over their personal or household finances, and maintaining savings. This aligns with findings from Asare-Nuamah and Owusu (2021) and Doss et al. (2020), who note that access to irrigated agriculture enhances women's income-generating potential and reduces household poverty levels.

In the Tempane District, women's increased control over income not only strengthens their economic autonomy but also improves their bargaining power in household decision-making, a crucial component of sustainable empowerment. The second-highest empowerment score was recorded under decision-making power (67.5%), showing that women are actively involved in household and farming decisions, including land use, income allocation, and crop selection. This indicates that irrigation participation provides women with both practical and strategic agency, allowing them to influence key livelihood decisions.

Table 5.1: Distribution of Women Empowerment Indicators among Farmers (N = 156)

Empowerment Domain	No N (%)	Yes N (%)
Decision-Making Power		
Participates in decisions on land use	42 (35.0%)	78 (65.0%)
Participates in household income use decisions	35 (29.2%)	85 (70.8%)
Participates in crop selection and farming decisions	40 (33.3%)	80 (66.7%)
Average	39 (32.5)	81 (67.5)
Access to and Control over Productive Resources		
Has access to irrigable land	38 (24.4%)	118 (75.6%)
Has access to agricultural credit or savings	55 (45.8%)	65 (54.2%)
Has received irrigation or agricultural training	48 (40.0%)	72 (60.0%)
Has access to farm inputs (seeds, fertilizer, tools)	42 (35.0%)	78 (65.0%)
Average	46 (36.3)	83 (63.7)
Economic Empowerment		
Earns income from irrigation farming	20 (16.7%)	100 (83.3%)
Has control over personal or household income	32 (26.7%)	88 (73.3%)
Participates in agricultural marketing activities	38 (31.7%)	82 (68.3%)
Has personal or group savings	45 (37.5%)	75 (62.5%)
Average	34 (28.1)	86 (71.9)
Self-Efficacy and Confidence		
Feels confident in making agricultural decisions	40 (33.3%)	80 (66.7%)
Able to express opinions in public or meetings	48 (40.0%)	72 (60.0%)
Participates in leadership or farmer group roles	55 (45.8%)	65 (54.2%)
Average	48 (39.7)	72 (60.3)
Social Well-being and Recognition		
Improved social status in community	52 (43.3%)	68 (56.7%)
Gained greater respect from family and peers	48 (40.0%)	72 (60.0%)
Participates in community meetings or projects	50 (41.7%)	70 (58.3%)
Average	50 (41.7)	70 (58.3)

However, access to and control over productive resources (60.6%) remains a challenge. Although most women reported access to irrigable land, inputs, and training opportunities, control over these resources is still limited compared to men. These disparities reflect persistent gender-based

structural barriers such as land tenure restrictions, financial exclusion, and cultural norms that constrain women's ability to translate access into ownership or long-term control (FAO, 2022).

The self-efficacy and confidence domain (60.3%) reveals that a majority of women feel capable of making agricultural decisions and expressing their opinions in public forums. However, fewer participate in leadership roles or farmer-based associations. This suggests that irrigation exposure enhances women's self-perception and decision-making confidence, but sociocultural expectations still limit their engagement in leadership or governance spaces. Similar patterns have been observed in studies by Alaofè et al. (2021) and Njuki et al. (2020), which emphasize that empowerment through agriculture is more pronounced in individual agency (confidence, income use) than in collective or institutional participation.

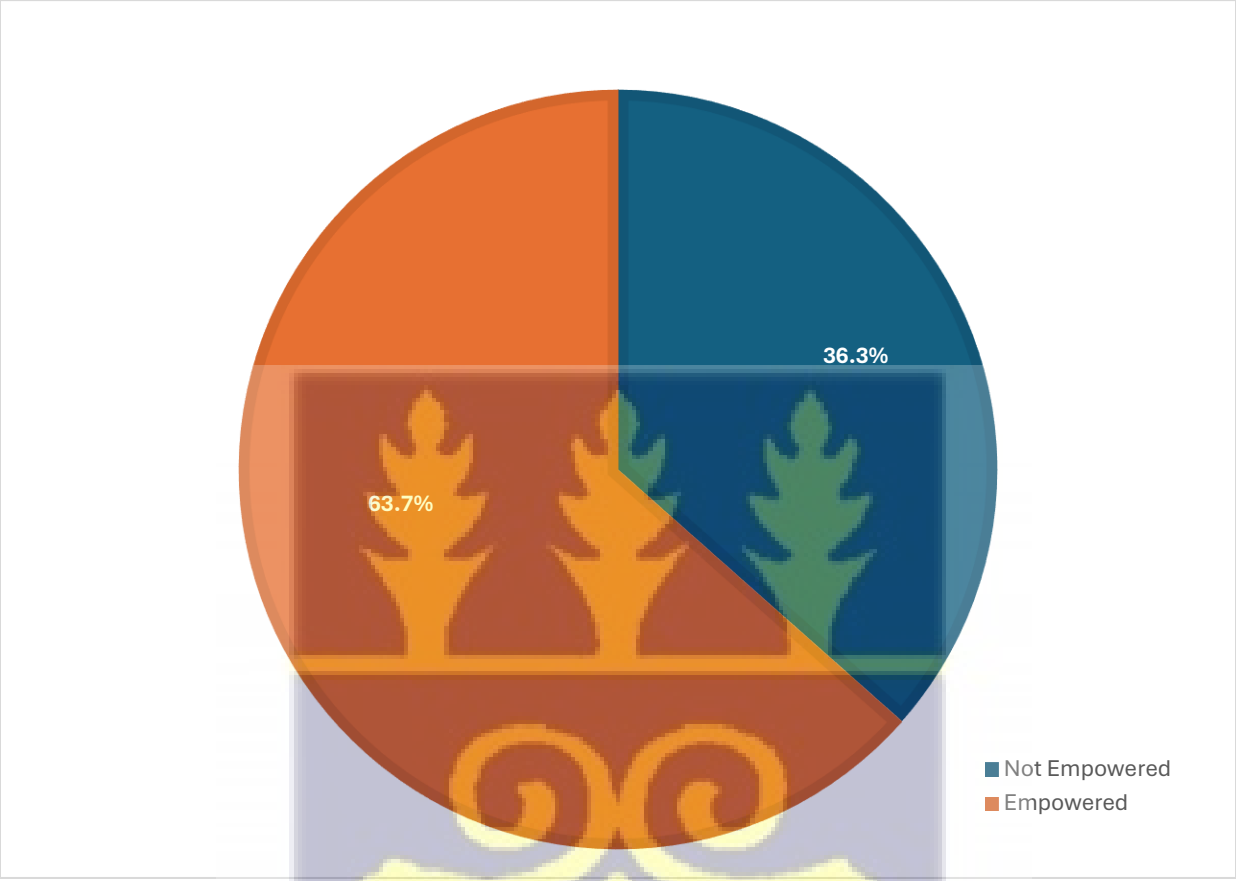
The lowest empowerment score was recorded under social well-being and recognition (58.3%), suggesting that improvements in women's community status, respect, and participation are still evolving. While many women acknowledge enhanced respect from family and peers, social recognition often lags behind economic gains.

This is largely due to enduring gender norms and traditional perceptions of women's roles in northern Ghanaian communities, which limit women's visibility in public life. These findings are consistent with Osei-Akoto and Abankwah (2023), who argue that social empowerment is a gradual process requiring deliberate community sensitization, inclusive leadership, and gender-responsive institutional policies.

5.3 Overall Women Empowerment Index

Figure 5.1 illustrates that the overall Women Empowerment Index (WEI) among farmers in the Tempane District stands at 63.7%, indicating a moderate level of empowerment.

Figure 5.1: The overall women empowerment index among farmers in the Tempane District.



Source: Author's work (2024)

This finding demonstrates that irrigation farming plays a critical role in improving women's socio-economic status, decision-making power, and self-worth in rural communities. The results suggest that women participating in irrigation schemes have gained not only financial benefits but also greater influence in household and agricultural decisions.

This aligns with studies by Doss et al. (2020) and Asare-Nuamah and Owusu (2021) highlighting the transformative potential of irrigation in promoting gender equality. According to Doss et al. (2020), access to productive agricultural technologies, such as irrigation, enhances women's bargaining power, increases their participation in household decision-making, and strengthens their economic independence. Similarly, Asare-Nuamah and Owusu (2021) found that participation in small-scale irrigation projects in northern Ghana significantly improved women's access to income, food security, and household welfare, thereby contributing to both material and psychological empowerment.

The observed empowerment level of 63.7% is consistent with findings by Alaofè et al. (2021) in Benin and Njuki et al. (2020) in East Africa, who reported that agricultural interventions particularly those that increase women's control over income and resources tend to produce moderate empowerment outcomes when cultural and institutional barriers persist. These studies emphasize that economic empowerment and household decision-making are often the first domains to improve, while social recognition and leadership participation evolve more gradually. This pattern mirrors the current study's results, where women achieved high scores in economic and decision-making domains but lower scores in social well-being and recognition.

Furthermore, Osei-Akoto and Abankwah (2023) assert that while women's involvement in irrigation enhances household welfare and food security, empowerment remains incomplete without supportive gender norms, access to land ownership, and inclusive irrigation governance structures. In the Tempane District, this is reflected in women's moderate access to productive resources and limited participation in irrigation management committees. Hence, the 63.7% WEI indicates progress but also highlights the need for structural and institutional reforms to sustain empowerment gains.

In line with FAO (2022), empowerment through irrigation must be viewed as a multidimensional process encompassing economic, social, and political domains. The moderate WEI score suggests that while irrigation farming has provided women with tangible economic and livelihood benefits, transformative empowerment characterized by autonomy, leadership, and social recognition requires continued gender-responsive interventions.

Overall, the findings reaffirm that irrigation farming serves as a viable pathway for women's empowerment, especially in rural and semi-arid regions of Ghana. However, empowerment outcomes remain uneven across domains, reflecting a broader regional trend in which women's participation in agricultural production does not automatically translate into full control over resources or social transformation (Alaofè et al., 2021; Doss et al., 2020; FAO, 2022).

5.4 Association between participation in irrigation farming and women empowerment among farmers in the Tempane District

Table 5.2 presents the association between women's participation in irrigation farming and their composite empowerment levels in the Tempane District. The results reveal a statistically significant relationship between irrigation participation and empowerment status ($\chi^2 = 21.1725$, $p < 0.001$, $df = 2$), indicating that women's participation in irrigation farming is strongly associated with higher empowerment levels. The significant relationship between irrigation participation and empowerment highlights irrigation farming as a critical enabler of gender equity and socio-economic advancement in the Tempane District.

Among women not participating in irrigation farming, 73.5% were in the low empowerment category, while only 8.0% attained high empowerment. Conversely, among women who actively participated, nearly two-thirds (64.7%) reported moderate empowerment, and an additional 6.6%

achieved high empowerment. A non-participating woman shared her frustration with limited access and dependency:

> *"I depend on my husband's farm because I don't have land near the dam. When there is no rain, I can't farm, and that makes it difficult to contribute at home."* (Female farmer, 45 years, Gumyoko community)

This perspective contrasts sharply with the experiences of participating women who described irrigation as a turning point in their livelihoods:

> *"Since I joined the irrigation group, I have my own plot and can grow vegetables all year round. Now, I make my own money and decide how to use it."* (Female farmer, 36 years, Tansia community)

Active participants reported improved access to irrigable land, agricultural inputs, training, and credit facilities, alongside greater involvement in household and community decision-making. These benefits have not only enhanced their incomes but also improved their confidence and visibility in community affairs. As one respondent emphasized:

> *"Before the irrigation project, men made all the farming decisions. Now, when we meet with the officers, women also speak and plan what to plant. It makes me feel equal."* (Female farmer, 40 years, Bugwia community)

These findings are consistent with studies by Asare-Nuamah and Owusu (2021), Alaofè et al. (2021), and Njuki et al. (2020), which have shown that women's participation in irrigation and agricultural interventions enhances their economic independence, decision-making capacity, and self-efficacy. Women participating in irrigation often highlighted how the activity contributed to both material well-being and social respect:

> *"Now people in my area respect me because I can support my children's school and even contribute to the community fund. They see that I am doing something meaningful."* (Female farmer, 42 years, Garu-Tempane boundary community)

However, the limited proportion of highly empowered women (6.6%) suggests that while irrigation farming fosters economic and functional empowerment, transformational empowerment characterized by leadership, control over resources, and social recognition remains constrained by structural and cultural barriers. Some women expressed frustration about their continued exclusion from leadership and control over irrigation schemes:

> *"Even though we farm and work hard, the men are the ones in the committees. We are not invited when big decisions are made about water or land."* (Female farmer, 39 years, Kpikpira community)

This indicates that empowerment outcomes are not uniform; rather, they reflect different stages of progress across domains. While many women have achieved moderate empowerment through improved income and participation, high empowerment involving institutional leadership and ownership rights remains limited. As one woman reflected:

> *"I feel stronger and more confident now, but I still don't have my own land title. Until we own the land, our power will always be small."* (Female farmer, 44 years, Tempane central)

These narratives underscore that participation in irrigation farming is a catalyst for women's empowerment, but without addressing resource inequalities, institutional biases, and gender norms, full transformation will remain elusive. Therefore, targeted interventions such as gender-

inclusive land reforms, women-led irrigation committees, and access to credit schemes are essential to elevate women from moderate to high empowerment levels, ensuring that irrigation farming contributes not just to income generation but to sustainable gender transformation and social equity in the Tempane District.

Table 5.2: Association between participation in irrigation farming and women empowerment among farmers in the Tempane District

	Women Empowerment			
Participation in irrigation farming	**Low N=57 (%)**	**Moderate N=89 (%)**	**High N=10 (%)**	**Total N (%)**
No	20 (73.5)	5 (18.5)	2 (8.0)	**27 (17.3)**
Yes	37 (28.7)	84 (64.7)	8 (6.6)	**129 (82.7)**
$\chi^2 = 21.1725$, $p < 0.001^b$, df = 2	57 (36.3)	89 (57.1)	10 (6.6)	

Note: b= Fisher Exact Test

5.5 Chapter Summary

The chapter demonstrates that irrigation farming in the Tempane District contributes significantly to women's empowerment across multiple domains. Women gain financial independence, decision-making capacity, confidence, and social recognition, though challenges remain in leadership participation and resource control. The integration of quantitative and qualitative findings highlights that empowerment is multidimensional, requiring both material and social support. Targeted interventions addressing structural, cultural, and institutional barriers are necessary to sustain and enhance empowerment outcomes. The next chapter presents the impact of participation in irrigation farming on poverty reduction among farming households in the Tempane District.

CHAPTER SIX: EFFECT OF PARTICIPATION IN IRRIGATION FARMING ON POVERTY REDUCTION

6.1 Introduction

This chapter presents the findings of the impact of participation in irrigation farming on poverty reduction among farming households in the Tempane District. Poverty remains a persistent challenge in northern Ghana, where livelihoods are predominantly dependent on rain-fed agriculture, leaving households vulnerable to seasonal fluctuations, erratic rainfall patterns, and declining productivity (Asare & Frempong, 2023; Namara et al., 2021). In such contexts, irrigation farming has emerged as a key strategy for improving agricultural productivity, stabilizing incomes, and enhancing rural welfare. By enabling year-round farming, irrigation offers smallholder farmers particularly women opportunities to increase income, food security, and resilience against climatic and economic shocks (FAO, 2022; Bacha et al., 2022).

The analysis in this chapter integrates both quantitative and qualitative data to examine how participation in irrigation farming influences household income, welfare, and poverty status. Specifically, it explores changes in household monthly income before and after irrigation, improvements in welfare and basic needs, and the overall livelihood achievements attained through irrigation. The chapter also assesses the relationship between levels of irrigation participation and poverty outcomes, supported by farmers' narratives that provide contextual insights into how irrigation has transformed household livelihoods and social dynamics.

Understanding these linkages is critical for designing sustainable poverty alleviation interventions in Ghana's semi-arid zones, where irrigation development remains central to agricultural modernization and inclusive growth. As highlighted by Osei-Akoto and Abankwah (2023), the

benefits of irrigation extend beyond income generation to encompass broader welfare dimensions such as nutrition, health, and women's empowerment. Therefore, this chapter situates irrigation not only as an economic tool but also as a vehicle for social transformation and community resilience.

6.2 Household Monthly Income Before and After Irrigation

The study sought to assess the effect of irrigation farming on household income levels in the Tempane District. Results in Table 6.1 show a marked improvement in household monthly income following women's participation in irrigation farming. Before engagement in irrigation, the majority of respondents (62.8%) reported earning less than GH₵2,000 per month. However, after engaging in irrigation, this proportion declined significantly to 35.3%. Conversely, households earning between GH₵2,000 and GH₵4,000 rose from 28.8% before irrigation to 48.7% after irrigation, while those earning above GH₵4,000 nearly doubled from 8.3% to 16.0% after participating in irrigation farming. These results indicate that irrigation farming has had a positive and redistributive impact on household income, with a significant proportion of respondents transitioning from lower- to middle- and higher-income brackets.

One female farmer from the Bugwia community highlighted the transformation in her livelihood:

> *"Before I joined the irrigation project, my income was not steady. During the dry season, I had no work and depended on my husband. But now I grow vegetables all year, and I sell them every week. I can pay school fees without waiting for anyone."* (Female farmer, 38 years, Bugwia)

Similarly, another respondent described the shift from seasonal poverty to steady income generation:

> *"In the past, we used to suffer when the rains stopped. But with the dam, I farm throughout the year. My income has increased, and I can even save some money during the dry months."* (Female farmer, 41 years, Tansia community)

The observed increase in income levels supports the assertion that irrigation farming enhances household economic resilience and contributes to poverty reduction. For many women, participation in irrigation not only provided direct income but also reduced their dependence on rain-fed farming and men's financial support:

> *"Now I don't wait for my husband to give me money. I earn my own from tomatoes and onions. I even contribute to our family food and help others when they are in need."* (Female farmer, 34 years, Kpikpira community)

These testimonies reflect broader quantitative findings that show income mobility among irrigation farmers. The shift from low- to middle-income categories indicates that irrigation farming offers a steady and diversified source of livelihood, allowing households to smooth consumption throughout the year. Another woman expressed how irrigation farming brought financial security and dignity:

> *"When I started irrigation, I realized I could make more money than from rain-fed maize farming. Now, during the dry season, I sell vegetables at the market. My income is regular, and people respect me more because I can support my family."* (Female farmer, 44 years, Gumyoko community)

Similar findings were reported by Asare-Nuamah and Owusu (2021), who found that participation in small-scale irrigation schemes in northern Ghana significantly raised farmers' incomes and improved food security. Likewise, Alaofè et al. (2021) in Benin and Mulwa et al. (2020) in Kenya observed that irrigation participation leads to diversified income sources, reduced income volatility, and improved welfare outcomes. Overall, the results underscore that irrigation farming provides a stable and profitable livelihood source, enabling households to overcome seasonal income fluctuations associated with rainfed agriculture. As one respondent succinctly summarized:

> *"Rain farming feeds you for six months, but irrigation feeds you for twelve."*
>
> (Female farmer, 37 years, Tempane central community)

Table 6.1: Monthly Household Income Before and After Irrigation

Income Category	Before Irrigation N=156 (%)	After Irrigation N=156 (%)
< GH₵2,000	98 (62.8)	55 (35.3)
GH₵2,000–4,000	45 (28.8)	76 (48.7)
> GH₵4,000	13 (8.4)	25 (16.0)

Source: Field Survey, 2024

6.3 Welfare and Basic Needs

Irrigation farming was also found to play a vital role in enhancing the welfare and ability of households to meet their basic needs. As shown in Table 6.2, the majority of respondents (75%) identified employment creation as the most significant welfare benefit derived from irrigation, followed by income generation (70.8%), food security (66.7%), and nutrition improvement (54.2%). These findings imply that irrigation farming serves as a socio-economic buffer against poverty by providing both direct and indirect livelihood benefits. It enables households to generate year-round employment and maintain a steady food supply, thus contributing to household resilience. A participant from the Kpikpira community explained how irrigation farming reduced her household's vulnerability to seasonal unemployment:

> *"Before the dam, when the dry season came, we were idle. There was no money and no food to sell. But now, irrigation gives us work all year. I am always busy in my garden, and I don't have to travel to look for jobs."* (Female farmer, 36 years, Kpikpira)

Many respondents emphasized that irrigation farming not only created employment but also improved access to basic needs such as education, healthcare, and nutrition. One woman narrated:

> *"Since I started irrigation, I have been able to send all my children to school. I pay their fees from the vegetables I sell. We also eat better because I grow okra, pepper, and tomatoes for both food and sale."* (Female farmer, 40 years, Bugwia)

Another farmer echoed this sentiment, noting that irrigation farming improved her family's food security:

> *"In the past, we used to run out of food before the next farming season. Now, because of irrigation, there is always something to eat or sell. My children don't go hungry anymore."* (Female farmer, 42 years, Tansia community)

The ability to generate income and maintain consistent food availability was also linked to improved household nutrition. As one respondent described:

> *"We now eat vegetables every day, not just when it rains. I even dry some for later. My children are healthier and rarely fall sick."* (Female farmer, 35 years, Gumyoko)

Beyond food and income, several women reported that irrigation farming improved their overall welfare and dignity, as it allowed them to contribute meaningfully to household expenses and decision-making:

> *"Irrigation has changed how people see women here. We are now helping our husbands and even leading in some farms. I feel proud because I can buy things for the house myself."* (Female farmer, 39 years, Tempane central community)

These qualitative accounts reinforce the quantitative evidence that irrigation farming is not only an agricultural intervention but also a social empowerment tool, particularly for women. The findings align with Doss et al. (2020), who reported that women's involvement in irrigation farming improves household consumption patterns, dietary diversity, and access to essential goods. Similarly, FAO (2022) emphasized that irrigation not only raises agricultural productivity but also enhances nutritional status and health outcomes, especially when women manage

production and income. Overall, both the statistical and narrative evidence confirm that irrigation farming significantly enhances household welfare, employment stability, and food and nutrition security, thereby promoting sustainable rural livelihoods in the Tempane District.

Table 6.2: Benefits of Irrigation Farming to Household Welfare and Livelihood

Benefits	Frequency (N=156)	Percentage (%)
Provision of employment	90	75.0
Source of income	85	70.8
Provision of food security	80	66.7
Source of nutrition	65	54.2

6.4 Livelihood Achievements

Beyond income and employment, irrigation farming has produced multidimensional welfare benefits for women farmers and their households. Table 6.3 presents key achievements reported by respondents. Improved financial security (73.3%) and food security (68.3%) were the most frequently cited outcomes, followed by improvements in health and nutrition (58.3%) and social status (50.0%). The results demonstrate that irrigation farming enhances holistic well-being, not only improving economic indicators but also advancing social and psychological empowerment. Women participants reported increased self-esteem and recognition within their households and communities. One woman expressed:

"Now I can take care of my family without always waiting for my husband. When my children need school things, I can provide. It makes me feel proud and respected." (Female farmer, 38 years, Kpikpira community)

Similarly, several participants explained how irrigation farming improved their financial independence and stability:

"Before joining irrigation, I used to depend on petty trading, which was not reliable. But with irrigation, I earn every week from selling vegetables. I can even save money with the women's group." (Female farmer, 41 years, Bugwia community)

Another farmer highlighted the food security and nutritional benefits that came with irrigation:

"Since we started the dry-season farming, our diet has changed. We now eat vegetables every day, and I also sell some to buy maize and rice. We no longer worry about food shortage." (Female farmer, 36 years, Tansia community)

Participants also emphasized improvements in health and well-being, noting that better nutrition and reduced stress contributed to an enhanced quality of life:

"We used to struggle during the dry season, and the worry made us sick. Now we are busy, we eat well, and we have peace of mind because there is always food and money." (Female farmer, 40 years, Gumyoko community)

In addition to economic and health benefits, irrigation participation also elevated women's social status and self-worth within the community. One woman shared:

> *"People in the community now see me differently because I manage my own farm. I am invited to women's meetings and even speak during community discussions. I feel more confident." (Female farmer, 35 years, Tempane central)*

These narratives underscore that irrigation farming has not only strengthened women's economic resilience but also enhanced their agency, social visibility, and psychological empowerment. The findings align with Osei-Akoto and Abankwah (2023), who found that women involved in irrigation projects in northern Ghana experienced both material and social gains, including respect, community visibility, and participation in leadership roles. Similarly, Njuki et al. (2020) observed that women's participation in irrigation and value chain activities strengthens household welfare by reducing vulnerability and promoting gender equity in rural livelihoods. Overall, the evidence from both the statistical data and participants' testimonies suggests that irrigation farming has served as a transformative pathway for improving financial security, food access, health, and social empowerment among women farmers in the Tempane District.

Table 6.3: Achievements Attained Through Irrigation Farming

Achievements	Frequency (n)	Percentage (%)
Improved financial security	88	73.3
Improved food security	82	68.3
Improved health and nutrition	70	58.3
Improved social status in the community	60	50.0

6.5 Poverty Status

Figure 6.1 illustrates the poverty status of respondents following their participation in irrigation farming. Poverty status was evaluated based on respondents' self-reported changes in household income and overall welfare before and after engaging in irrigation activities. The assessment considered key indicators such as monthly household income levels, the ability to meet basic needs (including food, healthcare, and education), and perceived improvements in living standards. Based on these indicators, households were classified into three categories: still poor (no or minimal improvement), moderately improved (some noticeable improvement), and significantly improved (substantial enhancement in income and livelihood security).

Figure 6.1: The poverty status after participation in irrigation farming

Source: Author's work (2024)

As shown in Figure 6.1, 34 (21.8%) respondents indicated that they remained still poor, reflecting little or no improvement in household income or welfare despite engaging in irrigation farming. Conversely, 69 (44.2%) respondents reported moderate improvement in their living conditions, signifying some progress in income levels and their ability to meet essential needs. Meanwhile, 53 (34.0%) respondents experienced significant improvement, demonstrating notable gains in income, livelihood security, and overall well-being.

The narratives of participants mirror this pattern of differentiated welfare outcomes. For some women, irrigation farming has provided only limited benefits due to small farm sizes, high input costs, and inadequate access to water or credit. One woman shared:

> *"Even though I farm during the dry season, the income is not enough. Sometimes the cost of fertilizer and fuel for pumping water takes almost everything I earn. I am still struggling to feed my family." (Female farmer, 42 years, Bugwia community)*

However, the majority of participants reported moderate improvement, with irrigation providing a more reliable income and food source throughout the year. As one respondent explained:

> *"I cannot say we are rich, but things are better now. At least we have food all year and can pay for our children's school fees without borrowing every time." (Female farmer, 36 years, Kpikpira community)*

Another farmer described irrigation as a turning point in reducing household vulnerability:

> *"Before irrigation, we depended only on the rains. When the rains failed, we suffered. Now, even in the dry season, I sell vegetables and make small savings. Life is more stable." (Female farmer, 39 years, Tansia community)*

For others, the transition has been more transformative, bringing substantial economic and social improvement:

> *"Since I joined the irrigation project, my income has increased a lot. I built a small room for my family and bought a motorbike for my husband. People now respect me because they see the change." (Female farmer, 33 years, Gumyoko community)*

Another woman echoed similar sentiments about empowerment and self-sufficiency:

> *"Now I don't wait for my husband to give me money before cooking or buying things for the house. My farm gives me enough to support the home. I feel proud and independent." (Female farmer, 37 years, Tempane central)*

Overall, 78.2% of households reported some degree of welfare improvement after participating in irrigation farming, underscoring its potential as an effective strategy for rural poverty reduction. These findings align with those of Namara et al. (2021) and Bacha et al. (2022), who observed that small-scale irrigation enhances agricultural productivity and improves household welfare. Similarly, Asare and Frempong (2023) noted that irrigation interventions in Ghana contribute to increased income stability and food security among rural farmers.

Moreover, these results reaffirm that irrigation farming serves as a catalyst for poverty alleviation by enhancing both monetary welfare (income) and non-monetary welfare (nutrition, social status, and overall well-being). As emphasized by FAO (2022) and Asare-Nuamah and Owusu (2021), irrigation facilitates a transition from subsistence to semi-commercial agriculture, thereby creating pathways out of poverty and fostering broader rural development and women's empowerment. Ultimately, the findings highlight that economic empowerment through irrigation has both

immediate and long-term benefits for household welfare, contributing directly to the achievement of Sustainable Development Goals (SDGs) 1, 2, and 5, which focus on poverty eradication, food security, and gender equality.

6.6 Association between level of irrigation farming participation and poverty status among farmers in the Tempane District

The results in Table 6.4 reveal a statistically significant association between participation in irrigation farming and household poverty reduction ($\chi^2 = 27.6247$, $p < 0.001$). A clear positive pattern emerges, showing that households engaged in irrigation farming reported notably lower levels of poverty compared to those not participating. Among respondents who did not participate in irrigation farming, 16 (59.3%) remained poor, and only 3 (11.1%) experienced significant improvement in income or welfare. In contrast, among those who participated in irrigation farming, 18 (14.0%) remained poor, while 50 (38.8%) reported significant improvement in their income, food security, and overall living standards.

This finding underscores that active participation in irrigation farming substantially enhances household welfare. Farmers who engage in irrigation activities especially those with consistent access to water, land, and inputs are more likely to experience improved living conditions and reduced poverty levels.

Qualitative insights from participants vividly illustrate how irrigation has transformed livelihoods in the Tempane District. Many respondents linked irrigation directly to improved economic resilience and food sufficiency:

> *"Before I started irrigation, there were times my children went to bed hungry when the rains failed. Now, even in the dry season, we harvest vegetables*

and sell them at the market. Poverty has reduced in my home." (Female farmer, 38 years, Tansia community)

Another woman emphasized the security irrigation provides against seasonal uncertainty:

"When there is no rain, other farmers wait at home, but I still work because I have my irrigation farm. The money I get helps me buy food and pay school fees. I no longer depend on my husband for everything." (Female farmer, 35 years, Kpikpira community)

Respondents also highlighted how irrigation has enabled small investments and asset accumulation, signaling a clear shift from chronic poverty to financial stability:

"From my irrigation profits, I bought a goat and later sold it to buy roofing sheets. I never thought I could do that before. This farming has really changed our lives." (Female farmer, 42 years, Gumyoko community)

However, not all farmers benefited equally. A few expressed frustrations due to limited access to water or high production costs:

"Those of us far from the water source suffer. Sometimes, I cannot afford the fuel for pumping, so I make little profit. I am still poor, but I see others doing better because they have good land near the dam." (Female farmer, 44 years, Bugwia community)

Overall, the strong association between irrigation participation and poverty reduction reinforces the role of irrigation as a key driver of rural economic transformation in the Tempane District. These findings are consistent with previous studies by Namara et al. (2021), Bacha et al. (2022),

and Asare and Frempong (2023), which emphasize that irrigation farming promotes income diversification, employment generation, and resilience to seasonal income shocks. In essence, irrigation farming does not only reduce income poverty but also fosters multidimensional well-being by improving food access, financial independence, and women's economic empowerment, thereby contributing to the sustainable upliftment of rural households.

Table 6.4: Association between level of irrigation farming participation and household poverty status among farmers in the Tempane District

	Household Poverty Status			
Participation in irrigation farming	**Still Poor N=34 (%)**	**Moderately Improved N=69 (%)**	**Significantly Improved N=53 (%)**	**Total N (%)**
No	16 (59.3)	8 (29.6)	3 (11.1)	27 (17.3)
Yes	18 (14.0)	61 (47.3)	50 (38.8)	129 (82.7)
$\chi^2 = 27.6247$, $p < 0.001^b$, df = 2				

6.7 Chapter Summary

Chapter Six examined the impact of irrigation farming on poverty reduction among households in the Tempane District. Findings indicate that participation in irrigation significantly improves household income, welfare, and livelihood resilience. The chapter demonstrates that irrigation farming is a transformative strategy for promoting economic empowerment, reducing vulnerability, and advancing social well-being among rural households in the Tempane District, supporting both income and non-income dimensions of poverty alleviation. The next chapter presents the constraints that limit their full participation in irrigated agriculture.

CHAPTER SEVEN: CONSTRAINTS LIMITING ACCESS TO IRRIGATION

7.1 Introduction

Despite the positive effects of irrigation farming on income, welfare, and women's empowerment in the Tempane District (as shown in previous chapters), farmers still face substantial constraints that limit their full participation in irrigated agriculture. These constraints are not only barriers to productivity and growth but also impede gender equity, empowerment, and poverty reduction efforts. Understanding these constraints is essential for designing interventions that ensure inclusive agricultural development. This chapter examines the multifaceted social, institutional, and economic barriers that farmers in the Tempane District report, explores how these constraints vary across demographic categories (age, type of irrigation scheme, location), and discusses implications for policy and practice.

7.2 Constraints limiting women's access to irrigation

7.2.1 Land Tenure Insecurity

Land tenure insecurity emerged as the most frequently reported constraint, with 42.9% of respondents indicating that insecure access to land limited their participation (Table 7.1). Qualitative data highlighted the profound impact of this insecurity on women's farming decisions and productivity. One participant explained:

> *"Although my late husband's family permits me to cultivate a small farm, I have little control over its size or location. The land is given to me as a privilege rather than a right, and if a male relative needs it, I must relinquish it even at the peak of the farming season. When this happens, I lose all the*

investment and effort I have put in. My ability to farm depends largely on the goodwill of others, which greatly limits my potential." (Female farmer, FGD, Tempane, 2024)

Another woman said:

"Sometimes I plant on a plot near the dam, but after the rains, when the water is good, a nephew of my husband comes and claims the land for his own. I lose seeds, fertilizer, everything. It makes me afraid to invest." (Female farmer, 29 years, Kpikpira community)

This demonstrates that land tenure insecurity is not merely a statistical concern but a lived reality that constrains women's ability to plan, invest, and expand production. This demonstrates that land tenure insecurity is not merely a statistical concern but a lived reality that constrains women's ability to plan, invest, and expand production. These findings are consistent with Ali et al. (2021) and Doss et al. (2020), who argue that insecure land tenure limits women's agricultural productivity, investment incentives, and long-term empowerment in Sub-Saharan Africa.

7.2.2 High Labour Demands

High labour demands were reported by 21.2% of participants as a significant barrier. Women noted that irrigation farming requires physically intensive labour, compounded by domestic responsibilities, limiting their productivity relative to men:

"Carrying water from far distances and tending to crops while managing the household is exhausting. Men get the plots near the dam, so they work less and produce more. Even when we work as hard as men, our output is

lower because of the long distances and extra labour required." (Female farmer, Interview, Kpikpira, 2024)

"In dry season, when water is low, I must walk long distances for water every morning; by the time I return, domestic work already awaits. My hands are tired before I even start." (Female farmer, 23 years, Tamale community extension, FGD)

This illustrates that unequal access to resources, such as plots near water sources, amplifies the labour burden for women. Similar patterns are observed in studies by Njuki et al. (2020) and FAO (2022), which emphasize that labour-intensive irrigation practices disproportionately disadvantage women, limiting efficiency and agricultural returns.

7.2.3 Limited Financial Capital

Limited financial capital was identified by 15.4% of respondents. Women frequently described challenges in securing credit for irrigation inputs, a situation exacerbated by requirements for male guarantors:

"The absence of money for pumps or fertilizer restricts what we can gain from irrigation. Banks ask for guarantors, usually our husbands. If he cannot provide it, we cannot get loans. Many women continue farming with small tools and cannot access the full benefits of irrigation." (Female farmer, FGD, Kpikpira, 2024)

"I saved small amounts over years, but the cost of diesel for pumping, good seeds and fertilizer is higher than I can manage alone. Some women get

microcredit, but interest is high, and repayment deadlines harsh when harvest fails." (Female farmer, 42 years, Bugwia community)

This confirms that financial exclusion restricts women's capacity to invest in irrigation, limiting both productivity and income potential. These findings align with Asare-Nuamah and Owusu (2021) and Alaofè et al. (2021), who note that limited access to credit and capital remains a major structural barrier to women's full participation in agricultural interventions.

7.2.4 Cultural Restrictions

Cultural restrictions were reported by 11.5% of respondents, reflecting deeply ingrained social norms that assign irrigation farming as a predominantly male activity. Qualitative accounts highlighted discriminatory treatment in resource allocation:

"Irrigation farming is often viewed as a male-dominated field, and consequently, when a woman participates in irrigation, she seldom receives equal treatment. Frequently, she is assigned land located far from the dam, or in regions known for their low soil fertility, resulting in significantly reduced yields." (Community leader, Male, Interview, Tempane, 2024)

"My mother-in-law told me that women should not farm too much outside the home. She says our duty is the house and children; farming hard and far is for men. So, when I want to expand, people whisper and say I am overstepping." (Female farmer, 45 years, Gbugumdaari community)

This demonstrates that cultural norms limit women's access to fertile plots, reinforcing inequities even when they are permitted to farm. These results are consistent with Doss et al. (2020) and

Osei-Akoto & Abankwah (2023), who argue that cultural norms and gendered expectations constrain women's access to productive land, reduce crop yields, and limit their ability to translate labour into income and empowerment

7.2.5 Exclusion from Governance Structures

Exclusion from Governance Structures was the least cited constraint (9.0%), but qualitative data show it is nonetheless significant. Women often participate symbolically in water user committees without substantive decision-making power:

> *"Although women are officially acknowledged as participants in water user committees, decision-making largely continues to be dominated by men. Women's names are frequently mentioned to demonstrate inclusivity; however, in critical matters, like the allocation of irrigated plots or scheduling of water turns, men lead the discussions and final decisions. Many women remain silent, and their opinions are seldom taken seriously." (MoFA Officer, Interview, Garu-Tempane, 2024)*

> *"I go to the association meetings, but when the big issues come, I don't know what to say because I don't own land or have strong ties. Men make the decision about water schedules, and often women just nod."(Female farmer, 50 years, Intermediate Irrigation Scheme User)*

This highlights that structural and institutional barriers persist, limiting women's ability to influence irrigation management decisions. Similar observations are reported by Njuki et al. (2020) and FAO (2022), who emphasize that formal inclusion in governance does not automatically translate to substantive empowerment for women.

Together, the quantitative and qualitative data demonstrate that women's access to irrigated land is constrained by land tenure insecurity, labour demands, financial limitations, cultural norms, and governance exclusion. These findings align with the Gender and Development (GAD) framework, which emphasizes that women's exclusion from productive resources is systemic, rooted in social, cultural, and institutional inequalities rather than individual shortcomings.

Table 7.1: Constraints limiting women's access to irrigation

Constraints	Frequency N=156	Percentage (%)
Land tenure insecurity	16 (36.4)	67 (42.9)
High labour demands	8 (18.2)	33 (21.2)
Limited financial capital	8 (18.2)	24 (15.4)
Cultural restrictions	6 (13.6)	18 (11.5)
Exclusion from governance	6 (13.6)	14 (9.0)

7.3 Constraints to access to irrigation by age category among farmers in the Tempane District

Land tenure insecurity was the most frequently reported constraint across all age categories, affecting 35.0% of farmers aged ≤25 years, 47.8% of those aged 26–40 years, and 36.4% of those over 40 years. This pattern highlights that insecurity in land rights is a cross-generational challenge in the Tempane District. A 29-year-old male farmer explained:

> "Even though I am still young, I cannot decide where to cultivate. The land belongs to my uncle, and I must seek permission each season. If he changes

> his mind, I lose everything I planted." *(Male farmer, Interview, Garu-Tempane, 2024)*

Similarly, an older female farmer noted:

> "At my age, I have no land of my own. I depend on my sons or brothers to allocate a small portion to me. It makes planning for irrigation difficult because I am never sure if I will get the same plot next year." *(Female farmer, FGD, Tempane, 2024)*

These qualitative accounts emphasize that age does not insulate farmers from the systemic issue of insecure land tenure, which continues to undermine investment decisions and productivity. Consistent with this finding, Ali et al. (2021) and Doss et al. (2020) observed that insecure land tenure affects both younger and older farmers across Sub-Saharan Africa, constraining agricultural innovation and discouraging long-term land improvements.

High labour demands emerged as the second most cited constraint (21.2%), particularly among younger farmers (≤25 years) who often lack access to labour-saving technologies and among older farmers who face physical limitations. As observed by Njuki et al. (2020) and FAO (2022), manual irrigation practices are labour-intensive and disproportionately burden farmers without mechanized support, reducing efficiency and participation rates across age cohorts. The combination of high physical demands and limited access to technology reinforces intergenerational inequality in productivity.

Limited financial capital was another key constraint, reported by 10.0% of young farmers, 13.0% of middle-aged farmers, and 18.2% of older farmers. The relatively higher proportion among older farmers reflects difficulties in accessing formal credit due to lack of collateral and lower financial

literacy levels. Studies by Asare-Nuamah and Owusu (2021) and Alaofè et al. (2021) similarly found that limited access to finance affects both youth and adults, although older farmers often experience greater exclusion due to informal land ownership and limited group membership in cooperative schemes.

Cultural restrictions and exclusion from governance were also evident across all age categories, with 10–13% of respondents indicating that sociocultural norms and decision-making exclusion constrained their full participation in irrigation. In line with Osei-Akoto and Abankwah (2023), these results demonstrate that cultural hierarchies persist in local irrigation systems, restricting equal access regardless of age.

The results presented in Table 7.2 show no statistically significant association between constraints to accessing irrigation farming and age category ($\chi^2 = 4.8644$, $p = 0.772$). This suggests that barriers such as land tenure insecurity, limited financial capital, cultural restrictions, and governance exclusion affect farmers broadly across all age groups rather than being concentrated within a particular demographic. The pervasiveness of these challenges implies that interventions aimed at promoting inclusive irrigation access should target farmers of all ages rather than focusing narrowly on youth or older farmers. Hence, policies designed to promote irrigation inclusivity should adopt a system-wide approach strengthening land tenure systems, improving credit accessibility, and mechanizing irrigation practices for all farmers. Tailored training programmes on irrigation technology and cooperative management should also include diverse age groups to enhance participation and sustainability across generations.

Table 7.2: Constraints to access to irrigation by age category among farmers in the Tempane District

	Age Category			
Constraints to women's access to irrigation	**≤ 25 years N=20 (%)**	**26-40 years N=92 (%)**	**>40 years N=44 (%)**	**Total N (%)**
Land tenure insecurity	7 (35.0)	44 (47.8)	16 (36.4)	67 (42.9)
High labour demands	6 (30.0)	19 (20.7)	8 (18.2)	33 (21.2)
Limited financial capital	4 (10.0)	12 (13.0)	8 (18.2)	24 (15.4)
Cultural restrictions	2 (10.0)	10 (10.9)	6 (13.6)	18 (11.5)
Exclusion from governance	1 (5.0)	7 (7.6)	6 (13.6)	14 (9.0)
χ^2 =4.8644, p =0.772[b], df = 8				

Note: b= Fisher Exact Test. Source: Field Survey, 2024

7.4 Constraints to access to irrigation by type of irrigation among farmers in the Tempane District

The study further examined whether the type of irrigation scheme small-scale individual or community-managed had any association with the constraints reported by farmers. Table 7.3 presents the cross-tabulation results, revealing that land tenure insecurity was the most frequently cited constraint among both groups, reported by 32.4% of individual irrigators and 46.2% of those in community-managed schemes. This finding suggests that regardless of irrigation type, insecurity over land rights remains a critical issue, limiting farmers' capacity to plan, invest, and expand production sustainably.

High labour demands were the second most reported constraint, affecting 24.3% of farmers in individual schemes and 20.2% in group schemes. Farmers explained that irrigation activities, particularly water fetching, bed preparation, and manual watering, required significant physical effort. This burden is often intensified for women and older farmers who lack access to mechanized

tools or family labour. As noted by Njuki et al. (2020) and FAO (2022), such labour-intensive practices reduce productivity and discourage participation, especially among vulnerable groups.

Limited financial capital also featured prominently, with 27.0% of individual irrigators compared to 11.8% of community scheme members reporting financial constraints. Individual farmers often face greater challenges accessing credit facilities since they operate independently and lack formal group collateral arrangements. Qualitative evidence supports this pattern, as one respondent noted:

> *"For individual farmers, getting financial support is hard. The banks prefer to work with groups because they can guarantee repayment. We end up using our savings or small family loans, which are not enough for pumps or fertilizer." (Male farmer, Interview, Kpikpira, 2024)*

This finding aligns with Asare-Nuamah and Owusu (2021) and Alaofè et al. (2021), who emphasize that limited financial access disproportionately affects smallholder farmers, curtailing investment in irrigation technology and productive inputs.

Cultural restrictions and exclusion from governance structures were comparatively less cited but remain important constraints. About 10.8% of individual irrigators and 11.8% of group irrigators reported facing cultural barriers, often tied to gender norms and community hierarchies. Similarly, 5.5% and 10.0% respectively indicated exclusion from decision-making structures in water management committees. These patterns resonate with findings from Doss et al. (2020) and Osei-Akoto and Abankwah (2023), who argue that sociocultural norms and unequal power dynamics restrict farmers' effective participation in irrigation governance.

The Chi-square test ($\chi^2 = 6.2731$, df = 4, p = 0.1794) indicates no statistically significant association between the type of irrigation scheme and the constraints faced by farmers in the

Tempane District. This implies that challenges such as land tenure insecurity, high labour requirements, and limited financial capital are common across both individual and community-managed irrigation systems. Interventions aimed at improving irrigation access should therefore address structural barriers particularly land security and financial support across all types of irrigation systems rather than tailoring solutions exclusively to one type.

Table 7.3: Constraints to access to irrigation by type of irrigation among farmers in the Tempane District

Constraints	**Type of Irrigation** Small-Scale Individual / Household Schemes N=37 (%)	Community-Managed / Group Irrigation Schemes N=119 (%)	**Total N (%)**
Land tenure insecurity	12 (32.4)	55 (46.2)	67 (42.9)
High labour demands	9 (24.3)	24 (20.2)	33 (21.2)
Limited financial capital	10 (27.0)	14 (11.8)	24 (15.4)
Cultural restrictions	4 (10.8)	14 (11.8)	18 (11.5)
Exclusion from governance	2 (5.5)	12 (10.0)	14 (9.0)
χ^2 =6.2731, p = 0.179, df = 4			

Note: b= Fisher Exact Test. Source: Field Survey, 2024

7.5 Chapter Summary

This chapter explored the constraints limiting farmers' access to irrigation in the Tempane District, focusing on women's experiences. Despite the benefits of irrigation for income, welfare, and empowerment, women face significant barriers including land tenure insecurity, high labour demands, limited financial capital, cultural restrictions, and exclusion from governance structures. Land tenure insecurity emerged as the most prominent challenge, affecting women across all age

groups and types of irrigation schemes, while high labour demands and limited financial resources further constrained productivity and investment. Cultural norms and symbolic participation in decision-making committees limited women's influence and access to fertile plots. Quantitative analyses showed no significant association between constraints and either age or type of irrigation scheme, indicating that these barriers are systemic and widespread. The findings highlight the need for comprehensive interventions addressing land security, labour support, financial inclusion, cultural norms, and governance participation to ensure inclusive and sustainable irrigation access, in line with the Gender and Development framework. The next chapter presents the summary, conclusions, and recommendations.

CHAPTER EIGHT: SUMMARY, CONCLUSION AND RECOMMENDATION

8.0 Introduction

This chapter presents the conclusions and recommendations derived from the study that examined irrigation farming as a tool for women's empowerment and poverty reduction in the Tempane District. The research aimed to assess gender differences in participation and access to productive resources, the relationship between irrigation participation and women's empowerment, the association between irrigation and poverty reduction, and the constraints limiting women's access to irrigation. The conclusions and recommendations are drawn from both quantitative and qualitative data gathered during the study.

8.1 Summary of Key Findings

8.1.1 Gender Differences in Access and Participation

The study found that irrigation farming in the Tempane District remains largely dominated by men. Women's participation is evident but constrained by limited access to key productive resources such as land, credit, and agricultural inputs. Gender norms and traditional land tenure systems were observed to influence the level of participation, with men having greater control over irrigable land and decision-making processes. Although women are active in small-scale and household-level irrigation, their efforts are often undervalued and less supported institutionally.

8.1.2 Irrigation and Women's Empowerment

Participation in irrigation farming contributed positively to women's empowerment in the study area. Women involved in irrigation reported greater financial independence, improved decision-making power in household matters, and enhanced confidence in their roles within the community.

Irrigation farming provided opportunities for women to generate regular income, support household expenses, and engage in social and community activities. However, empowerment outcomes varied depending on women's access to resources such as land, education, and technical support.

8.1.3 Irrigation and Poverty Reduction

The study revealed that irrigation farming has significantly contributed to improving household welfare and reducing poverty in the Tempane District. Farmers who participated in irrigation reported higher and more stable income levels compared to those who relied solely on rain-fed agriculture. Irrigation also improved food availability and enabled households to sustain their livelihoods during the dry season. This consistent source of income has allowed many families to meet essential needs such as education, healthcare, and nutrition, thereby reducing their vulnerability to poverty.

8.1.4 Constraints Limiting Access to Irrigation

Despite the benefits associated with irrigation farming, several constraints were identified as limiting women's full participation. These included insecure land tenure arrangements, high labour demands, limited financial capital, cultural restrictions, and exclusion from irrigation governance structures. Such constraints were found to affect farmers across all age groups and types of irrigation schemes. The persistence of these barriers highlights the need for structural reforms, capacity building, and policy interventions to ensure equitable access and participation for women.

8.2 Conclusion

The study concludes that irrigation farming has significant potential as a transformative tool for women's empowerment and poverty reduction in the Tempane District. Participation in irrigation

has enabled women to increase their income, improve household welfare, and enhance their decision-making power and confidence within the community. These findings align with Empowerment Theory, which emphasizes the enhancement of individuals' capacity to make strategic life choices, and with the Gender and Development framework, which highlights the importance of equitable access to resources and opportunities for achieving gender equality. The study shows that when women are supported to participate equally in irrigation, they experience both economic and social benefits, contributing to broader rural development. However, persistent gender-based inequalities in access to land, credit, inputs, and decision-making roles continue to limit the full potential of irrigation farming. Addressing these systemic barriers through deliberate interventions is essential to maximize women's empowerment and ensure inclusive participation across all levels.

8.3 Recommendations

8.3.1 Policy-Level Recommendations

1. **Implement Gender-Sensitive Land Tenure Reforms**-The Government of Ghana, through the Ministry of Lands and Natural Resources and the Lands Commission, should design and enforce gender-responsive land policies that guarantee women secure and independent rights to irrigable land. This should include joint land titling for married couples, issuance of land certificates to women farmers, and establishment of minimum land allocation quotas for women under state or community irrigation schemes.

2. **Mainstream Gender in Irrigation and Agricultural Policy Frameworks**-The Ghana Irrigation Development Authority (GIDA) and the Ministry of Food and Agriculture (MoFA) should adopt gender and empowerment frameworks such as the Gender and

Development and Women's Empowerment in Agriculture Index in policy design and monitoring. Also, all irrigation projects should include gender impact assessments at the planning stage and ensure that infrastructure design, credit schemes, and extension programmes directly respond to women farmers' constraints.

3. **Expand Access to Gender-Responsive Agricultural Financing**-The Bank of Ghana, in partnership with rural and community banks, should develop microcredit and agricultural loan schemes specifically tailored for women irrigation farmers. These schemes should have flexible collateral requirements, reduced interest rates, and loan guarantee mechanisms backed by government or donor programmes.

4. **Integrate Irrigation Development with National Poverty Reduction and Gender Policies**-Irrigation initiatives should be explicitly linked to the implementation of Ghana's Medium-Term National Development Policy Framework and the National Gender Policy to ensure coherence across ministries.

8.3.2 Institutional-Level Recommendations

1. **Enhance Agricultural Extension and Technical Support for Women**-The MoFA and GIDA should recruit and train additional female extension officers to improve outreach to women farmers. Regular training programmes and demonstration sessions on modern irrigation techniques, climate-smart agriculture, and post-harvest management should be organized at community irrigation sites. Partnerships with technical institutions such as Irrigation Development Centres and Agricultural Colleges should be fostered to support ongoing capacity development.

2. **Strengthen Women's Participation in Irrigation Governance**-Water user associations and irrigation scheme committees should institutionalize affirmative action policies, ensuring at least 40% female representation in leadership and decision-making roles. Capacity-building programmes should be provided for women representatives to enhance their leadership, negotiation, and financial management skills. Monitoring mechanisms should be developed to ensure that women's involvement is substantive and not symbolic.

3. **Promote Sustainable, Long-Term Empowerment Programmes**-Development partners and NGOs operating in the Tempane District should shift from short-term project-based interventions to sustainable, community-driven empowerment models. Programmes should incorporate exit strategies that strengthen local institutions such as women's cooperatives to maintain gains after donor support ends. Coordination between NGOs, government agencies, and traditional authorities should be strengthened through District Irrigation Coordination Platforms to harmonize interventions.

4. **Develop Gender-Responsive Monitoring and Evaluation (M&E) Systems**-GIDA and MoFA should design M&E frameworks that track gender outcomes such as women's land access, income growth, and participation in governance. Regular evaluation reports should be shared with district assemblies to guide adaptive policy and programming.

8.3.3 Community-Level Recommendations

1. **Address Cultural Barriers and Promote Gender Equality Awareness**-Traditional and religious leaders should be actively engaged in sensitization campaigns to challenge cultural norms that restrict women's access to land and water resources. Community forums, radio discussions, and agricultural fairs should be used to promote messages on

gender equality and shared household responsibilities. Local women's groups should be empowered to act as advocates for gender equity within their communities.

2. **Support Formation of Women's Irrigation Cooperatives**-Women irrigation farmers should be encouraged and supported to form cooperatives or producer groups to pool resources, share equipment, and negotiate better prices. These cooperatives can also serve as entry points for training, credit access, and marketing initiatives. District Assemblies and NGOs can assist with cooperative registration, governance training, and linkage to buyers.
3. **Integrate Irrigation Farming with Complementary Livelihood Activities**-Community programmes should promote agro-processing, value addition, and small-scale agribusiness ventures (e.g., tomato paste, dried vegetables, seed production) to diversify income and enhance resilience to seasonal shocks. Women should receive training in business management, marketing, and bookkeeping to strengthen their entrepreneurship skills. Partnerships with private sector actors can help women farmers integrate into local and regional agricultural value chains.
4. **Promote Collective Management of Irrigation Infrastructure**-Communities should establish maintenance committees for shared irrigation facilities, ensuring that women are equally represented in management teams. This will improve sustainability and community ownership of irrigation projects.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE FOR FARMERS

The researcher is a postgraduate student at the University of Ghana, undertaking a study on Irrigation Farming for Women Empowerment and Poverty Reduction in the Tempane District. This interview aims to examine GIDA's involvement in irrigation development and the associated gender implications. Your responses will be handled with utmost confidentiality, utilized solely for academic purposes, and your participation is entirely voluntary. Withdrawal is permitted at any time.

Serial number:.....

Date:.....

SECTION ONE: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS		
1.	Sex of respondent	[ ] Male [ ] Female
2.	How old are you? (years)	[ ] <25 [ ] 26-40 [ ] >40
3.	What is your Marital Status?	[ ] Married [ ] Single [ ] Widowed [ ] Divorced
4.	What is your household size?	……
5.	What is your religion?	[ ] Muslim [ ] Christian [ ] Traditionalist
6.	Level of Education	[ ] No education [ ] Primary [ ] Secondary tiary
7.	Occupation?	……..
8.	Average monthly income	[ ] < GH₵ 2000 [ ] GH₵ 2000-4000 [ ] > GH₵ 4000
9.	Source of income?	……..
10	Are you the breadwinner of the family	[ ] Yes [ ] No
SECTION TWO: IRRIGATION FARMING AND LIVELIHOOD		
11	Do you have access to irrigated land for agricultural activities?	1. Yes [ ] 2. No [ ]
12	Which farming do you do?	1. Dry season farming [ ] 2. Rainy season farming [ ]
13	Which of these farming activities are you involved in?	(Tick all those applicable) 1. Sustenance [ ] 2. Commercial [ ] 3. Both [ ]
14	Why do you engage in irrigation farming?	Rank with 1=Highest, 2=Higher, 3=High,4=low, To generate cash/income [ ] To produce food for the household [ ] To Produce livestock feed [ ] Others (specify)……
15	Do you engage in other activities that give you income?	1. Yes [ ] 2. No [ ]
16	If yes to 15, what are the activities you doto earn income?	

		……
Impact of Irrigation Projects on Agricultural Productivity and livelihood.		
17	Type of irrigation farming?	[ ] Subsistence [ ] Commercial [ ] Both
18	Comparing irrigation farming some years back and irrigation farming now,what would you say about your crop production?	1. Good [ ] 2. Bad [ ] 3. Average [ ]
19	Monthly household income before irrigation farming?	[ ]< GH₵ 1000 [ ]GH₵ 1000- GH₵ 2000 [ ]> GH₵ 2000
20	Monthly household income after irrigation farming?	[ ]< GH₵ 1000 [ ]GH₵ 1000- GH₵ 2000 [ ]> GH₵ 2000
21	In which specific way(s) has this irrigation farming been of help to you?	Rank responses with 1st, 2nd, 3rd, 4th ……. Provision of employment [ ] Source of income [ ] Source of nutrition [ ] Provision of food security [ ] Others, specify [ ] …… ……..
SECTION THREE: INTERRELATIONSHIP BETWEEN IRRIGATION AND WOMEN'S EMPOWERMENT		
22	Are you involved in decisions related to the use of irrigated land?	1. Yes [ ] 2. No [ ]
23	Have you participated in gender-sensitive irrigation projects?	1. Yes [ ] 2. No [ ]
24	Role of Women in Irrigation Practices	[ ] Decision-making [ ] Operation and maintenance [ ] Water distribution [ ] No involvement
25	How has your involvement in irrigation projects affected your income level?	a) Significantly increased [ ] b) Somewhat increased [ ] c) No significant change [ ] d) Decreased [ ]

26	Have you experienced any changes in your decision-making power within your household as a result of your involvement in irrigation projects?	A. Yes, increased decision-making power [ ] B. No change [ ] C. Yes, decreased decision-making power [ ]
27	Do you feel that your participation in irrigation projects has led to a greater sense of empowerment and confidence?	1. Yes [ ] 2. No [ ]
28	Any challenges faced by women in accessing irrigation?	[ ] Lack of knowledge/training [ ] Limited access to resources [ ] Cultural barriers [ ] Financial constraints [ ] Other (please specify)……..
29	How do women farmers get access to resources—such as natural resources, human capital, and access to financial resource? ……	
30	Do women get access to good quality land and water for irrigation? Specify ……..	
31	Are women involved in decision making involving irrigation farming? Explain …….	
32	Do women have ability to earn their own income and control over their spending decisions? How ……	
33	Do women have access to markets and participate in market transactions including selling agricultural products and purchasing agricultural inputs or household goods? ……	
34	How does women contribute to decisions regarding land allocation, crop choice, planting, division of labor, input use, harvesting, post harvesting practices, and sale of crops. ……	
35	Do women have a heavy workload with domestic responsibilities, farming, and other livelihood activities? ……	
36	What has been your achievement (good health and nutrition, financial security, food	

	security, and social status) through irrigation farming? …… …..
37	How can women's involvement in irrigation decision-making be improved? …… ……
38	In your opinion, how do gender-sensitive irrigation projects benefit women? …… …..

Thank you for your time and responses.

APPENDIX 2: KEY INFORMANT INTERVIEW GUIDE FOR GHANA IRRIGATION DEVELOPMENT AUTHORITY (GIDA)

The researcher is a postgraduate student at the University of Ghana, undertaking a study on Irrigation Farming for Women Empowerment and Poverty Reduction in the Tempane District. This interview aims to examine GIDA's involvement in irrigation development and the associated gender implications. Your responses will be handled with utmost confidentiality, utilized solely for academic purposes, and your participation is entirely voluntary. Withdrawal is permitted at any time.

1. What are the main objectives for establishing irrigation schemes in the Tempane District?

2. How would you assess the performance of these schemes in meeting their intended objectives?

3. What specific roles does GIDA play in the management and governance of the Tempane irrigation systems?

4. What key challenges does GIDA face in managing the schemes, particularly regarding women's participation?

5. To what extent do women farmers have access to irrigable land, inputs, and decision-making spaces within these schemes?

6. How does GIDA support women farmers in overcoming barriers such as land tenure, finance, and cultural restrictions?

7. What are the major opportunities and potentials of the Tempane dams for improving livelihoods and reducing poverty?

8. What weaknesses or structural limitations of the dams hinder their effective utilisation?

9. How does GIDA collaborate with farmers, local communities, and other institutions (e.g., MoFA, NGOs) in managing irrigation schemes?

10. From your perspective, what additional measures are needed to strengthen gender-responsive irrigation governance in the Tempane District?

APPENDIX 3: SEMI-STRUCTURED INTERVIEW SCHEDULE FOR DEPARTMENT OF AGRICULTURE (MOFA)

The researcher is a postgraduate student at the University of Ghana, undertaking a study on Irrigation Farming for Women Empowerment and Poverty Reduction in the Tempane District. This interview aims to examine GIDA's involvement in irrigation development and the associated gender implications. Your responses will be handled with utmost confidentiality, utilized solely for academic purposes, and your participation is entirely voluntary. Withdrawal is permitted at any time.

1. What are the key roles and responsibilities of MoFA in supporting irrigation farming in the Tempane District?

2. How would you describe MoFA's involvement in the management and governance of irrigation schemes?

3. What major challenges does MoFA encounter in delivering its services to irrigation farmers?

4. To what extent does MoFA provide technical support and extension services to farmers, especially women?

5. What barriers do women farmers face in accessing MoFA's services (e.g., training, credit, inputs), and how are these addressed?

6. How do irrigation farmers, particularly women, benefit from government flagship programmes such as Planting for Food and Jobs?

7. What are the observed socio-economic impacts of irrigation farming on households and communities in the district?

8. How does MoFA coordinate with GIDA, NGOs, and other stakeholders to support irrigation development?

9. What measures has MoFA implemented to promote gender-responsive agricultural development in the district?

10. In your view, what further interventions are needed to strengthen irrigation farming and enhance women's empowerment?