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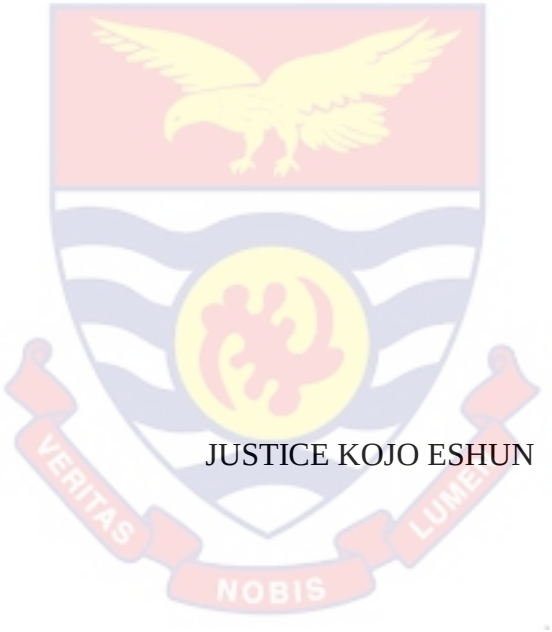
EFFECTS OF INLAND VALLEY RICE PROJECT ON FARMERS IN SHAMA DISTRICT OF WESTERN REGION



JUSTICE KOJO ESHUN

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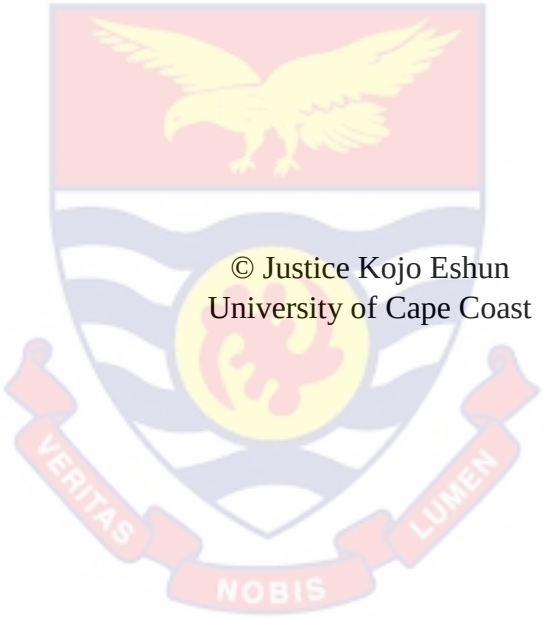

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EFFECTS OF INLAND VALLEY RICE PROJECT ON FARMERS IN SHAMA DISTRICT OF WESTERN REGION

BY

JUSTICE KOJO ESHUN

Thesis submitted to the Department of Geography and Regional Planning of the Faculty of Social Science, College of Humanities and Legal Studies, University of Cape Coast, in partial fulfilment of the requirement for the award of Master of Philosophy degree in Geography and Regional Planning

DECEMBER 2023

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: ..... Date: .....

Name: Justice Kojo Eshun

Supervisors' Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of the thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: ..... Date: .....

Name: Dr. Jones Abrefa Danquah

ABSTRACT

The Inland Valley Rice Project enhances agriculture by improving soil fertility, conserving water, and offering a sustainable method for continuous planting. However, low farmer engagement, marketing challenges, and restricted access to irrigated land hinder the project's success and result in socioeconomic difficulties, high transportation costs, and decreased profits for farmers. This study evaluated the effects of the inland valley rice project on farmers in the Shama District. Specifically, the study accessed the level of access to land by farmers, examined the factors influencing market accessibility of farmers, examined the efficiency of inland valley rice production in the Shama district, and analysed the effects of the project on the livelihood outcomes of farmers. The underlined principle and research approach was Pragmatism and a descriptive mixed-method approach. Data were generated from 185 respondents using questionnaires and interview guides. It was found that gender-based disparities in agricultural land ownership prevail in the Shama district, with male farmers dominating. Factors influencing market accessibility include distance to market centres, transportation modes, and road conditions. It was found that the seasonal average rice yield significantly surpasses the national average yield of 26.56 bags/Acre by 29.80 bags/Acre. The project creates employment opportunities, contributing to local job opportunities and increasing income generation. However, challenges related to mechanization affected the efficiency of the project. It is recommended that the government explore options for providing farmers with affordable and secure land access to ensure the efficient production of Inland Valley rice.

KEY WORDS

Inland Valley Rice Production

Livelihood Outcomes

Market accessibility

Rice Production

Rice Production Efficiency

ACKNOWLEDGEMENT

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DEDICATION

To my family and friends

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LIST OF ACRONYMS

PPA	Participatory Poverty Assessment
PRA	Participatory Rural Appraisal
GGA	Good Governance Assessment
SLA	Sustainable Livelihood Approach
SLF	Sustainable Livelihood Framework
IVRP	Inland Valley Rice Production
PFJ	Planting for Food and Jobs
MOFA	Ministry of Food and Agriculture
IVRDP	Inland Valley Rice Development Project
NERICA	New Rice for Africa
GIS	Geographical Information System
FAO	Food and Agriculture Organisation

CHAPTER ONE

INTRODUCTION

Background of the study

Sustainable agriculture, which focuses on higher yield, soil conditions, and precision agriculture, has been advocated as a technique to increase resource usage efficiency and production (Tilman et al., 2011). This is especially pertinent in developing nations when yield discrepancies persist (Beza et al., 2017). Examining potential field, farm, and regional limits is essential when considering the options for sustainable intensification. At the field level, crop management systems must accommodate farmers' demands for high yields, efficient resource usage, labour productivity, and profitability. Structural changes, such as inland valley agriculture, may be necessary at the farm and regional levels to reduce farmers' environmental and economic risk and alleviate their resource constraints (land, labour, and capital) (Silva et al., 2018).

An inland valley " has a landscape that extends from the interfluves to the valley bottom with its seasonal depression of standing water" (Windmeijer & Andriesse, 1993). Inland valleys in West Africa provide the necessary potential for rice-based agricultural systems since they are mainly untapped, have more water available, have less fragile soil, and have higher fertility (Giertz et al., 2012; Rodenburg et al., 2014; Schmitter et al., 2015). Inland valleys, which have approximately 190 million acres of land, are typical African landscapes (Rodenburg et al., 2014). These landscapes are essential for food security and poverty alleviation, attributed to their significant agronomic potential, characterised by relatively abundant and reliable water

resources and superior soil fertility compared to adjacent uplands (Andriesse et al., 1994). Kangalawe and Liwenga (2005) indicate that rice is the predominant crop cultivated by populations residing in marshes and valleys. According to the West Africa Rice Development Association, rice farming predominates throughout the inland valleys of African nations. Additionally, it suggests that growing rice is more productive than growing crops on uplands.

Rice is farmed abundantly worldwide and is the main staple meal for many people. After wheat, rice is the second most important grain in the world, delivering almost half of the food intake in the world. The rice market is expected to grow by 28% by 2050 (Zhu et al., 2018). However, rice production has ceased in 35% of cultivated areas (Khoury et al. 2014). It is estimated that about 3.5 billion people depend on it for their dietary needs. It is cultivated both in the advanced world and the global south. Its production is not limited to only China and India, which contribute about 50%, but to the global south of which Africa and, for that matter, Ghana is not an exception (Muthayya et al., 2014).

In Ghana, the Poverty Reduction Strategy modernises agriculture through technologies such as the inland valley rice projects to promote rural development, reduce food shortages, reduce poverty, and increase economic growth. Food security is a significant threat to economic development, and Ghana lacks rice self-sufficiency. Tanko and Amikuzuno (2015) observe that Ghanaians prefer and consume foreign rice, which has resulted in the high importation of rice. According to the Ministry of Food and Agriculture (2017), this insufficiency is caused by a high national demand compared to the quantity produced. Thus, compared to consumption, domestic rice production

decreased from 55% in 2014 to 47% in 2017. As a result, the government of Ghana decided to support smallholder farmers as a way of reducing poverty, promoting food security, and increasing the overall contribution of the agricultural sector to the country's Gross Domestic Product (MOFA, 2019) by implementing the Planting for Food and Jobs (PFJ) initiative.

To rejuvenate the agricultural sector, rice was identified as a priority crop for cultivation under the Planting for Food and Jobs (PFJ) initiative. The programme supported beneficiaries with resources through proximity and extension services, enabling them to maximise the advantages of subsidised inputs such as fertilisers (MOFA, 2019). Production, income, job, retailing rice price, and other indicators were to be used to gauge the success of the PFJ program. The Shama district was one of the locations singled out by the Planting for Food and Jobs initiative's Inland Valley Rice development project, which intended to lower unemployment and raise farmers' incomes by increasing rice output.

Statement of the Problem

About 25 districts in five regions, "Ashanti, Brong-Ahafo, Central, Eastern, and Western", comprise the current scope of the Inland Valley Rice Development Project (IVRDP). The western region's Inland Valley Rice Project has been a boon to the rice-producing systems in the Shama district. The interior valleys of the region were introduced to the rice cultivation methods used in the Shama district because they improve soil fertility through the geological fertilisation process and conserve water. Rice farming in Shama utilises inland valleys, which would improve continuous planting and less disturb production operations despite the unpredictability of rainfall in the

area. To combat poverty, the Inland Valley Rice Project was revived so local rice farmers may see a rise in output, employment, and income.

Kijima et al. (2008) observed that cultivating the New Rice for Africa (NERICA) variety resulted in higher incomes for poor farmers in Uganda. Therefore, it was expected that the project would contribute to the higher income of farmers in Ghana. However, Mpianing (2016) observed that inland valley projects did not achieve their objective of poverty alleviation and income increase in Ahafo-Ano South while causing health and environmental challenges. Donkoh et al. (2010) also observed that the efficiency and effectiveness of inland valley rice production in the Northern Region was low with contributing factors such as education, extension visits, farmers' experience, and group membership.

According to Dzudzor (2013), even though Ghana produces rice, it still imports most of its rice. According to ISSER (2023), 60% of rice consumed in the country is imported and this constitutes an import bill of 391 million dollars in 2020. The over-dependence of foreign-produced rice increases the country's vulnerability to external shocks. However, Adupong (2013) also observed that farmers are frustrated, disengaged, and uninterested in the inland valley rice projects in Ohiamadwen, which has resulted in socioeconomic challenges. Moreover, the project has raised disinterest in farmers, with only 180 farmers in the Shama district involved due to the high cost of accessing irrigated land and high input prices. The employment rate is far from the project objective to increase agricultural employment and rice production and reduce national rice imports (Shama District Rice Growers Association Records, 2022). In addition, to increase incomes of smallholder rice producers

of both sexes, with a primary focus on gender mainstreaming has not been released. (Kranjac-Berisavljevic et al, 2003). Furthermore, there is an issue of rice produce market accessibility, which is a significant worry for farmers in the Shama district (Donkoh et al., 2010; Shama District Rice Growers Association Records, 2022). Market access is crucial for agriculture to become the main driver of economic or pro-poor growth (OECD, 2007).

Physical market access, the distance to markets, and the absence of roads from farms to the market, according to Gatare et al. (2015), are factors that affect farmers' access to markets. Because of these difficulties, it is hard for farmers to buy necessary supplies and market their finished goods. It causes consumers and businesses to incur high transportation and transaction costs, leading to oligopolistic markets and diminished profits (Mazoyer et al., 2008; Gatare et al., 2015; Mpianing, 2016). Due to increased uncertainty and a lack of available alternatives, marketing opportunities, farm-gate prices, and input costs all suffer when producers are located further away. It makes post-harvest losses even more of an issue, which in certain parts of the Shama district can reach as high as 50%. Kherallah et al., 2000; Makhura and Mokoena, 2003), asserted that access to financing, availability of extension services, level of organization, necessary training, and farmers' socioeconomic status are predictors of smallholder farmer physical market access.

Access to irrigated land has its own set of inequalities resulting from power and restricted irrigated land, making it impossible for some people to access large tracts of it for various reasons (Shamsia, 2017). Land access difficulties and marketing challenges have a damning effect on national goals for Inland Valley Rice Development Projects in Ghana. As a result, incentives

to engage in the inland rice valley production project are weakened, and subsistence rather than market-oriented production systems emerge.

Despite the national objectives of Inland Valley Rice Development Projects in Ghana, their impact is often evaluated from a macro rather than micro perspective (MOFA, 2019). Because governments implement developmental programs and projects in communities, some do not always result in food security, poverty reduction and reduced unemployment for the rural poor, owing to unequal access. As a result, the study was carried out to assess the effects of the inland valley rice project on farmers in the Shama District.

Purpose of the study

The purpose of the study is to assess the effects of the Inland Valley rice project on farmers in the Shama District.

Research Questions

The following research question will guide the study:

1. How is access to land by farmers affected by the project?
2. What are the factors influencing the physical market accessibility of farmers in the Shama district?
3. How has the inland valley rice production in the district been efficient?
4. What is the project's effect on the farmers' livelihood outcomes?

Research objectives

The following objectives will guide the study:

1. Assess the level of access to land by farmers in the project area
2. Examine the factors influencing physical market accessibility of the farmers in the Shama district,

3. Examine the efficiency of inland valley rice production n in the Shama district, and
4. Analyse the effects of the project on the livelihood outcomes of farmers.

Significance of the study

The findings of this study will help assess Ghana's current infrastructure development and machinery relevant to rice production. The findings will also help develop policies based on experiences on challenges faced in the Inland Valley rice project to develop new policies to achieve national agricultural development objectives. It will help measure the project's contributions to the farmer's welfare in the catchment area. The findings will also be used as a yardstick to measure the project's success by the central government or the district assembly on their achievement and correct their lapses. It will also help develop policies based on experiences on challenges faced in the inland valley rice project to develop new policies to achieve national agricultural development objectives. In addition, the findings of this study will contribute to existing literature.

The organisation of the study

There are five parts to the study. The first chapter introduces the study, outlining its rationale, issue statement, research objectives and questions, importance, and organisational framework. The literature review, which provides the theoretical underpinnings for the argument, is presented in Chapter 2. Chapter 3's Methodology details the study's research area and the numerous data collection strategies employed. The collected data are analysed and discussed in Chapter 4. The study's summary, conclusions, and policy recommendations are presented in Chapter 5.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter reviews the literature on inland valley rice production and its effects. The review provides a conceptual and operational definition of terms, the theoretical framework that guides the study and the literature on global, African and Ghana's development and production of inland valley rice production.

Inland valley and Rice production

An inland valley is "described as having a landscape that extends from the interfluves to the valley bottom with its seasonal depression of standing water" (Windmeijer & Andriesse, 1993). The term only refers to the wet area and its hydro-morphic fringes despite being known by a variety of regional names, such as "basfonds, fadamas or inland swamps in West Africa, mbuga in East Africa, and vleis, dambos, mapani, matoro, inuta or amaxhaphozi in Southern Africa" (Acres et al., 1985; Thenkabail & Nolte, 1996; Giertz et al., 2012). They are widely spread over the West African terrain, making up an estimated 8–28% of the total land area in the subregion (Thenkabail et al., 2000). Due to various factors, such as easy access to river water, high soil fertility compared to uplands, availability of soil moisture during dry seasons, high water availability during wet seasons compared to uplands, and availability of groundwater through lateral inflow from higher parts of the landscape, they have a high potential for the development of rice. The success of the Green Revolution in East and Southeast Asia was substantially influenced by the cultivation of lowland rice in inland valleys. Increasing rice

planting in inland valley lowlands in West Africa is thought to increase rice output volumes and close the consumption-production gap (Fashola et al., 2007).

Inland valleys across West Africa hold considerable potential for rice-based agricultural systems, thanks to their improved water availability, reduced soil vulnerability, and enhanced fertility (Giertz et al., 2012; Rodenburg et al., 2014; Schmitter et al., 2015). However, rice production in Benin's inland valleys faces challenges stemming from both biophysical and socio-economic limitations (Djagba et al., 2013). These challenges include insufficient access to financial resources for investment in intensification, poor maintenance and management of irrigation systems, inadequate national policies, and underdeveloped markets for fertiliser procurement and rice sales (Saito et al., 2015; Schmitter et al., 2015).

According to the United States Department of Agriculture (2013), smallholder farmers, who cultivate only 10% of the world's arable land, contribute to 90% of global rice production. On average, credit-utilising farmers in this sector operate rice farms of 0.82 hectares, compared to 0.63 hectares for those without credit access (Kinkingninhoun-Medagbe et al., 2015). Despite the recent improvements in rice yields driven by government and agricultural development programmes introducing modern technologies and practices, smallholder farming still largely depends on the natural physical attributes of the land. This reliance is exacerbated by limited access to inputs and insufficient funding to mitigate natural constraints such as irregular rainfall, low soil fertility, and unfavourable physical soil conditions (Janssens et al., 2010).

Ghana's Ministry of Food and Agriculture initiated the Inland Valley Rice Development Project (IVRDP) with a total investment of $17.1 million (Adam, 2012). The project was based on the premise that inland valley rice farming, when supported by improved water management and the adoption of more efficient rice production methods, is more profitable than traditional irrigation or upland cropping. According to Adupong (2013), enhanced water management and advanced production techniques significantly increase the profitability of inland valley rice farming compared to conventional methods. The implementation of simple, cost-effective water management systems, alongside the use of improved production inputs and post-harvest management practices, provides a foundation for sustainable rice cultivation in these regions. Efforts to boost the production of high-quality rice aim to enhance food security, reduce rice imports, and increase the income of smallholder farmers, traders, and consumers within the rice value chain (Adupong, 2013).

Inland valleys' suitability for rice farming is influenced by both valley- and non-valley-related factors. The climatological circumstances, socioeconomic variables, and farming techniques are examples of non-valley-related parameters. The savannah zones' principal climatological restrictions are the uneven rainfall distribution, high temperatures during the second crop cycle, and seasonally cool nighttime temperatures. High air humidity and low sun radiation are the primary climatological restrictions in the Equatorial Forest Zone (Kotze, 2011; Sakané et al., 2011). Several biophysical and socioeconomic issues should be considered during the site evaluation because not all inland valleys are necessarily suited for agricultural production (Kotze, 2011; Sakané et al., 2011).

Finding the best inland valleys for rice cultivation is the first step in growing rice farming in West Africa's inland valleys. Suitability analysis, which considers the most critical aspects of rice farming, may be used to choose the best locations within reachable inland valleys for rice growth and consequent high yields.

Assessing the suitability of land for cultivating specific crops, such as paddy rice, wheat, maize, mustard, mango, and sugarcane, within a watershed has advanced significantly in recent years (Mokaram & Aminzadeh, 2010; Krishna & Regil, 2014). Modern approaches often integrate remote sensing with GIS, combining multiple variables like climate, drainage density, geology, hydrology, landforms, land use, soil, topography, and vegetation using techniques such as a weighted overlay analysis (Fujii et al., 2010; Krishna & Regil, 2014) or a pairwise comparison matrix (Kihoro et al., 2013). Some studies evaluate these criteria based on the method developed by Sys et al. (1993), while others rely on expert opinions, insights from local agronomists, and researchers' knowledge to classify land into suitability categories (Mustafa et al., 2011; Halder, 2013; Kihoro et al., 2013).

Drivers for inland valley use in rice production

While Africa has 190 million hectares of inland valley land, the exact percentage of that area utilised for rice production is unknown. Even though Andriesse et al. (1994) only provided a preliminary estimate for this region in West Africa (10-25%), this number does include inland valleys in peri-urban regions that are mainly used for vegetable cultivation owing to their closeness to markets (Erenstein, 2006; Erenstein et al., 2006). It is predicted that the proportion of Africa's interior valleys devoted to rice or rice-based agricultural

systems would be significantly lower than in the central, eastern, and southern regions. However, due in part to the droughts of the 1970s (Niasse et al., 2004) and since soil fertility has been decreasing in the uplands due to unsustainable farming practices, the inland valleys have become more valuable for crop cultivation. (Windmeijer & Andriesse, 1993). Soil fertility is typically insufficient to support high agricultural production, although it is more significant in valley bottoms and hydromorphic margins than in upland soils (Andriesse et al., 1994; van der Heyden & New, 2003). Production years need to be followed by 3-7 years of fallow to retain soil fertility and control pests, diseases, and weeds in rain-fed upland rice systems in SSA, where yields are now approximately 1 t ha-1 (Rodenburg & Demont, 2009; Becker & Johnson, 2001). Without the requirement for the lengthy periods of unproductive fallow necessary on the uplands, well-managed inland valley rice can yield 5-6 tonnes per hectare (Wakatsuki & Masunaga, 2005).

The revitalisation of inland valleys is closely linked to global environmental changes observed in recent decades. Climate models predict shifting and increasingly variable precipitation patterns across Africa, with expectations of reduced rainfall in the Sahel and increased precipitation in equatorial regions. However, there is significant uncertainty regarding the intensity, timing, and geographic distribution of future rainfall and droughts (Giannini et al., 2008; Cook & Vizy, 2006; Hoerling et al., 2006; Christensen et al., 2007; Biasutti et al., 2008). As agricultural conditions grow drier and more unpredictable (Scoones, 1991; Sakané et al., 2011), the consistent yields offered by crops grown in wetlands become increasingly important. Nonetheless, climate change also poses significant hydrological risks to inland

valley ecosystems, as they are highly vulnerable to fluctuations in water availability, quality, and timing. To mitigate these risks, adaptive management strategies must be implemented (Erwin, 2009).

Beyond their natural advantages, inland valleys present a compelling economic opportunity. Africa imports approximately US $5 billion worth of milled rice annually, primarily from Asian countries, accounting for around 40% of the region's yearly rice consumption (Seck et al., 2010; 2012). However, declining global rice export supplies since the early 2000s have driven a significant increase in regional production, with farm-gate prices rising from an estimated US $285 per tonne in 1999 to US $564 per tonne in 2009 (FAO, 2010). These sharp price fluctuations have spurred the expansion of rice cultivation, leading to intensified utilisation of inland valleys (Sakurai, 2006).

Multipurpose nature of inland valleys

Inland valleys hold immense significance not only for agriculture—particularly in the cultivation of rice, maize, and horticultural crops (Sakané et al., 2011)—but also for their critical ecological roles. These include biodiversity conservation, water storage, flood and erosion control, nutrient cycling, and climate regulation (Wood et al., 2013). Additionally, these ecosystems support cultural heritage through activities such as recreation, tourism, clay and sand collection for crafts and construction, and the sustainable harvesting of forest, wildlife, fisheries, and fodder resources (Dugan, 1990; Adams, 1993). They also provide local communities with non-agricultural plant resources, where rural populations possess detailed

knowledge of plant species, their uses, and where they can be gathered (Rodenburg et al., 2012).

Despite their versatility, inland valleys face degradation due to overexploitation and the growing demand for their resources. While their economic potential is widely recognised, unregulated development threatens the unique ecosystem services they provide (Dixon & Wood, 2003). Striking a balance between conserving natural resources and expanding agricultural land is especially critical for wetland ecosystems in Africa (Wood et al., 2013). Any development initiatives must be carefully planned and implemented with active participation from local communities. However, past policy frameworks have often overlooked the vital role wetlands play in local livelihoods (Silvius et al., 2000; Wood et al., 2013). Understanding how communities use and manage these environmental services is a key step toward formulating sustainable development strategies (Rodenburg et al., 2012).

Importantly, ecosystem services within inland valleys are not always in conflict. Valuable non-cultivated plants can often be found in agricultural landscapes, which serve as critical multifunctional sites (Rodenburg et al., 2012). For example, during weeding, farmers may identify beneficial weed species and preserve them or separate them for later use (Rodenburg & Johnson, 2009). Similarly, when clearing fields, useful plants, particularly trees, are often left standing (Leach, 1991; Madge, 1995; Kristensen & Lykke, 2003). This approach helps address the challenge of diminishing wood resources (Shepherd, 1992).

Inland valley communities in Togo and Benin exemplify this synergy. For instance, they have implemented practices such as maintaining small

community forests and cultivating gardens with valuable plants (Rodenburg et al., 2012). These examples highlight how local populations can integrate agricultural productivity with biodiversity conservation and sustainable management, ensuring the long-term resilience and functionality of inland valley ecosystems.

Comparative analysis of rice production efficiency

The efficiency of rice production holds immense significance in global food security. Approximately 480 million tons of milled rice is produced annually worldwide (Muthayya et al., 2014). A nuanced understanding of this efficiency at regional levels, such as in West Africa, particularly in Ghana's Central Region, offers invaluable insights into the intricate landscape of agricultural practices and challenges. The evolution of global rice production efficiency has been substantial, driven primarily by technological advancements, enhanced agricultural practices, and the widespread adoption of high-yielding rice varieties (FAO, 2020). A comprehensive assessment of rice production efficiency encompasses various dimensions, including eco-efficiency, which delves into the intricate relationship between inputs, economic outputs, and the environmental consequences of rice production (Huang et al., 2022). Fannin (2021) even postulates that global rice production systems could boost output by 36% while concurrently mitigating excess nitrogen, underscoring the untapped potential for further efficiencies in rice production.

Production efficiency exhibits considerable variations across countries in Africa, where rice is a staple. According to a report of the Alliance for a Green Revolution in Africa (AGRA) (2021), 34 million tons of milled rice is

consumed annually in Sub-saharan Africa with only 35% produced locally. This makes rice an essential crop and food in Africa. As reported by Africa Agriculture (2008), an acre of land typically yields an average of 25 bags of rice, although this yield may vary depending on the rice variety cultivated. Kenya, for instance, showcases varying yields, with the basmati rice variety averaging 21.7 bags per acre and the BW196 variety reaching 26.03 bags per acre, culminating in an overall average of 30 bags per acre for farmers (Kihoro et al., 2013). With its smallholder rainfed rice farmers, Nigeria sees an annual production of 4.6 tonnes of paddy per year from a crop area of 3.3 hectares (Okoruwa, 2006; Idiong, 2007). In 2012, the national average yield of rice in Nigeria was merely 1.8 tonnes of paddy per hectare (FAO, 2013), significantly below the potential averages of 3.0 t/ha for upland systems and 5.0 t/ha for lowland systems (Imolehin & Wada, 2000; Ayedun & Adeniyi, 2019).

Within the Ghanaian context, rice production has emerged as a focal point for agricultural development initiatives. This is because about 1.5 million metric tonnes of rice is consumed annually, with approximately 50% being imported due to unpredictable quality and quantity of yields (Darfour & Rosentrater, 2016; IDH Trade, 2023). Ragasa and Chapoto (2017) note concerted efforts to enhance rice yield per acre by promoting improved farming techniques, the utilization of certified seeds, and the application of appropriate fertilizers. Anang, Bäckman, and Sipiläinen (2016) provide insights into the gross biological production of paddy and milled rice in Ghana for 2012/2013, totalling 481,010 and 331,897 tons, respectively. Despite these efforts, the country faced a net deficit of -89,878 tons, leading to a total supply of 821,279 tons. Per capita consumption of milled rice doubled from 1985 to

2010, increasing from 12.7 to 24 kg/head/year, and rose to 32 kg per annum in 2012/2013, representing a 75% increase.

The average rice yield in Ghana is estimated at 2.5 tons per hectare (29.41 bags), with an achievable yield potential of 6.5 tons per hectare (75.29 bags) (Anang, Bäckman & Sipiläinen, 2016). Recently, farmers typically harvest an average of 26.5 bags of rice per acre (IPAD, 2023; Stagg, 2022; SRID, 2022). However, regional disparities within Ghana contribute to variations in yield. For instance, data from the Central Region indicates a regional average of 22.5 bags per acre, while in the Shama District, the average rice production is reported as 29.8 bags per acre, according to the Ministry of Food and Agriculture. In specific areas like Biemso 1 in the Ahafor Ano-South District, farmers achieve an exceptional average of 11.73 bags per acre (84kg/bag; 20 bags (50kg/bag)) and farmers in Ohiamadwen and Kobinanokrom achieve an average yield of 13 bags per acre (21 bags[50kg bags/acre]) and 12.23 bags per acre (20.55 bags [50kg bags/acre]) respectively (Antwi, 2009). This regional variation underscores the impact of diverse factors on rice production within Ghana, demanding a tailored approach to address these nuances and enhance overall efficiency.

Theoretical Framework of the Study

Analysing the effects of inland valley rice production on farmers involves using different methodologies and strategies. Several models, such as the rational choice model, the rice self-sufficiency model (Moinina et al., 2021), the integrated rice assessment yield gap and management framework (Silva et al., 2018) and the livelihood sustainability framework (Carney, 1998; Scoones, 1998), have been used in assessing rice production and livelihood

outcomes. The study is grounded on the integrated assessment of rice yield gaps and management model and the Sustainability livelihood framework model to present better the relationship between inland valley rice production and the livelihood outcomes of farmers in the Shama district.

The integrated rice assessment yield gap and management framework

Silva et al. (2017) examined the correlation between management practices and rice production in Central Luzon, the Philippines, using the integrated evaluation of rice yield gaps and management practices framework (Figure 1). It examines the proportional contributions of several growth parameters to crop production to analyse rice yield. The rice yield is broken down into effectiveness, resources, and technology. When applied to inland valley rice production, the framework is pertinent.

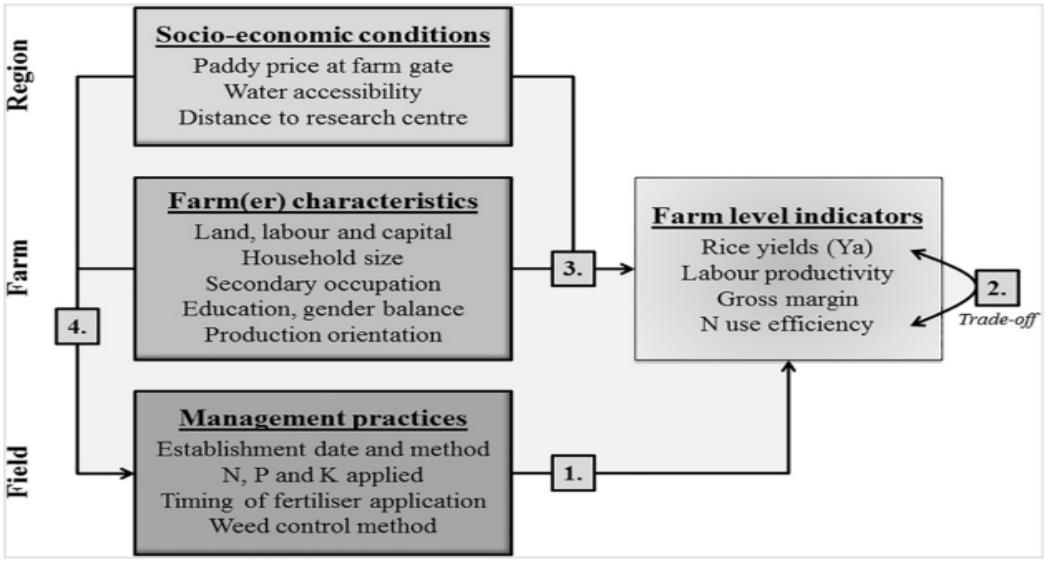

Figure 1: The integrated rice assessment yield gap and management framework
Source: Silva et al. (2018)

An integrated analysis of agricultural systems considers several scale-based forces that may be utilised to pinpoint obstacles to sustainable intensification. It calls for creating indicators that capture various aspects of

smallholder agricultural systems and investigating potential trade-offs and efficiencies among such measures (Klapwijk et al., 2014). By doing so, it is possible to evaluate whether technically feasible management packages for closing the yield gap fit the needs and attributes of farmers, the effects of using a specific management package at the farm level, and the best management package to close the yield gap taking into account various objectives and resource constraints. Additionally, as these variables form the "operating space" for agricultural output, it is significant to understand how elements at the farm and regional levels (resource availability, farm(er) characteristics, and socioeconomic circumstances) interact with crop management strategies (Studwell, 2013; Takahashi & Otsuka, 2009; Estudillo & Otsuka, 1999; Ledesma, 1980).

The Sustainability Livelihood Framework (SLF)

The SLF postulates that families have varying degrees of resource endowment, capability, and contact with the institutions and policies that shape their operating environment. The interplay of these variables determines their choices for a livelihood and the resulting variations in welfare outcomes. As a result, the fundamental problem of individual and family endowments has received substantial attention in the many applications of the SLF. In Figure 2, a diagram of SLF supports the points.

According to Scoones (1998), Ashley and Carney (1999), and DfID (1999), the analysis in the SLF continues to be centred on people and households. These studies recognise the vulnerabilities of the poor in society as the primary problem in creating and putting into practice development interventions in the many applications and modifications of the framework. In

doing so, SLF provides five broad resource categories from which people may estimate their production potential, particularly in light of their livelihood's shocks, trends, seasonality and the institutional structures and processes they must face. These resource groups are:

1. Natural Resources, such as soil, water, biodiversity, and the services provided by them to the environment;
2. Social networks and affiliations are said to be represented by Social Capital;
3. Human Capital, including labour, skills, and knowledge;
4. Physical capital, such as building infrastructure and production equipment and machinery; and,
5. Financial Capital includes money, credit, debts, savings, and other economic assets.

People develop and identify livelihood strategies aimed at achieving optimal welfare outcomes. These outcomes include higher income and improved well-being, reduced vulnerability to economic shocks and natural disasters, enhanced food security, and the sustainable use of available natural resources. The choice of strategies often depends on the level of resources and assets available within their resource groups. The institutional procedures and structures that determine the sequence of economic exchanges, however, do not have any independent influence on decisions about such choices of livelihood options. Among these are laws and social norms, cultural and societal sensitivities, governmental structures, and standards for business transactions.

Beyond one's endowments, the framework notes that these institutional configurations, political structures, and power dynamics may result in varying degrees of access to these resources for sustaining one's livelihood, affecting the kinds of livelihood activities that should be pursued and the potential outcomes. Therefore, the critical function of institutional and policy elements in the framework is their impact on the creation of livelihood portfolios, the final determination of livelihood outcomes, and access to livelihood resources (Scoones, 1998). Accordingly, based on the SLF, it is hypothesised that household group welfare is a function of household assets, trends, circumstances, and context of processes for forming livelihoods, as well as the institutional and regulatory environment that influences economic and social exchanges.

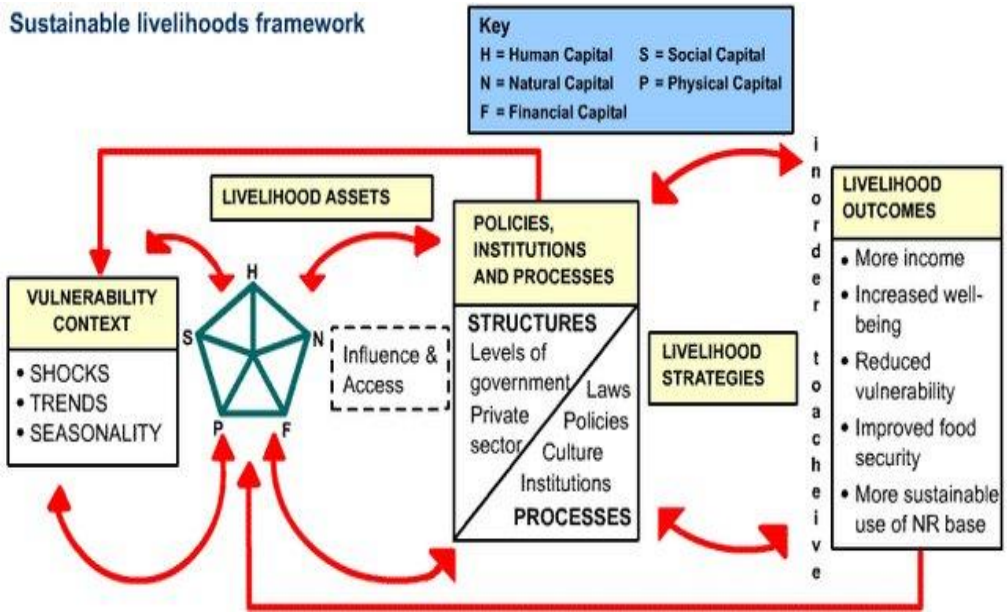

Figure 2: Sustainable livelihood framework
Source: Carney (1998) and Scoones (1998)

At its core, the framework depicts stakeholders operating within a context of vulnerability while having access to specific Assets. These assets gain significance and utility through the prevailing social, institutional, and

organisational context, referred to as Transforming Structures and Processes. This context plays a crucial role in shaping the livelihood strategies individuals can adopt to achieve their desired livelihood outcomes. The framework highlights the relationships between these elements, focusing on the key influences, processes, and their interconnections with various aspects of livelihoods.

Vulnerability Context

The vulnerability context establishes the external environment in which individuals live and holds significance by directly impacting their asset status. It encompasses various factors, including trends (such as demographic, resource, and governance trends), shocks (such as health crises affecting humans, livestock, or crops; natural disasters like floods or earthquakes; economic disruptions; and conflicts, including national or international wars), and seasonality (such as fluctuations in prices, products, or employment opportunities). This context represents the aspect of the framework that is largely beyond the control of stakeholders (Devereux, 2001).

Livelihood Assets

The approach is primarily focused on the needs of individuals. Therefore, it is essential to analyse how people attempt to transform their assets into favourable livelihood outcomes to determine their strengths (assets) accurately. To attain their goals, people need a variety of assets, yet no one asset endowment is adequate to produce the necessary results (Bebbington, 1999).

- **Human Capital**: This represents the abilities to work, knowledge, skills, and good health that enable individuals to pursue various

livelihood strategies and achieve their goals. It varies at the household level based on factors like household size, leadership potential, skill levels, and overall health. Human capital often plays a critical role in determining the use and effectiveness of other forms of capital (DFID, 2000).

- **Social Capital**: Social capital refers to the social resources individuals leverage to secure their livelihoods. This includes social networks and connections that facilitate cooperation and build trust among individuals, as well as participation in more formalised groups with established norms, regulations, and consequences (DFID, 2000).
- **Natural Capital**: Natural capital encompasses the stock of natural resources from which essential services and resources for livelihoods are derived. These include land, water, forests, air quality, erosion control, biodiversity, and the rate of change in these resources (DFID, 2000).
- **Physical Capital**: Physical capital includes the critical producer goods and infrastructure that support livelihoods, such as affordable transportation, safe housing, sanitation, clean and reliable energy, and access to essential water and sanitation services (DFID, 2000).
- **Financial Capital**: Financial capital refers to the financial resources people use to support their livelihoods. It includes the availability of money or its equivalent, which allows individuals to choose from a range of livelihood strategies (DFID, 2000).

Transforming Structures and Processes

Transforming structures and processes encompass the frameworks, organisations, regulations, and mechanisms that influence people's livelihoods. These are crucial because they function across various levels, effectively determining access to resources, facilitating exchanges, and managing returns from different livelihood activities. The term "structures" refers to the foundational elements, such as both governmental and private institutions, which create and enforce policies, provide services, conduct transactions, and engage in other actions that affect livelihoods (Shankland, 2000; DFID, 2000). In contrast, "processes" represent the underlying systems that shape the interactions and behaviour within these structures. Key livelihood processes play a significant role in guiding decisions, regulating access to resources, and allowing stakeholders to adapt or replace resources with alternatives (DFID, 2000).

Livelihood Strategies

Livelihood strategies refer to the diverse and combined actions individuals undertake to achieve their livelihood goals. People often blend various activities within these adaptable processes to meet their changing needs at different times and across various geographical or economic contexts. These strategies are closely tied to the status of assets and the structures and processes that transform them. The impact of a shifting asset status on other strategies may either facilitate or hinder their effectiveness, depending on the prevailing institutional structures and regulations (Shankland, 2000; Keeley, 2001).

Livelihood Outcomes

Desirable livelihood outcomes include increased income (in the form of cash), improved well-being (such as enhanced self-esteem, better health, access to services, and a sense of belonging), reduced vulnerability (through greater resilience resulting from improved asset status), improved food security (due to greater financial capital to purchase food), and more sustainable use of natural resources (e.g., secure property rights). These outcomes, derived from the configuration of components within a livelihood framework, help us understand the 'results' of such a configuration. They highlight the priorities and drivers of various stakeholders. Consequently, these outcomes can guide predictions about how individuals might respond to new opportunities and help identify the metrics that should be used to assess the effectiveness of our support initiatives (DFID, 2000).

Strength of the Sustainable Livelihood Framework

The SLF method demonstrates the multiplicity of means by which people make a living, most of which are employed in tandem. For the poor, who must often engage in a variety of economic activities to make ends meet, this is especially crucial, as it is not any individual activity but rather the sum of all of them that determines the household economy (Hussein & Nelson, 1998). The SLF method provides a complete picture of what resources, or a mix of resources, are crucial to the poor by emphasising the wide range of assets people draw on while building their livelihoods (Holland & Blackburn, 1998).

By zeroing in on the macro and micro circumstances that decide or constrain those living in poverty, this approach helps, us better comprehend its

origins "'s ability to gain access to various forms of wealth and support themselves. Such restraints may originate from locally rooted formal and informal institutional and social elements or be the product of macro-level policies, economic processes, and legislative frameworks (Frankenberger, 1996).

Furthermore, the SLF approach allows us to see how even the poor are active decision-makers, not passive victims, in shaping their livelihoods by focusing on how people develop their livelihood strategies (coping and adapting strategies) to achieve specific outcomes in response to a particular "vulnerability context." This is crucial information for planning aid programs that capitalise on the skills and resources of the disadvantaged (Frankenberger, 1996).

The SLA is compatible with all other methods used in modern infrastructure creation. As an alternative, it seeks to leverage interactions between the two. Participatory Poverty Assessment (PPA), Participatory Rural Appraisal (PRA), and Good Governance Assessment (GGA) are only a few of the typical approaches and instruments that are used (Kollmair et al., 2002). Livelihood provides a more realistic framework for measuring the direct and indirect effects on individuals, making it a better basis for evaluating the socioeconomic impact of projects or programs with poverty reduction, as at least one of their overarching aims is "conditions of living (Frankenberger, 1996).

Its malleable structure and flexibility to modification make it suitable for use in a wide variety of local contexts, with its scope of implementation varying according to the specifics of the development research or project at

hand. To better comprehend how a socially constructed environment functions and to locate prospective beneficiaries or partners in practice, the SLA could be used as an analytical tool for the identification of development priorities and new activities before any development activity is undertaken (Ellis, 2000)

Weakness of the Sustainability Livelihood Framework

The sustainable livelihood framework has several flaws, beginning with how it defines key concepts and ending with how it is implemented. A few of the restrictions are expressed below.

In the first place, the SL method necessitates a high level of analytical skill and extensive background knowledge. In particular, if the counterpart is a government extension organisation, the counterpart may not dedicate enough resources to work as extensively with the local populace as the strategy assumes. They may lack the analytical capacity or knowledge of poverty and livelihood concerns to use the technique (Mosse, 1994) effectively. Despite SLA's emphasis on people, they are rarely depicted in the actual design. While there are many "capitals" (one of which is "human"), "influences," "institutions," and "policies," where are the people? The new household economics method, from which SLA emerged, emphasises clusters of task-oriented activities. Therein lies the possibility that SLA may become a relatively mechanical and quantitative cataloguing exercise, thereby lending credence to the sweeping critiques of post-modernists (Mosse, 1994).

Moreover, despite the importance of "culture" as a factor in communities, SLA offers surprisingly little information on the topic (Ashley, 2000). Essential factors like leisure that can majorly affect available resources are also left out of the SLA framework. For instance, Brinson et al. (2009),

authors of a study on the commercial fishing of Atlantic billfish off the coast of West Africa, noted the impact of recreational fishing on the stock and argued that it should be accounted for in an SLA alongside the more conventional emphasis on fishing as a means of subsistence.

As a final point, there is an issue with the "social relations of poverty," or how inequality and power relations sustain and perpetuate poverty on a micro and macro scale. The SLF method emphasises changing the systems and practices that create their livelihoods to improve the lives of the poor (DFID, 1999). However, this is made more difficult because people's access to resources and economic opportunities is influenced by informal structures of social dominance and authority within communities. Moreover, these disparities are rarely apparent outside (Mosse, 1994).

Application of the SLF in farmers' livelihood and rice production studies

Researchers have used the SLF to assess the livelihood outcomes for rice farmers. Mumuni and Oladele (2016) used the SLF to examine the availability of capital for a livelihood and the propensity for entrepreneurship among Ghanaian rice farmers. Farmers' internal locus of control, farming management skills, and agricultural entrepreneurial talents improve with access to more robust livelihood capital.

Tran et al. (2021) utilised the sustainable livelihood paradigm to evaluate the livelihood changes of triple-rice farmers, particularly about a modified water management approach on the floodplains of the Vietnamese Mekong Delta. They found that the livelihoods of rice farmers appeared to be comparatively sustainable, but they also found obstacles to sustainable farm-based livelihoods, such as unpredictable rice markets and a labour shortage.

The livelihood adaption indices and sustainability of rice farmers in Bangladesh's Northwestern Region were evaluated by Eyasmin, Ghosh, and Adeleye in 2021. They found that food security, skilled farmers, extended families, and dominant male households affected the adaptability index and measures like organic manure, shifting planting dates, diseases-tolerant varieties, and irrigation. However, most widely used tactics, such as fertiliser and irrigation, are not long-term. Sustainability is highly impacted by farm size, financing availability, and extension contact. Off-farm pursuits, crop diversification, and high-yield cultivars are more sustainable adaptation techniques.

Ahmed, Allison, and Muir (2008) utilised the sustainable livelihoods paradigm to pinpoint challenges and openings for expanding freshwater prawn farming in southwest Bangladesh. They discovered that in a "gher" farming (*Gher' farming is a unique system that incorporates the joint operation of three enterprises: freshwater prawn, fish and rice*) setting, access to various livelihood assets combined to pursue prawn farming results in sustainable livelihoods. Additionally, prawn farming in "gher" systems is crucial to the economy of southwest Bangladesh, generating significant foreign cash while also boosting food production, diversifying the economy, and creating more jobs. Although there are significant potential advantages, there are some sustainable limits, including rising production costs, high levels of debt, inadequate supplies of wild fry and snail meat, and low technical support. Long-term sustainability is also hampered by inadequate resources, frail transformational structures and processes, a vulnerable environment, minimal institutional support, and a dearth of extension services.

Putra, Setiawan, and Andriani (2022) used the sustainable livelihood method to examine the extent to which the assets that farmers can access can support rosella farming in a study on the Sustainable Livelihood Asset-Based Strategy for Rosella Farmers in Pagung Village. Due to their reliance on government aid to meet their basic requirements, they learned that the features of the asset with the lowest access and the highest level of vulnerability by rosella farmers are social assets. The study's findings also demonstrated that the consolidation technique was the most suitable in providing farmers of rosellas with sustainable livelihoods through the use of yards to breed cattle or goats. The choice of strategy is driven by farmers' inability to access social assets that could support their livelihoods. Outside of rosella farming, farmers can generate additional money by producing livestock.

Yang et al. (2018) used the sustainability Livelihood approach to look into rural Chinese households' resources and livelihood tactics in agricultural heritage systems. They discovered that traditional agricultural knowledge is required in both terrace systems—the Honghe Hani Rice Terraces System (HHRTS) and the Shexian Dryland Terraces System (SDTS)—to prevent the conversion of pure agricultural households to non-agricultural or part-time agricultural households. Additionally, they found that relative to average livelihood asset values, the livelihood assets of households solely engaged in agriculture are lower under these two terrace systems. Contrarily, non-agricultural and part-time agricultural households have higher-than-average livelihood assets. Additionally, non-agricultural households have the highest value for livelihood assets in the SDTS compared to non-agricultural households in the HHRTS.

Relevance of the Sustainability livelihood framework to the study

The sustainability livelihood framework is crucial to the study since it aids in presenting the primary aspects that impact the farmers' livelihoods and their typical interactions. Additionally, it will aid in evaluating the project's contribution to the farmers' ability to sustain their way of life in the Shama district. It will also aid in assessing the farmers' welfare and poverty level.

Conceptual Framework Narrative

The model contains four variables: production efficiency, market accessibility, farmers' socio-demographics and livelihood outcomes. The relationship between these variables is shown in Figure 3. The socioeconomic characteristics of the farmers involved in the Inland Valley rice project affect production efficiency, market accessibility, and livelihood outcomes. The farmer's socioeconomic background will contribute to the state in which the farm is being run, his access to capital investment, and the management practices employed for the continuous yield of rice production. Relatively, the production efficiency is affected by the farm level indicators such as the rice yield, the area cultivated, and the number of crop cycles. Moreover, the farmer's accessibility to the market is essential as it plays a role in achieving improved livelihood outcomes for the farmer by influencing the farmer's socioeconomic characteristics and production efficiency. In the end, all these factors work together to determine whether the livelihood outcomes of the farmers and the project goals were achieved in terms of improved food security, employment, increased well-being, and others.

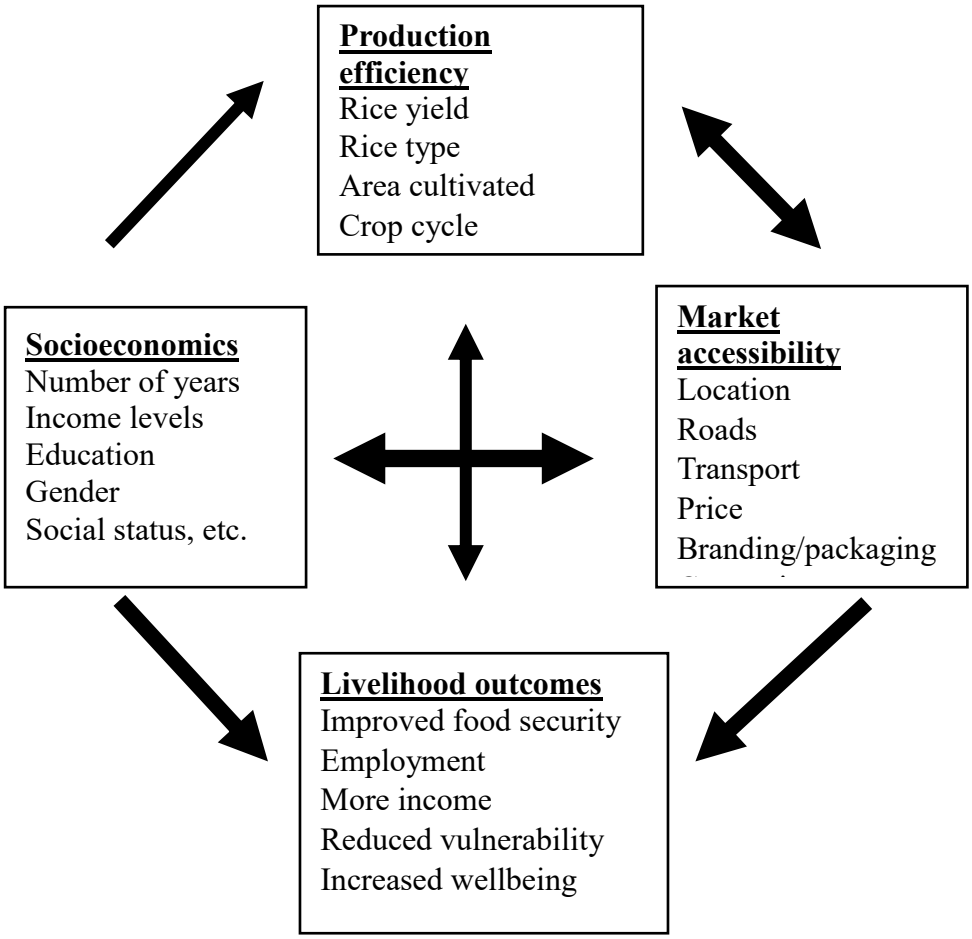

Figure 3: Conceptual framework for the study
Source: Adapted from Carney (1998), Scoones (1998), DfID (1999), and Silva et al. (2018).

Empirical Review

Land has historically been a fundamental and essential factor in crop production throughout Sub-Saharan Africa, serving as a key foundation for the region's agricultural systems (Daudu et al., 2022). Millions of impoverished rural inhabitants who rely on agriculture, livestock, or forest resources for their livelihoods require secure access to productive land. In rural areas, agriculture remains the primary income source for survival (Daudu et al., 2022). However, land access is often restricted, as control remains in the hands of families and local authorities who determine who is granted access. The recipients of community land allocations typically do not possess formal

recognition as land rights holders. Furthermore, family and community leaders often rely on memory and physical landmarks to delineate property boundaries, as most community land transactions are still made without official documentation (Twene, 2016).

Sub-Saharan Africa is experiencing a shift in land tenure systems, driven by factors such as population pressure, institutional changes related to land distribution, and the introduction of land registration programmes, all of which could stimulate land rental and purchase markets (Jayne, Chamberlin, & Headey, 2014). Population growth and climate change have significantly increased the demand for land (Holden & Otsuka, 2014). Empirical evidence suggests that the availability and security of land tenure are pivotal to rural economic development (Deininger et al., 2011; Jayne et al., 2014; Holden & Otsuka, 2014; Ali & Deininger, 2015; Frank et al., 2017). Additionally, the diverse land tenure systems across Africa complicate comparisons of land ownership rates, often conflicting with Western notions of property ownership. For example, the right to transfer property ownership may be absent or cumbersome in communally owned areas (FAO, 2003).

Despite this, official land titles, which guarantee tenure security, are commonly used as the main indicator of land ownership (Brasselle et al., 2002). Besley (1995) highlighted the potential endogeneity between investment and rights, noting that once land is developed, owners are likely to protect their rights to safeguard their investments. However, the issue of causality remains, as rights may be enforced through informal systems, not just formal laws (Brasselle et al., 2002). Farmers are more inclined to register land that promises high returns, as they are willing to pay registration fees

only when confident in the land's potential. In contrast, land rights may rely on prior investment in areas where formal rights are not established (Brasselle et al., 2002; Aikins, Oduro & Twerefou, 2021).

Aikins et al. (2021), following Brasselle et al.'s methodology (2002), found that tenure security positively affects investment decisions, but investments in land do not influence tenure security. On the other hand, Abdulai et al. (2011) demonstrated that differences in land tenure security significantly impact farmers' decisions to invest in land improvement. In rural Burkina Faso, Bambio and Agha (2018) concluded that strong land rights directly encourage investment in land and related improvements.

A more recent study by Vu and Goto (2020) revealed that awareness of extended agricultural land-use rights boosts agricultural investments, particularly in irrigation, soil conservation, and organic fertiliser usage. Similarly, Suchá et al. (2020) found that enhanced land ownership stimulates investment in urban agriculture in South Africa.

Factors influencing farmers'physical market accessibility

Because it is regarded as one of the most significant factors determining their performance, access to markets is essential for integrating farmers into the mainstream (National Department of Agriculture, 2000; Magingxa, Alemu & van Schalkwyk, 2009). Farmers lack the opportunity or incentive to become productive because they lack a successful marketing mechanism for their inputs and outputs (Van Schalkwyk et al., 2003).

Market access is defined by Killick et al. (2000) as the methods used by individuals to enter markets as well as the nature, effectiveness, and costs

of these methods. They contend that the following factors determine market access:

- **a.** Information about the frequency, calibre, and cost of receiving updates on product availability, features, and prices.;
- **b.** information about the counterparties to transactions, as credibility, is essential if payment is not immediate or quality assurance is expensive;
- **c.** the level of trust in market behaviour. For instance, the degree to which markets are governed (either willingly or by the government),
- **d.** the actual prices found in the markets where individuals transact, and the physical expenses of entering the market, which depend on the infrastructure quality and transportation sector organisation.

Because a market is a site where farmers' crop production can be converted into advantages and contributes to the gained income and prosperity of the farmers' families, physical market access is just as crucial as production difficulties. As a result, farmers' share primarily depends on their capacity to access the market.

Soekartawi (2002) asserts that the neglect of the marketing sector is one of the flaws of agricultural systems in emerging nations, including Indonesia. Farmers ultimately have a challenging economic opportunity since they do not receive accurate market information. Heinmen (2002) contends that because they have trouble accessing the market, most rural residents are unable to improve their circumstances. Although they have access to agricultural input, they cannot sell to customers. According to Magesa et al. (2014), rural farmers have traditionally relied on traders and other

intermediaries to increase their profits since they have limited access to agricultural markets.

According to Gatare et al. (2015), three aspects can be used to analyse the issue of farmers' lack of market access: their physical access to marketplaces, the market's structure, and their lack of knowledge, skills, and producer organisations. The subject of physical access also pertains to access to the transportation system. The knowledge of price and rivals is part of the information. Irianto (2008) also mentions the creation of farmer groups to assist farmers in gaining access to the market in connection to producer organisations. According to Suryono et al. (2016), motivation may also impact a company's capacity to gain market access.

According to Van Schalkwyk et al. (2003), a sophisticated agricultural marketing system with infrastructure supporting agricultural production and marketing serves the established commercial sector and the regions where commercial agriculture predominates. Small-scale farmers typically have limited access to inputs, credit, and knowledge, and marketplaces are frequently hindered by insufficient property rights and transaction costs (Lyne, 1996). Transaction costs are the expenses related to the transactions required for transformation, according to Morrison et al. (2000). Transactions are defined as actions that permit or restrict transformation activities.

Farmers depend on intermediary traders due to their ignorance and inability to access the consumer market. This also impacts farmers who lack a strong negotiating position with intermediary traders. In the Seruyan Regency, banana kapok growers frequently feel helpless and accept the prices set by middlemen. According to Puspitasari (2015), one of the issues that Indonesian

farmers frequently encounter is that they still hold a weak bargaining position when negotiating the selling price of their crops. One of the challenges to farmers' income growth is their poor negotiating stance.

Gatare, Zenon, and Oduor (2015) assert that some factors, including the producer's position to the buyer's distance, the quality of the road and means of transportation, Market information includes knowledge of pricing and rivals, as well as cost factors including transportation, produce collection, and market research. members to a collection location for sale or delivery. It also includes information on how the organisation gets produce from

In the words of the International Fund for Agricultural Development (2003), market access is in three dimensions: physical access to markets (distances, costs, etc.), market structure (asymmetry of relations between farmers, market intermediaries, and consumers), and producers' lack of skills, information, and organization understanding of the market, prices, and bargaining. Kherallah et al., 2000; Makhura and Mokoena, 2003), also assert the following criteria as predictors of smallholder physical market access: access to financing, availability of extension services, level of organization, necessary training, and farmers' socioeconomic status.

The determinants impacting the involvement of smallholder vegetable producers in high-value market chains in Tanzania were investigated by Sumari et al. (2018) using the binary logit model. Income, farm location relative to main roadways, yield, availability of irrigation, extension services, market data, and distance to valuable markets were some of the important aspects identified by their study. Factors that contributed to smallholder farmers' ability to reach high-value markets were age, education, farm size,

and participation in farmer organisations or cooperatives (Maspaitella et al., 2018).

The competitiveness of smallholder African indigenous vegetable growers in high-value agro-food chains was examined by Ngenoh et al. (2019) in Kenya using a multivariate probit model. Researchers found that farmers' access to knowledge, farm location, soil fertility, and irrigation practices were significant determinants of their success in high-value marketplaces. Certification, according to the study's authors, might boost farmers' engagement in the market, particularly in situations when they are part of organisations or have access to extension services, which raise the chances of certification.

What motivates smallholder farmers in Southern Ghana to take part in mango marketplaces that fetch high prices was the subject of Akrong, Mbogoh, and Irungu's (2021) research. Using the triple hurdle model, they found that criteria including certification, income, education, trust, credit accessibility, tricycle ownership, farming experience, and motorised vehicle ownership were the most important in determining market participation. Export market participation was also affected by factors such as family size, income, agricultural experience, distance to paved highways, and price.

Agricultural families' decision-making processes about market involvement have frequently been explained using the double-hurdle and Heckman two-stage models. Factors such as road distance, tree count, group participation, income, access to training and extension services, and market intelligence impacted marketing channel choices, according to Muthini et al. (2017), who used the double-hurdle model to analyse the topic. Among the

factors that affected involvement in export markets, only group membership stood out. Similarly, Musara et al. (2018) used the double-hurdle model to evaluate the preferences of small-scale sorghum farmers in semi-arid Zimbabwe regarding market involvement and channels. According to their research, farmers' marketing choices were influenced by factors such as sorghum market prices, market distance, dependence ratios, family income, and the quantity of customers at the market.

The Heckman two-stage selection model was used by Kyaw et al. (2018) to examine the factors that influence farmers' participation in rice markets. The researchers found that age, education, household size, income, road access, distance to the market, extension services, livestock ownership, rice production, rice prices, farmer organisation membership, and market information were important factors. It is possible that the double-hurdle model won't work when farmers have to make decisions that are more involved and involve three separate processes before they can reach the market. Because of this, the triple-hurdle model was developed to illustrate this procedure more accurately. To determine how transaction costs affected smallholder cassava farmers' market involvement in central Madagascar, Okoye et al. (2016) used the triple-hurdle model. Participation in the market was favourably impacted by characteristics including group membership, local residency, road infrastructure, and agricultural experience, according to their findings. Market involvement was adversely affected by age, distance from the farm to the market, and distance to the closest town, on the other hand. Another factor that contributed to the choice to sell cassava off-farm was the availability of transportation and marketing competence. The distances to the

market or the closest town were too far, and the transportation expenses were too expensive, to encourage sales outside the farm. Greater distances and high transportation costs reduced the amount of cassava sold, but personal mobility, excellent road conditions, and marketing skills boosted it.

Effects of inland rice valley production on farmers

Ex-post evaluations of projects are rare or not easily accessible, leading to a scarcity of empirical data on the impacts of Inland Valley (IV) facilities despite the large number of such initiatives (Metzger & Günther, 2015). Recent program evaluations in the Sudanian zone of West Africa, specifically in Mali, Burkina Faso, and Guinea, have shown mixed results. Katic et al. (2013) conducted ex-post cost-benefit analyses on the Initiatives Intégrées pour la Croissance Économique au Mali (IICEM) and the Programme d'Aménagement des Bas-Fonds du Sud-Ouest (PABSO) in Burkina Faso. Their focus was on estimating the financial benefits resulting from improved agricultural output due to water management infrastructure development. They found positive outcomes in most areas, with Mali having an average economic internal rate of return (IRR) of 58% and Burkina Faso 8%. The IRR is the point where the net present value (NPV) of all the project's positive and negative cash flows equals zero, according to Francis et al. (2005). Factors such as increased yields in rice and high-value vegetable crops during the dry season were the main contributors to profitability. However, these evaluations were limited to four locations and conducted a few years after project completion. They were based on long-term projections of cash flows, assuming that returns would be sustained and infrastructure would be adequately maintained.

Despite its importance in diets, West African countries have not yet achieved rice self-sufficiency (Van Oort et al., 2015; Sers & Mughal, 2020; Soullier et al., 2020). To meet the gap between domestic rice demand and supply, these nations rely on imports (Mendez del Villar & Lançon, 2015). In recent years, many have launched National Rice Development Strategies (NRDS) to boost Inland Valley rice production (Soullier et al., 2020). However, average rice yields remain below 2 tonnes per hectare, far from the potential output of around 6.5 tonnes per hectare in rainfed lowland rice farming (Saito et al., 2015; Niang et al., 2017).

Inland valleys also provide a wide range of marketable and non-marketable products, known as ecosystem services (ES), which benefit local populations. According to the Millennium Ecosystem Assessment (MEA, 2005), these services include provisioning, regulating, cultural, and supporting ES. Food production is a key provisioning service provided by IVs. Increasing food production in IVs can improve food security for smallholder farmers in West Africa (Alemayehu et al., 2022).

Huat et al. (2020) assessed the effects of IV development on agricultural, hydrological, and socio-economic performance. They found that the development of inland valleys contributed to agricultural expansion, improved farmer incomes, and increased investment potential. Given their natural high production capacity, inland valleys have long been used for crop farming (Rodenburg, 2014). According to Saito et al. (2013), the functioning of inland valley ecosystems—supporting various socio-economic functions—is shaped by interactions between climate, soil types, and hydrology. These interactions determine the crop production potential of IVs (Bontemps &

Toussile, 2013). As a result, the agricultural use of inland valleys significantly impacts the livelihoods of rural households, contributing to both consumption and cash income (Dossou-yovo et al., 2017).

Chapter Summary

The study-related literature on inland valley production was reviewed in this chapter. The conceptual, theoretical and empirical reviews made up its primary divisions. The integrated rice assessment yield gap and management framework and the sustainable livelihood framework formed the underpinning of the theoretical framework. They showed a knowledge gap in assessing the impacts of the inland valley rice production after the execution of the project. There were similarities and variations between the reviewed works and other essential comments. These reviewed works would be extremely useful to the thesis since they would allow the researcher to determine whether the thesis conclusions aligned with the results of the literature reviewed and any necessary discussions.

CHAPTER THREE

METHODOLOGY

Research Philosophy

"A collection of shared views, values, and practices among members of a scientific community that acts as a guide for selecting the sorts of research challenges scientists should address and the types of investigations they are willing to undertake" is the definition of research philosophy (Boateng, 2014). Finding philosophical concepts in research is quite essential. Although it is mostly hidden, it might have an impact on research.

The pragmatic philosophy was used in the study. Pragmatism avoids discussing challenging philosophical ideas like truth and reality as a research paradigm. Furthermore, it acknowledges that there could be one or many realities that can be experimentally studied (Creswell & Clark, 2011). Real-world issues are the main emphasis of the pragmatic philosophy. It makes it possible to use a variety of procedures and data-gathering techniques in a study. Pragmatism urges scholars to focus on the two inquiry techniques rather than classifying post-positivism and constructivism as two different ontological and epistemological perspectives (Morgan, 2014).

Research approach

A mixed research methodology was used to achieve the goals of this study since it enabled the researcher to blend qualitative and quantitative research methods in a single study (Creswell & Clark, 2011). According to Creswell (2012), a mixed research design is utilised when a researcher wishes to gain a better knowledge of the specified topic. He also mentioned the fundamental presumption for choosing such a research design. In this instance,

one research method's strength balances another flaw. This is because both procedures helped the researcher crosscheck the data he acquired from the field, using both increased the degree of validity and dependability of the data. As a result, a mixed-method analysis provided results that converged or contradicted each other. According to Bryman (2008), a mutual confirmation from both approaches indicates a higher degree of authenticity because there is a significant decline in business, information loss, or insufficient information.

A schedule of interviews with farmers and other project stakeholders from the Shama District's Inland Valley Rice Project was used to collect the study's qualitative data. Participants discussed the present status of the project, its effects on rice production, and the effects on participants' livelihoods of participating in the initiative.

The quantitative data for this study was collected using a questionnaire. This allowed for collecting data on the demographics of farmers engaged in the projects, the impacts on crop yield, and their livelihood. The output of this data allowed the researcher the opportunity to examine the IVRD project, the challenges facing the project, and its livelihood implications for participants.

Research Design

A study's plan or design used to gather and analyse data is the research design. According to Adam and Kamuzora (2008), a research design is a thorough work plan that directs a research study to achieve the stated objectives of the research. Descriptive research was used to achieve the study's goals because it is designed to provide an accurate account and a deeper understanding of the impact of the Inland Valley Rice Development Project. A

descriptive study design is a form of research that involves observing and describing a subject's behaviour without interfering.

Study Area

The Shama District was carved out from the former Shama Ahanta East Metropolitan Assembly of the western region in February 2008(Figure 4). It has 67 settlements with a total land area of 199.5 sq. km and 117,224 people. Of the total population, 59,000 representing 54%, are in the active labour force and are primarily into fishing and farming. The research was conducted in the Shama District of the western region of Ghana. The district lies within the low-lying areas of the country with elevations in most parts less than 80 metres above sea level with a generally undulating landscape. The primary economic activities of the indigenes are fishing and growing crops such as oil palm, maize, sugar cane, cassava, sweet potato, coconut, and rice, which are readily supported by the climatic conditions, which are two rainfall regimes.

The study areas were Anto-Aboso and Asemasa in the Shama District. These two areas were chosen because the Inland Valley Rice Development Project is heavily predominant in these areas (Shama District Rice Growers Association Records, 2022).

The climatic profile of the Shama District is influenced by its geographical location along the Gulf of Guinea. The district experiences a tropical climate with high temperatures and significant yearly rainfall. The region typically undergoes two distinct seasons - a wet season and a dry season. The wet season spans from April to October and sees substantial precipitation, fostering lush vegetation and supporting agricultural activities.

From November to March, the dry season is marked by reduced rainfall and higher temperatures. The proximity to the coast contributes to the moderating influence of the Atlantic Ocean, preventing extreme temperature variations. The coastal influence also results in elevated humidity levels, particularly during the wet season. These climatic conditions create a conducive environment for cultivating various crops, including rice, which is a significant component of the agricultural activities in the region.

The edaphic characteristics, or soil properties, of the Shama District, significantly impact the types of crops that can be cultivated successfully. The district exhibits a diversity of soil types, ranging from coastal sands to fertile alluvial soils along riverbanks. The coastal sands, although well-draining, may pose challenges for certain crops due to lower nutrient retention capacities. On the other hand, the alluvial soils are generally fertile and suitable for a wide range of crops. These soils benefit from periodic flooding along riverbanks, replenishing nutrients and enhancing soil fertility. Rivers and water bodies in the district contribute to water availability for irrigation, particularly during the dry season, facilitating year-round agricultural activities. Farmers in the Shama District often cultivate crops such as rice, maize, cassava, and oil palm, taking advantage of the diverse soil types to optimize agricultural productivity. Additionally, the district's edaphic characteristics are crucial in supporting vegetation cover and biodiversity. The Shama District in the Western Region of Ghana experiences a tropical climate with distinct wet and dry seasons influenced by its coastal proximity. The diverse edaphic characteristics, encompassing coastal sands and fertile alluvial soils, contribute to the region's

agricultural potential, making it an integral part of Ghana's agricultural landscape.

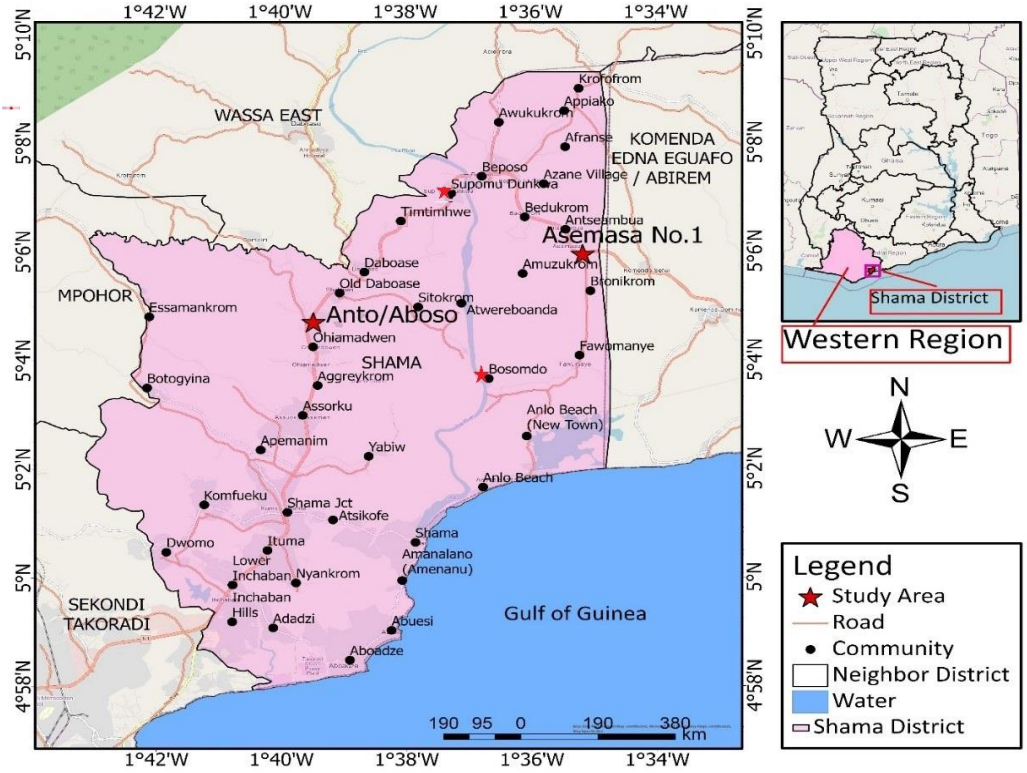

Figure 4: Map of Shama District

Population

A target population is a group of individuals or organisations with characteristics that interest researchers in a particular study (Asiamah et al., 2017). A well-defined target population is significant because it helps others assess the sample's reliability, sampling technique(s), and study findings (Asiamah et al., 2017). The target population were the farmers and stakeholders involved in the Inland Valley Rice Development Project in the Shama District. The stakeholders included the Ministry of Food and Agriculture District Director, the President of the Shama District Rice Growers Association, and Agricultural Extension Officers from the Ministry of Food and Agriculture. Based on the Shama District Rice Growers

Association records (2022), the total population of rice farmers engaged in the Inland Valley Rice Development Project in the district were 150 farmers (Shama District Rice Growers Association records, 2022). Moreover, the target population also involved 25 farmers who owned the land where the inland valley rice project was taking place.

Sample size

The sample size for this study was 185. The sample comprised 150 farmers from the Shama District Rice Growers Association, 25 farmers who owned the land, (initial farmers) and 10 key informants. The choice of selecting all 150 farmers for interview from the Shama District Rice Growers Association provided intensive and in-depth information on inland valley production and the livelihood outcomes before and after the project execution. In addition, due to the small number of farmers in the Shama District Rice Growers Association, conclusions were more accurate and reliable when every farmer was taken into account and interviewed. In addition, the 25 farmers who owned the land (initial farmers) were selected because they had in-depth knowledge of the land ownership regulation and could give in-depth information about the land access and ownership dynamics before and after the execution of the Inland Valley Rice Project. Furthermore, the ten key informants were selected because of their expertise in the inland valley rice project.

Sampling procedure or technique

The census sampling method, as well as the purposive and snowballing sampling methods, were used to select the interviewees for the study.

Census sampling

A census method is a sampling process where all population members are analysed. This method was used because it provided intensive and in-depth information covering many facets of the Inland Valley rice project. The census sampling method was used in selecting and interviewing all 150 farmers of the Shama District Rice Growers Association.

Purposive Sampling

The purposive sampling method helps select those with much knowledge about the research (Neuman et al., 2011). The purposive sample technique identifies key informants involved in the Inland Valley Rice Development Project from the Shama District. The stakeholders or key informants were selected based on the following criteria.

i. Knowledge and experience in the Inland Valley Rice Development Project,
ii. Role/Position in the Shama district, and
iii. Involvement in the Inland Valley Rice Development Project.

The following Ten (10) key informants or stakeholders were selected for the in-depth interview

a. The Ministry of Food and Agriculture District Director.
b. Agro-chemical seller
c. The President of the Shama District Rice Growers Association.
d. Two owners of rice mills
e. One Agric Extension Officers
f. Two land owners
g. Two people engaged in buying and selling rice

Snowball sampling

This method is commonly used when samples with the target characteristics are not easily accessible. With this technique, existing subjects were asked to nominate subjects they knew, increasing the sample size. The snowball sampling technique was used in selecting and interviewing the 25 farmers who initially farmed the land where the Inland Valley Rice Production Project took place.

Source of Data

The data used in this study were collected from both primary and secondary sources. The primary data sources were obtained from the questionnaires, interviews, and the observation checklist. The secondary data sources were obtained from journals, thesis, newspapers, dissertations, and others.

Data collection and instrument

Questionnaires and in-depth interviews (IDIs) were designed to collect primary data from the field in keeping with the study's underlying philosophy of pragmatism. These two primary data collection instruments were used because it was widely acknowledged that questionnaires and IDIs were some of the most effective means of primary data collection when information should come directly from people who are actively involved and aware of the issues under investigation (Patton, 2002).

Questionnaire

The sampled respondents were given a questionnaire to fill out. The questionnaires were created cohesively based on the study objectives. The questionnaire had two sorts of questions: closed and open-ended. There

were three sections to the questionnaire. The sociodemographic features of respondents, such as sex, age, level of education, and other factors, were the emphasis of Section A. Section B focused on factors affecting farmers' access to land. Section C also focused on the physical market accessibility of farmers engaged in the project. The instrument also assesses the impact of Inland Valley Rice Production efficiency on rice yield, area cultivation, and crop cycle in section C, and section D focuses on the livelihood impacts of the project participants.

In-Depth Interview (IDI) Guide

Ten (10) key informants were subjected to in-depth interviews. These key individuals were chosen based on their experience level and role in the Inland Valley Rice Development Project in the Shama District. There were two portions to the IDI guide. Section A asked respondents about their backgrounds, while Section B asked about the state of the projects, the impacts on rice production, and the livelihood impacts associated with the project

Observation Checklist

A field observation checklist was used to check the rice yield, rice type, areas cultivated in the different communities, and the number of crop cycles.

Data Analysis

The questionnaires were coded and entered into the computer software for analysis using Microsoft Excel and SPSS (version 26). Descriptive analysis was performed to summarise data to describe the distribution of scores. The quantitative data from the questionnaire was analysed using SPSS version 25. The qualitative data obtained from the interviews was manually transcribed and analysed using Maxqda pro-2020. This was achieved through

the application of thematic analysis. In addition, the study employed a t-test as inferential statistics to compare differences in rice production efficiency in different locations against the Shama District.

Ethical Considerations

First, the University of Cape Coast Institutional Review Board's ethical permission was requested before the study was carried out. All participants were informed of the research's goal when permission was granted, guaranteeing that they had provided their informed consent. They were also informed that the study is just being done for academic purposes and that participation has no known dangers. A permission form was sent to participants so they may indicate their comprehension and desire to take part in the study. Confidentiality is a significant ethical problem that will be taken into account. Participants were assured that neither their personal information nor their names or identities would be used in the research. Finally, the study correctly cited all references and information sources.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

Introduction

This chapter presents the results and discussions of the data obtained from the field on the effects of the inland valley rice project on farmers in the Shama district. The discussions are based on the sociodemographic characteristics and the study's objectives.

Socioeconomic Characteristics of Respondents

This section provides information and discussions on the socioeconomic characteristics of the farmers surveyed farmers involved in the inland valley rice production in the Shama District. A total of 153 respondents were interviewed for the study, and their characteristics are presented in this section. It includes their age, educational level, income, marital status, and other characteristics. The information on the socioeconomics are presented in Table 1.

Table 1: Socioeconomic Characteristics of the Respondents

Variable	Category	Frequency (n=153)	Percentage
Gender	Male	112	73.2
	Female	41	26.8
Age	20 – 30	19	12.4
	31 – 41	42	27.5
	42 – 52	64	41.8
	53 – 63	28	18.3
Education Level	No Formal Education	28	18.3
	Basic/JHS	49	32.0
	Secondary	65	42.5
	Tertiary	11	7.2
Income	GH₵ 2000 – 3000	19	12.4
	GH₵ 3001 – 4000	41	26.8
	GH₵ 4001 – 5000	53	34.6

	GH₵ 5001 – 6000	33	21.6
	GH₵ 6001 – 7000	7	4.6
Household Size	≤ 3	47	30.7
	4 – 7	99	64.7
	8 – 11	6	3.9
	12 – 15	1	0.7
Household Size Age Group	Below 18 years	119	77.8
	Above 18 years	34	22.2

Source: Field Data (2023)

Gender of the Farmers

From table 1, the gender distribution of the respondents were mostly males. The data reveals that out of the 153 surveyed farmers, 73.2% were males, while 26.8% were females. This indicates that more male farmers are participating in the inland valley rice production in the Shama District than females. The finding that male farmers are more represented in the survey population aligns with a common trend observed in many agricultural contexts in Ghana (Bissah et al., 2022; Asante, 2023). Historically, women faced barriers to accessing productive resources, including land, credit, and technology, influencing their ability to participate in agricultural projects (Ankrah, Freeman & Afful, 2020).

Age of the Farmers

The breakdown of the farmers based on their age group and distribution for each category are presented in Table 1. Most farmers (41.8%) fall within the age range of 42 to 52. This suggests that middle-aged individuals are prominently participating in the project. Their involvement reflects their role as active contributors to the community's agricultural activities and household livelihood. Moreover, about 12.4% and 27.5% of the

respondents fall within the age range of 20 to 30 and 31 to 41, respectively. Furthermore, about 18.5% of the respondents were aged between 53 to 63. This Older adult's involvement indicates their experience and knowledge in agricultural practices and their engagement in farming activities (Elder, Robertson & Ardelt, 2020; Jin, Wang, He & Gong, 2017).

Education Level of Farmers

Education plays a vital role in shaping individuals' livelihoods and ability to engage effectively in agricultural activities. The education level of farmers can significantly influence their adoption of modern farming practices, understanding of market dynamics, and overall contribution to agricultural development (Issahaku & Abdulai, 2020). Table 1 presented the analysis of the education level distribution among the farmers participating in the inland valley rice project in the Shama District. The data reveals that 18.3% of the farmers have no formal education. Due to their limited literacy, these farmers might face challenges accessing and applying new technology and practices in the inland valley rice production (Norton & Alwang, 2020). Moreover, most farmers (81.7%) had formal education. These groups of farmers were observed to understand the agribusiness concepts better and were open to learning and adopting improved agricultural methods (Wongnaa & Awunyo-Victor, 2018).

Marital Status of Farmers

Figure 5 provides data on the marital status distribution of the farmers. Most of the farmers (78.4%) were married. The remaining 21.6% were single. The high proportion of married farmers underscores the likelihood of household-based agricultural engagement, potentially influencing resource

allocation and distribution (Kinkingninhoun et al., 2020; Muggaga et al., 2022).

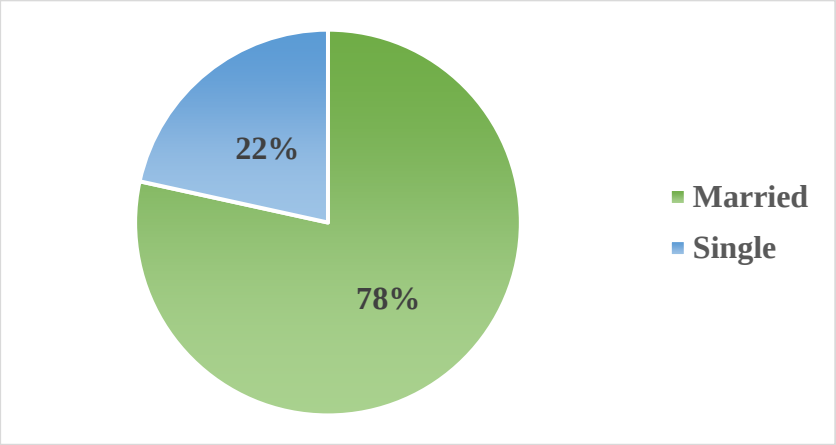

Figure 5. Marital Status Distribution of Farmers
Source: Field Data (2023)

Years Spent in Rice Farming

The findings presented in Table 2, which detail the distribution of farmers based on the number of years they have spent farming, have significant implications for the inland valley rice production. The distribution of farmers across different categories of farming experience provides insights into the level of expertise and potential variations in agricultural practices within the context of the Inland Valley rice project. Studies often highlight the importance of farmers' experience and its impact on productivity, innovation adoption, and sustainable practices (Danso-Abbeam, Ehiakpor & Aidoo, 2018; Nakano, Tsusaka, Aida & Pede, 2018).

Table 2: Years Spent in Farming

	Years		Gender		Total
			Female	Male	
Farming Years	≤ 5	Count	13	29	42
		% Within	31.0%	69.0%	100.0%
	6 – 10	Count	28	69	97
		% Within	28.9%	71.1%	100.0%
	11 -15	Count	0	14	14
		% Within	0.0%	100.0%	100.0%
Total		Count	41	112	153
		% Within	26.8%	73.2%	100.0%

Source: Field Data (2023)

Table 2 further reveals individuals based on gender and the number of farming years spent within specific intervals. This data suggests a noticeable gender disparity in the farming population. Within the 0-5 years of farming category are 13 females and 29 males, with males representing a substantial 69% of this group. In the 6-10 years of farming category, the gender distribution remains skewed, with 28.9% females and 71.1% males. However, it is fascinating to note that in the 11-15 years of farming category; all 14 individuals are male, signifying that as individuals gain more farming experience, it tends to be predominantly male. This finding aligns with studies highlighting gender imbalances in agriculture (Obayelu, Ogbe & Edewor, 2020; Nyasimi & Huyer, 2017). It reflects the common trend where men are often more engaged in farming activities, especially as the years of experience increase. This finding shows the importance of addressing gender disparities in agriculture and supporting female farmers to ensure equal opportunities and outcomes in the inland valley rice production.

Income of Farmers

The economic well-being of farmers is a critical aspect of agricultural development, directly impacting their livelihoods and the success of farming

projects (Bellon, Kotu, Azzarri & Caracciolo, 2020). This analysis delves into the income distribution of farmers after the harvesting season, as presented in Table 1. The table categorises farmers' income into different ranges, providing insights into the financial outcomes of the inland valley rice project in the Shama District. About 12.4% of farmers fall within GH₵ 2000 – 3000 income range. These farmers represent a segment with relatively lower income after the harvesting season, which might be influenced by various factors, including yields, market prices, and post-harvest losses (Chegere, 2018).

Also, 26.8% of the farmers fall within the GH₵ 3001 – 4000 income range. This segment represents farmers with a moderate-income level, potentially reflecting the successful adoption of improved agricultural practices or favourable market conditions. About 34.6% of the farmers, indicating a substantial proportion of participants with income in GH₵ 4001 – 5000 range. This could indicate a positive outcome from the project, as many farmers can generate income within this bracket.

Furthermore, 21.6% of farmers fall within the GH₵ 5001 – 6000 income range. This group demonstrates a relatively higher income level, suggesting successful cultivation practices, efficient resource utilisation, and effective market engagement. The smallest group, comprising 4.6% of the farmers, falls within the GH₵ 6001 – 7000 income range. This could indicate a subset of farmers who have achieved a higher level of income, potentially due to favourable conditions, higher yields, or value addition (Van der Ploeg et al., 2019). The income distribution after the harvesting season directly relates to the project's effect on farmers' livelihood outcomes. The diversity in income levels reflects the heterogeneity of outcomes, which might be

attributed to variations in farming practices, market access, resource availability, and project interventions (Garbero & Jäckering, 2021; Kansiime, van Asten & Sneyers, 2018).

Household Size of Farmers

Table 1 provides the findings that shed light on the household sizes of the respondents as well as the age distribution within the household sizes. The distribution of farmers' household sizes reveals the composition of farming households of farmers involved in the study. Most farmers (64.7%) had a household size of between 4 and 7 people. The least (0.7%) of farmers had a household size of 12 to 15 people. Nevertheless, about 30.7% and 3.9% of farmers had households ≤ 3 people and 6 to 9 people, respectively.

Regarding the age distribution within the household sizes, about 77.8% of individuals below 18 years old resided within the farming household, while 22.2% of individuals above 18 years old were part of the farmer's household. The varying household sizes and age distribution could impact labour availability, resource management, and allocation of agriculture tasks. These findings align with Alidu et al. (2022) observations indicating that farmers in Ghana usually have larger household sizes, which serve as assets in the provision of farm labour.

Access to credit Facility

Access to credit facilities and ownership of bank accounts are crucial factors that significantly influence farmers' agricultural practices, investment capabilities, and overall financial stability. The findings in Table 3 indicate the access to credit facilities and ownership of bank accounts among the farmers. Most farmers (92.2%) had access to credit facilities and bank accounts, while

7.8% reported not having access to and owning bank accounts. The substantial proportion of farmers with access to credit facilities and bank accounts indicates a positive outcome of the Inland Valley rice project in enhancing financial empowerment (Agarwal, 2020). Out of the 92.2% who had access to credit facilities or bank accounts, the majority (66.7%) of the respondents were males compared to females (25.5%). Access to credit enables farmers to invest in their farms, buy farm inputs, and adopt technologies that improve productivity and income (Teye & Quarshie, 2022).

Table 3: Farmer's Access to Credit Facility and Ownership of Bank Accounts

			Gender		Total
			Female	Male	
Credit Facility and Bank Accounts	**No**	Count	2	10	12
		% Of Total	1.3%	6.5%	7.8%
	Yes	Count	39	102	141
		% Of Total	25.5%	66.7%	92.2%
Total		Count	41	112	153
		% Of Total	26.8%	73.2%	100.0 %

Source: Field Data (2022)

Moreover, the farmers who have access to bank accounts further indicated the institutions in which they own the bank account and have access to credit facilities. From Figure 6, most farmers (63%) indicated that they own bank accounts. They mentioned the Agricultural Development Bank and the Ghana Commercial Bank as the institutions that own accounts and get credit facilities to invest in their farms. In addition, 27% of the farmers indicated they own accounts at Credit Unions, and 10% indicated they own accounts and access credit facilities from Cooperative Unions in the Shama District.

These findings are consistent with literature that stresses the importance of access to credit for smallholder farmers (Guo, Liu, Liu, Chen & He, 2023; Appiah-Tumasi, Donkoh & Ansah, 2022; Balana & Oyeyemi, 2022). The ownership of bank accounts facilitates secure and efficient transactions, enabling farmers to manage their earnings and payments better. This diversification indicates that farmers are not solely reliant on mainstream banks but are also engaging with localised credit and cooperative systems. These findings highlight the project's success in offering a range of options that cater to the specific needs of different farmers, further contributing to the resilience and sustainability of their agricultural endeavours

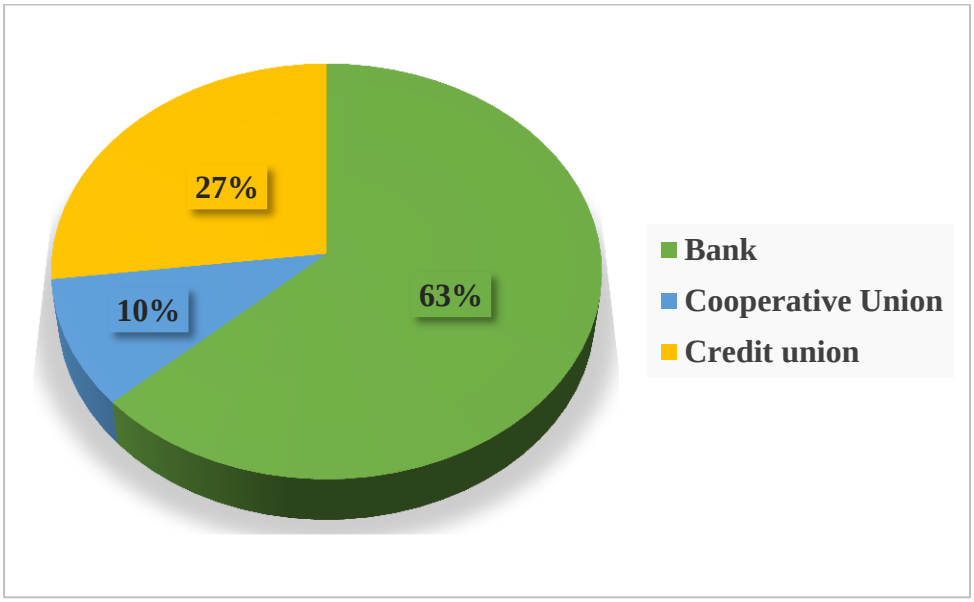

Figure 6: Type of Financial Institution
Source: Field Data (2023)

Engagement in Other Activities Aside from Farming

The findings presented in Table 4 shed light on the engagement of farmers in activities other than inland valley rice production, providing insights into the diversification of income sources. The data revealed that a significant proportion of the farmers (86.3%) engage in activities beyond farming, while a small portion (13.7%) solely focus on farming.

Among the respondents who engaged in other non-farming activities, 60.8% were males, while 25.5% were females. The respondents expressed their engagement in other economic activities, such as trading, driving, and trading, to supplement their income during the non-farming season. From Figure 7, most of the respondents were engaged in driving (39%), followed by plumbing (30%) and trading (31%). According to the leader of the landowner,

> *Most farmers engage in other activities besides farming during the non-planting seasons. I am a taxi driver, and most farmers have shops that provide additional income alongside rice farming.*

The findings align with studies that indicate that Ghanaian farmers' engagement in other activities contributes to their excellent financial stability (Jumpah, Adams & Ayeduvor, 2020; Yamba, Appiah, Pokuaa-Siaw & Asante, 2017). This enhances their capacity to invest in inland valley rice production, ensuring consistent input supply and better adoption of modern farming practices.

Table 4: Engagement in Other Activities Aside from Farming

			Gender		Total
			Female	Male	
Engagement in Other Economic Activities	**No**	Count	2	19	21
		% Of Total	1.3%	12.4%	13.7%
	Yes	Count	39	93	132
		% Of Total	25.5%	60.8%	86.3%
Total		Count	41	112	153
		% Of Total	26.8%	73.2%	100.0%

Source: Field Data (2023)

Ease of Access to Land by Farmers

In agricultural production, access to land is the bedrock upon which farmers' endeavours rest **(**Myeni et al., 2019). Within the context of the Shama District, where the practice of inland valley rice production holds prominence, the ease of access to land is a pivotal factor that shapes the viability and sustainability of farming activities. This section focuses on the objective one of the studies, which assessed the ease of access to land by farmers for inland valley rice production in the Shama District. The factors analysed in this section include the size of farmers' landholding and farm size, usage of the land ownership, means of access, and ownership agreement.

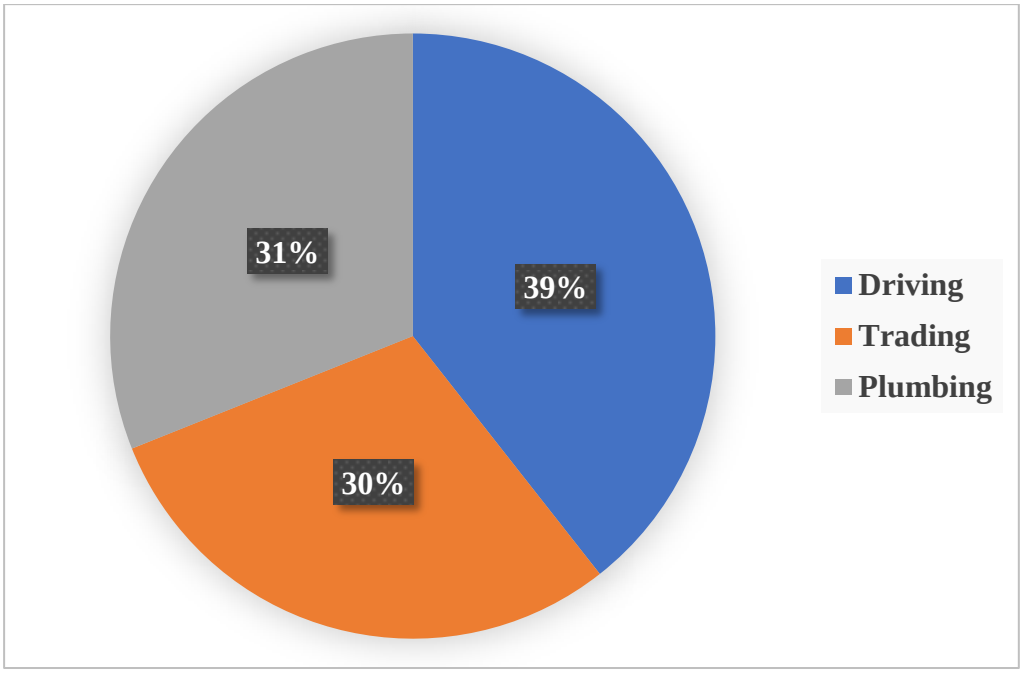

Figure 7: Other Economic Activities Aside from Farming
Source: Field Data (2023)

Land Holding of Farmers

Table 5 presents findings related to landholding and gender among inland valley rice farmers in Shama District. It offers insights into the distribution of landholding sizes among female and male farmers. A significant majority of the land is held by male farmers, as indicated by the

total percentage of land ownership (73.2%) compared to that of female farmers (26.8%). This disparity in land ownership aligns with broader trends in many agricultural communities, where men often have more access to and control over land resources (Leavens, Gugerty & Anderson, 2019; Maharjan et al., 2020).

Most farmers (51.6%) were found to have small landholdings (1-5 acres); female farmers account for 13.1% of this category, while male farmers represent 38.6%. These figures suggest that female farmers are underrepresented among smaller landholdings, potentially limiting their ability to engage in agricultural activities and generate income. Moreover, about 45.1% of the respondents indicated a land holding within the 6–10-acre category; female farmers comprise 12.4% of the total, while male farmers comprise 32.7%. The gender gap continues to be evident in this landholding size category. Female farmers are also underrepresented in terms of medium-sized landholdings. Lastly, in the largest category (11-15 acres, 3.3%), the gender gap is even more pronounced, with female farmers representing only 1.3% of this group, while male farmers account for 2.0%. This highlights the rarity of female ownership of larger parcels of land, which could limit their ability to expand their agricultural operations.

Table 5: Farmer's Land Holding and Gender Cross tabulation

	Acres		Gender		Total
			Female	Male	
Landholdings	**1 – 5**	Count	20	59	79
		% Of Total	13.1%	38.6%	51.6%
	6 – 10	Count	19	50	69
		% Of Total	12.4%	32.7%	45.1%
	11 – 15	Count	2	3	5
		% Of Total	1.3%	2.0%	3.3%
Total		Count	41	112	153
		% Of Total	26.8%	73.2%	100.0%

Source: Field Data (2023)

The findings indicate that male rice farmers in Shama District generally possess more extensive landholdings than their female counterparts, suggesting unequal access to and control over agricultural resources. Such disparities in land ownership have implications for female farmers' ability to engage in agriculture, generate income, and potentially exacerbate gender-based inequalities in the Shama District (Chigbu, 2019; Abubakar, 2021). These findings underline the importance of addressing these disparities through policies and interventions to promote gender equality and women's access to land and resources in agriculture.

Farm Size of Farmers

Table 6 provides insights into the distribution of farm sizes among female and male rice farmers in the Shama District. Most respondents reported having farm sizes ≤ 5 acres (79.1%), while 20.9% had farm sizes between 5 to 10 acres. The data further revealed a significant gender disparity in farm size. Male farmers in Shama District own and operate most of the land, with

73.2% of the total farms, while female farmers account for 26.8%. Among farms with size ≤ 5 acres, female farmers represent 22.9% of this category, while male farmers constitute 56.2%. These figures suggest that fewer female farmers in the Shama District operate small-sized farms, which may limit their agricultural productivity and income-generating potential (Pierotti, Friedson-Ridenour & Olayiwola, 2022).

Table 6: Farmland Size and Gender Cross tabulation

			Gender		Total
			Female	Male	
Farm Size	≤ 5 acres	Count	35	86	121
		% Of Total	22.9%	56.2%	79.1%
	6 – 10 acres	Count	6	26	32
		% Of Total	3.9%	17.0%	20.9%
Total		Count	41	112	153
		% Of Total	26.8%	73.2%	100.0%

Source: Field Data (2023)

In the 6– 10 acres category, female farmers comprise only 3.9% of the total, while male farmers account for 17.0%. The disparity persists in this medium-sized farm category, where female farmers are significantly underrepresented. These findings highlight gender-based inequalities in access to and control over agricultural land in the Shama District. Such disparities can have substantial implications for the livelihoods of female farmers. Limited access to larger farms may restrict their ability to engage in more diverse agricultural activities, generate higher incomes, and participate fully in decision-making processes within the agricultural sector (Zakaria, 2017).

Moreover, the fertility of the farmland also plays a vital role in cultivating the inland valley rice production. Figure 8 shows that most farmers (59%) rate their farmlands as fertile. About 1% rate their farmlands as moderate in fertility, while 40% rate their lands as fertile in supporting rice

production. This assessment suggests that most farmers can access fertile lands, significantly boosting rice yields and agricultural productivity (Hou et al., 2019). Such fertile lands require fewer soil amendments and may support sustainable rice farming practices (Bationo, Fening & Kwaw, 2018).

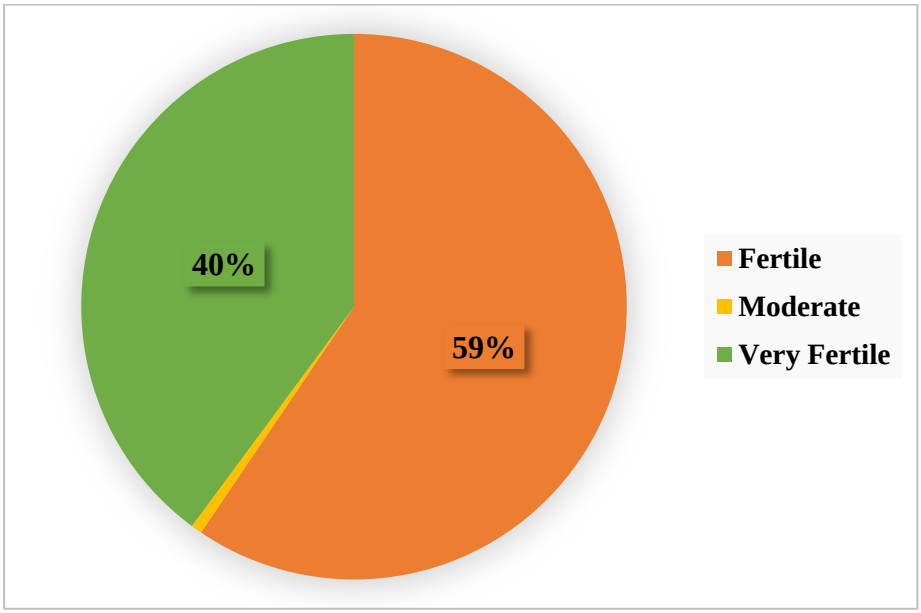

Figure 8: Fertility of Farmland
Source: Field Data (2023)

Land Access and Ownership

Land access and ownership are critical for farmers' crop production (Daudu et al., 2022). In the Shama District, where agriculture and rice production are the primary sources of occupation, access to land is essential to the livelihood of individuals in the district. From Table 7, farmers engaged in the inland valley rice production indicated their ownership of the land used in the project. Most Farmers (64.1%) indicated they do not own the land. They explain that they rent the land for the rice project. However, about 35.9% of the farmers indicated that they own the land they use for farming. The fact that most farmers do not own land and rely on renting signifies a potential challenge in terms of land-tenure security. This could lead to uncertainties and

limitations in long-term planning, investment and decision-making in inland valley rice production (Bambio & Agha, 2018). Moreover, the findings reveal an apparent gender disparity in farmland ownership. Male farmers in Shama District own most of the farmland, with 73.2% male ownership, while female farmers account for 26.8%.

Table 7: Land Ownership of Farmers

			Gender		Total
			Female	**Male**	
Ownership of Farmland	**No**	Count	22	76	98
		% Of Total	14.4%	49.7%	64.1%
	Yes	Count	19	36	55
		% Of Total	12.4%	23.5%	35.9%
Total		Count	41	112	153
		% Of Total	26.8%	73.2%	100.0%

Source: Field Data (2023)

Moreover, the farmers who did not own the land further expressed their relationship with landowners. From Figure 9, about 71% of the farmers indicated that they are unrelated to the landowners. About 12% and 17% of the farmers indicated they are related to them through tribal ties and family, respectively.

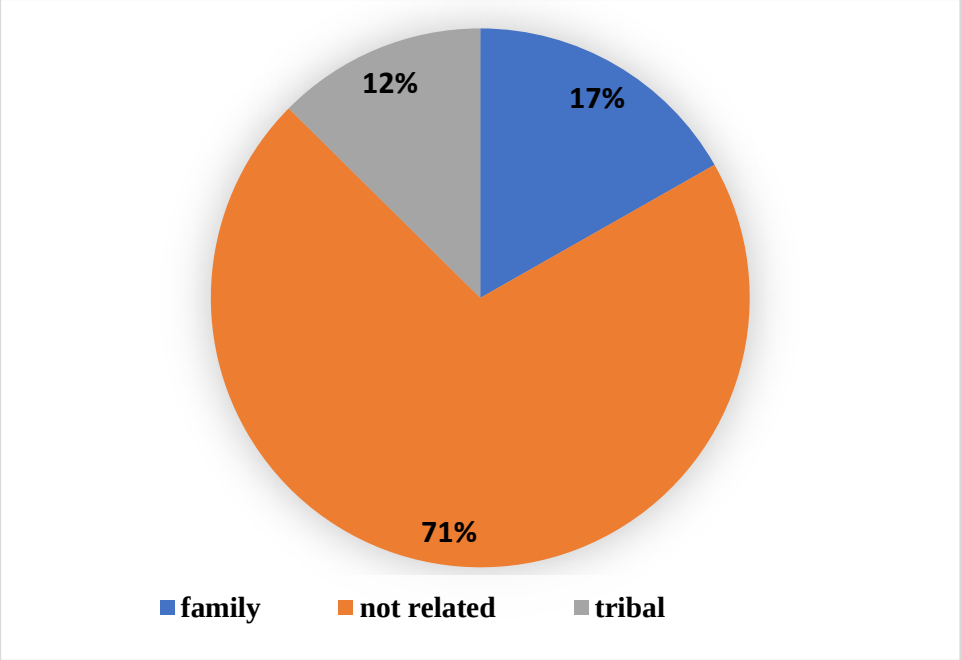

Figure 9. Relationship with Landowners
Source: Field Data (2023)

The fact that most farmers have no familiar or tribal ties with landowners suggests a transactional or rental-oriented relationship regarding land access for rice production (Jayne, Chamberlin, & Headey, 2014).

The findings from Figure 10 underscore the diverse mechanisms through which farmers in the Shama District access land for the rice project, highlighting the significance of social and familial relationships. Moreover, about 51% of farmers typically access land through relationships with the landowner's household, family, or clan, emphasising the importance of social networks and community ties in securing land for agricultural activities. According to a Male landowner,

> *Most of the land is given to family members in the community. I got the land I cultivated from my family. Giving land to family relations is easy because the person is known and can be trusted.*

This approach can foster trust, cooperation, and shared interests between landowners and farmers, potentially contributing to more stable and long-term land access arrangements (Keely et al., 2019).

However, the 31% who do not access land through such relationships may face different challenges related to land tenure, potentially requiring alternative strategies to secure land access (Yelsang, 2013). The 18% of respondents unsure about this access mechanism highlights the need for awareness and clarity regarding the land acquisition process. The community's multifaceted nature of land access is vital for project planning and policy development to ensure equitable and sustainable access to land resources for the Inland Valley rice project.

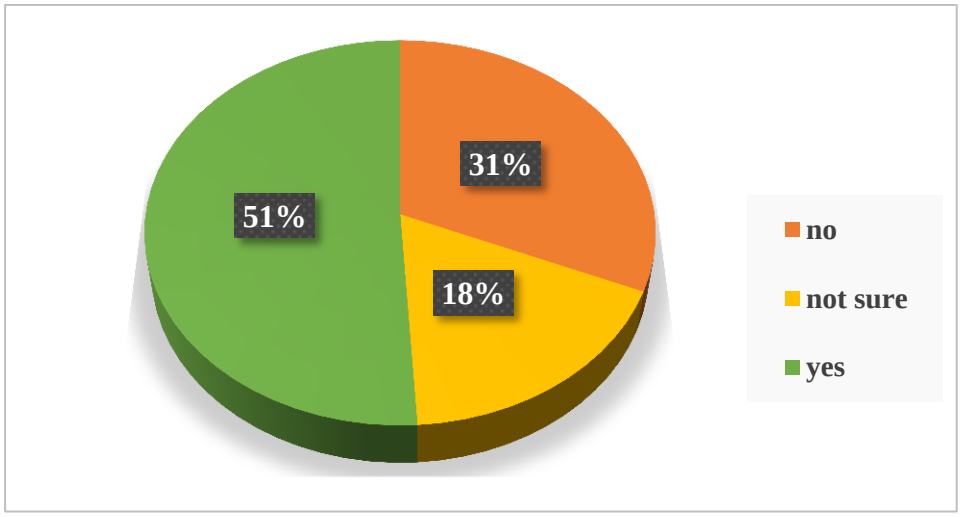

Figure 10: Access to land through family members and clan
Source: Field Data (2023)

It was further discovered that landowners in the district do not sell their lands to individuals for agriculture and other purposes. It was further discovered that farmers access to land through inheritance, renting and from friends. The findings in Figure 11 indicate that most farmers (62.7%) obtain land in the area through rent. The landowners usually rent the farms to people by agreeing

on crops to be given to the landowners per the cultivated land in the form of rent. According to a Male landowner,

> *Landowners usually rent land to farmers in the community. The terms of the rental agreement do not require the farmer to pay money but to share crops. The requirement involves the farmers paying some bags of rice to the landowner per the number of acres cultivated by the farmer as rent. For instance, farmers who rent land pay two bags of rice per acre (pole) of land cultivated per harvesting season.*

Further to the rental agreement, all the respondents indicated that title deeds and documents indicate that they have rented the land for cultivation. The landowner further confirmed this assertion, expressing that these documents and deeds help them prevent any misunderstanding arising from the rent of the land to farmers.

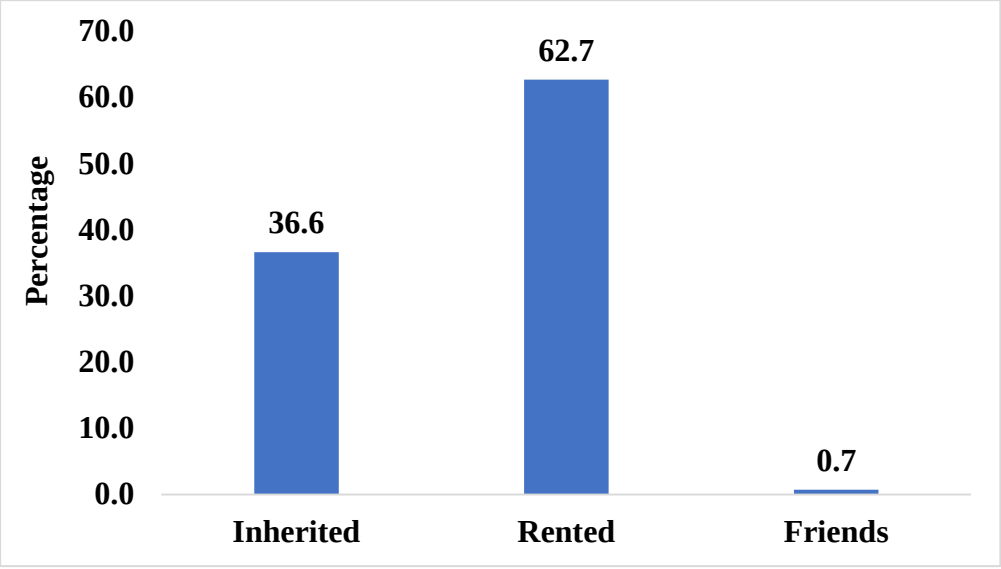

Figure 11: Ways of land access
Source: Field Data (2023)

Furthermore, about 36.6% of the respondents indicated they gain access to their farmlands through inheritance. A 45-year-old male farmer explained;

Most of the farms are inherited, including mine. I got it from my family, so I do not pay rent. However, I cannot sell the land since it is an inheritance, but I can only pass it on to my children and other relatives.

However, it was discovered that the lands the farmers inherited can be released to third parties for cultivation, as shown in Table 12. From Table 12, most farmers indicated that the inherited lands could be released to third-party farmers who want to cultivate the land, as indicated by the respondents.

From Table 8, about 36.6% of the respondents indicated that the inherited land can be released to third parties for farming. They further expressed that the land can only be released to third parties through rental agreements and sharecropping.

Table 8: Release of inherited land and conditions

Characteristic	Category	Frequency (153)	Percentage
Release of inherited	Yes	56	36.6
Land to Third Party	No	97	63.4

Source Field Data (2023)

However, most respondents (63.4%) indicated that these lands cannot be released to third parties. They expressed that this often leads to conflicts and misunderstandings since multiple family members may be interested in the same land. The Extension Officer confirmed these statements by stating:

It is difficult for farm owners who inherited lands in the district to pass on the farmland to third parties for farming. Often, issues arise when a family member wants to cultivate the land and feels entitled to the land because of family relations. This often causes tension and disputes among the farmers.

These findings align with Aswani, Albert and Love's (2017) observations that inherited land is closely tied to familial identity and heritage and allowing outsiders to access it may lead to land rights and ownership disputes. These findings highlight the complex and culturally sensitive nature of land tenure systems, especially in the context of inherited land. While some landowners are open to leasing their land to third parties, others prioritise preserving family cohesion and preventing potential conflicts.

Also, from Figure 10, about 0.7% of the farmers indicated that they acquired lands in the area through an introduction by friends who live in the community, which shows the influence of social networks in accessing land resources. The findings regarding land access mechanisms in the Shama District carry significant implications for the sustainability and dynamics of agricultural activities, particularly in the context of the inland valley rice project. The fact that landowners typically do not sell their land for agriculture suggests that land is a valuable and limited resource, and alternative arrangements like renting, inheritance, and referrals through friends play pivotal roles in securing access (Jayne, Chamberlin, & Headey, 2014; Grubbström & Eriksson, 2018). The prevalence of renting indicates that land access in the area is often facilitated through informal agreements, where farmers pay for a portion of their crops. According to Hirons et al. (2018), this system promotes shared interests between landowners and farmers and highlights the importance of clear rental agreements and documents in Ghana.

Furthermore, the findings in Table 13 highlight a significant gender disparity in access to land within the Shama District. Table 13 shows that most farmers (88.9%) indicated unequal access to land between males and females

in the Shama District. The primary reasons for this gender disparity are the community's traditional laws. The respondents further explained that the traditional laws put men ahead of women in terms of access to land, as males are considered heads of the family and inherit family resources. A female farmer commented;

> *It is hard to have access to farmland or inherit land as a female in the area. The traditional laws do not favour females owning land since men control the land in the area and give it to males rather than females. This results from the customary laws that lean more toward patrilineal inheritance in the district.*

Moreover, Table 9 demonstrated a notable gender disparity in land access in the Shama District. Among the female farmers, only 3.3% do not have access to land, while 23.5% have access to land. Among the male farmers, 7.8% do not have access to land and substantial access to land. The findings suggest that female farmers do not have equal access to land compared to males. This is generally due to land distribution policies, customs and economic constraints. These findings underscore the deep-rooted gender-based disparities in land ownership and access, which can have far-reaching implications for gender equality, agricultural productivity and overall community development (Yokying & Lambrecht, 2020; Quaye, Fuseini, Boadu & Asafu-Adjaye, 2019). Traditional laws and customs in Ghana often disadvantage women regarding land ownership and control, limiting their ability to engage in agriculture and secure their livelihood (Addaney et al., 2022; Baada, Baruah & Luginaah, 2019).

Table 9: Gender disparity in access to land

			Gender		Total
			Female	**Male**	
Unequal Access to Land	**No**	Count	5	12	17
		% Of Total	3.3%	7.8%	11.1%
	Yes	Count	36	100	136
		% Of Total	23.5%	65.4 %	88.9%
Total		Count	41	112	153
		% Of Total	26.8%	73.2 %	100.0 %

Source: Field Data (2023)

The findings in Figure 11 provide valuable insights into farmers' multifaceted challenges when acquiring land for inland valley rice production in the Shama District. These challenges encompass a range of factors, both social and traditional. The most commonly cited challenge is the high cost of land rental (42.5%). This highlights farmers' economic barriers, as exorbitant rental fees can significantly impact their ability to access and cultivate land for rice production (Gyapong, 2021; Yaro, Teye & Torvikey, 2017). Moreover, family and social dynamics play a role in land acquisition challenges, as indicated by 28.1% of respondents. These factors might involve traditional laws and customs, disputes, conflicts, or competition for land within families or communities, hindering access to suitable farmland (Collins & Mitchell, 2018).

Poverty is another significant hurdle (Figure 12), as 15% of respondents attribute their land acquisition challenges to financial limitations. Insufficient resources can prevent farmers from securing land, even when it is available for rent or purchase. Some farmers face challenges related to tenancy agreements (10.5%), which may involve complex terms or unfavourable

conditions. These agreements can deter farmers from pursuing land access. The presence of cronyism (favouring specific individuals or groups from tribes in land allocation) is noted by 3.9% of respondents. This practice can result in unequal opportunities for land access, disadvantaging specific segments of the residents in the Shama District (Shonhe, Scoones & Murimbarimba, 2020).

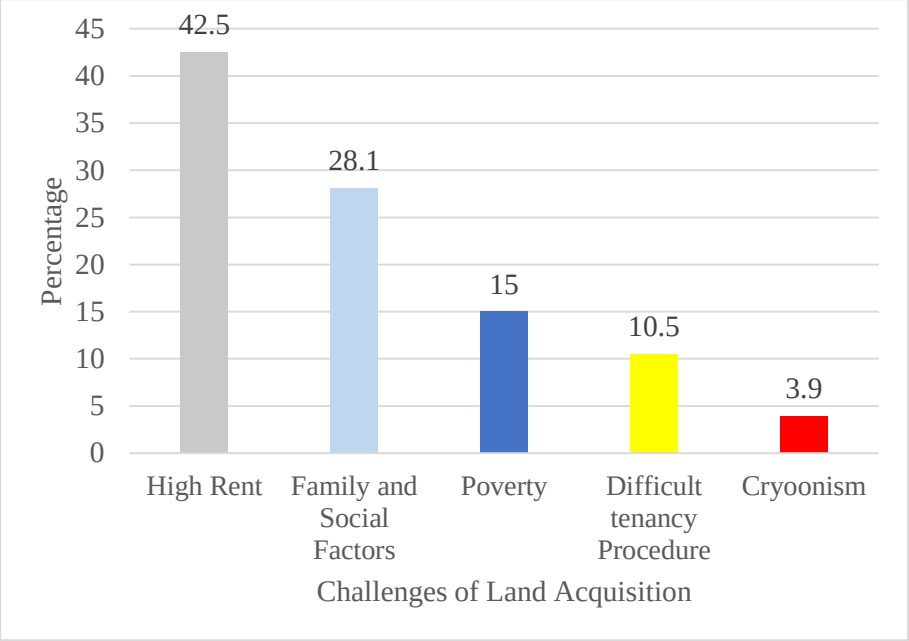

Figure 12: Challenges of land acquisition in Shama District
Source: Field Data (2023)

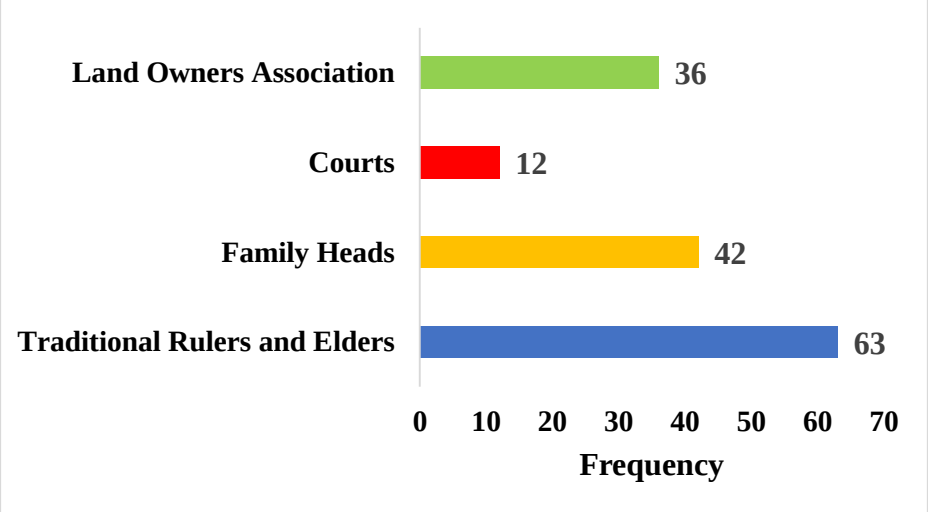

Figure 13: Channels for Addressing Land Ownership Problems
Source: Field Data (2023)

The findings in Figure 13 illuminate the various avenues employed to address land ownership issues arising from land acquisition for inland valley rice production in the Shama District. These channels provide insight into the complex interplay of local governance, customary practices, and legal frameworks. Most respondents, constituting 63, trust traditional rulers and community elders to resolve land-related disputes. This reliance aligns with the cultural reverence for chiefs and elders as the guardians of the land, especially in cases where land ownership arrangements are informal (Lanz, Gerber & Haller, 2018). Their involvement often imparts a sense of legitimacy and community consensus to the dispute resolution process.

A significant segment of respondents, amounting to 42, highlight the pivotal role played by family heads in addressing land-related challenges. These issues typically revolve around land divisions and conflicting interests among family members concerning specific farming plots. Family heads assume the crucial responsibility of mediating these intra-family disputes. Approximately 36 respondents reference the Land Owners Association as a critical channel for addressing land ownership issues. This suggests the presence of organised groups or associations dedicated to handling land-related matters, likely focused on promoting equitable land access practices within the community. Moreover, about 12 respondents opted for formal legal mechanisms like the court to resolve land ownership problems. This indicates recognition of legal avenues as a recourse for dispute resolution, particularly in cases where customary practices or community-led resolutions prove insufficient (Asaaga, 2021).

These diverse channels underscore the coexistence of customary and formal approaches in tackling land-related challenges (Ibrahim, Abubakari, Akanbang & Kepe, 2022; Edwin, Glover & Glover, 2020). They emphasise the significance of local governance structures and traditions in mediating land disputes while acknowledging the role of formal legal mechanisms when necessary. Understanding and respecting these channels is pivotal for crafting interventions and policies that align with the community's existing dispute resolution mechanisms, ultimately fostering sustainable and harmonious land access for inland valley rice production in the Shama District.

Factors Influencing Market Accessibility of the Farmers in the Shama District

This section focused on objective two of the study, which examined the factors influencing market accessibility of the farmers in the Shama district. Analysis under this section includes distance to the market centre, mode of transportation, conditions on the road, market price and rice profitability.

Distance to Market and Transportation Factors

The accessibility of markets is a vital determinant of success for farmers, and it is profoundly influenced by the geographical aspect of "distance to market" and the means of transportation. In agricultural regions like the Shama District, the challenges related to the distance farmers must traverse to reach market centres and the modes of transportation available are pivotal factors shaping their market access. The findings in Table 10 provide a crucial insight into the distance to market and transportation factors that

influence the market accessibility for inland valley rice farmers in the Shama District.

Table 10 shows that most farmers (68.6%) do not have farms near the market centre. Gatare et al. (2015) observed this as a common challenge farmers face in many agricultural communities. Moreover, the findings also indicated that most farmers (70.6%) view the distance from the farms to the market centre as too long. These findings indicate that the distance to the market centre significantly impedes the farmers' ability to access the market promptly, affecting the efficient transportation and marketing of the rice produce (Okoye et al., 2016). This challenge aligns with a common issue in rural agricultural settings, where remote farm locations can lead to increased transportation costs, delays in getting products to market, and potential quality degradation of perishable goods like rice (Fliehr, Zimmer & Smith, 2019).

The findings regarding the transportation used by farmers in the Shama District reveal various methods to transport the rice produce. Notably, tricycles (43.2%) emerge as the most common mode of transportation, indicating their adaptability to rural road conditions and suitability for carrying agricultural goods. Taxis (23.5%) also play a significant role, providing farmers with a relatively faster mode of transport. Additionally, the use of trucks (26.8%) suggests that larger quantities of produce are being transported, potentially reflecting the scale of rice production in the region. Head porterage (6.5%) highlights the resourcefulness of some farmers who may not have access to motorised transportation. These findings align with the Morgan, Dogbey, Arimeyaw and Owusu (2019) observations that farmers in Ghana

often transport farm produce to market through head porterage, truck, taxi and tricycle.

Table 10: Distance to Market and Transportation

Characteristic	Category	Frequency	Percentage
Farm closeness to Market Centre	Yes	48	31.4
	No	105	68.6
Distance	Long	108	70.6
	Short	45	29.4
Means of Transportation	Head Porterage	10	6.5
	Taxi	36	23.5
	Tricycle	66	43.2
	Truck	41	26.8
Nature of Road	Feeder Road	102	66.7
	Footpath	3	2.0
	Highway	45	29.4
	Urban Road	3	2.0
Nature of Road affect Transportation of Rice	Yes	148	96.7
	No	2	3.3
Condition of Road	Good	134	87.6
	Bad	19	12.4

Source: Field Data (2023)

Regarding the nature of the road, most of the roads used for transportation are feeder roads (66.7%), reflecting the region's rural nature. Highways (29.4%) are also relatively common, suggesting a link to more urbanised areas. Additionally, there are footpaths (2.0%) and urban roads (2.0%). Interestingly, almost all respondents (96.7%) acknowledge that the road's nature significantly affects the rice transportation from the farm. They further reported that the road condition is in good shape, as reported by 87.6%

of the respondents. The predominance of good road conditions is positive as it suggests that road quality is not a significant hindrance for most farmers.

However, the minority of farmers (12.4%) facing bad road conditions highlights an issue that needs to be addressed. They explained that the road is full of potholes and has no storm drains (waterlogged). These characteristics of the poor road nature align with the findings of Morgan, Dogbey, Arimeyaw and Owusu (2019) that highlight these as the dire conditions of roads leading to farms in agricultural communities. The farmers further indicated that the dire conditions of the road lead to increased transportation costs, delays and post-harvest losses of rice, a common phenomenon present in rural agricultural communities in Ghana (Morgan, Dogbey, Arimeyaw & Owusu, 2019).

Price, Information and Market Competition

The ability of farmers to access markets efficiently and profitably is a fundamental determinant of their economic success. Many factors influence this access; price, information, and market competition play pivotal roles. Understanding how these factors intersect and impact market accessibility for farmers is crucial for crafting effective strategies to enhance their livelihoods and contribute to sustainable agricultural development.

The findings in Table 11 collectively illuminate the intricate relationship between factors, including price dynamics, information dissemination mechanisms, and market competition, and their profound implications for farmers' market accessibility within the Shama District. Price exerts a significant influence, with an overwhelming 98.7% of respondents recognising its pivotal role in shaping market participation and rice production

decisions. The diverse range of prices for a bag of rice, from GH₵ 450 to GH₵ 700, underscores the variability in market rates, potentially affecting farmers' income and financial viability. Most respondents (39.9%) reported prices from GH₵ 450 to GH₵ 500 per bag. In comparison, 9.8% indicated prices between GH₵ 601 and GH₵ 650 per bag. These price categories reflect the different segments of the rice market, with some rice likely commanding premium prices while others are positioned as more affordable options. These findings align with the assertion by Musara et al. (2018) that price influences the market participation and crop production of farmers.

The findings in Table 11 regarding farmers' perceptions of the profitability of rice production at current market prices in the Shama District are reassuring. Despite the challenges of price variations and market competition, most farmers view rice production as profitable. This positive perception serves as a strong incentive for farmers to continue investing in rice farming, as it suggests that their efforts can yield satisfactory financial returns (Abdul-Rahaman & Abdulai, 2020; Bidzakin, J. K., Fialor, Awunyo-Vitor & Yahaya, 2019). Moreover, the long-term profitability perception, with 85.0% of respondents affirming the sustainability of rice farming as a viable livelihood option, underscores the resilience and potential of local rice agriculture. This positive outlook not only supports the economic well-being of individual farmers but also contributes to the overall food security and economic development of the Shama District by promoting a thriving and sustainable local rice industry.

Table 11: Price, information and market competition

Characteristic	Category	Frequency (153)	Percentage
I	Yes	151	98.7
	No	2	1.3
II	GH₵ 450 – 500	61	39.9
	GH₵501 – 550	18	11.8
	GH₵551 – 600	24	15.6
	GH₵601 – 650	15	9.8
	GH₵651 – 700	35	22.9
III	High	112	73.2
	Low	41	26.8
IV	Profitable	122	79.7
	Not Profitable	31	20.3
V	Yes	130	85.0
	No	23	15.0
VI	Yes	153	100
VII	Government	1	0.7
	Group	124	81.0
	Individuals	28	18.3
VIII	Yes	23	15.0
	No	130	85.0

Source: Field Data (2023)

Key:

I. Influence of the price of rice on market participation and rice production
II. The price of a bag of rice
III. The current market price of a bag of rice compared to imported rice
IV. Profitability of rice at current market price
V. Profitability of rice production over the years
VI. Availability of competition in the rice market in Shama District
VII. Control and determination of market price and information
VIII. The monopoly of the rice market

Nevertheless, it is notable that all respondents (100%) acknowledge the presence of competition in the Shama District rice market (Table 11). This high level of competition underscores the diversity of stakeholders involved in rice production and marketing within the district. Competition can be driven by various factors, including multiple players such as farmers' groups, individuals, and government agencies. The prevalence of competition is a positive sign as it can promote market efficiency, price competitiveness, and product quality (Bergquist, 2017).

Furthermore, most respondents (81.0%) indicate that groups primarily control and determine market prices and information (see Table 11). This suggests that collective efforts and organisations are central to shaping market dynamics and disseminating crucial information to farmers (Maspaitella et al., 2018). Group control of market factors can enhance farmers' bargaining power and contribute to fair pricing practices. However, the role of government (0.7%) and individual control (18.3%) should not be overlooked, as they can also influence market dynamics and information dissemination.

Lastly, a minority of respondents (15.0%) perceive a monopoly in the Shama District rice market. This perception raises questions about market fairness, pricing transparency, and equitable access for all rice producers. If a monopoly exists, it may restrict market access and limit opportunities for smaller farmers and producers (Farm, 2017). Addressing concerns related to market monopolies is essential for fostering a competitive and inclusive rice market that benefits all stakeholders.

Figure 14 shows that the factors contributing to the higher price of the locally produced rice in the Shama district compared to the imported rice

range from input, labour, rental and service costs. It was revealed that most farmers cited high input cost as the main factor contributing to the high cost of rice bags ranging from GH₵ 450 to GH₵ 700. About 27% of the farmers indicated high rental costs, while 17% indicated high costs of other services rendered to the farmers. Also, 7% of the farmers indicated the high cost of labour. According to the Agric Extension Officer, input, labour, services and rental costs are the determining price of rice in the Shama District, and the high prices of these factors often transfer into the cost of the rice, making it costly for consumers, which often leads to consumers preferring imported rice due to the price.

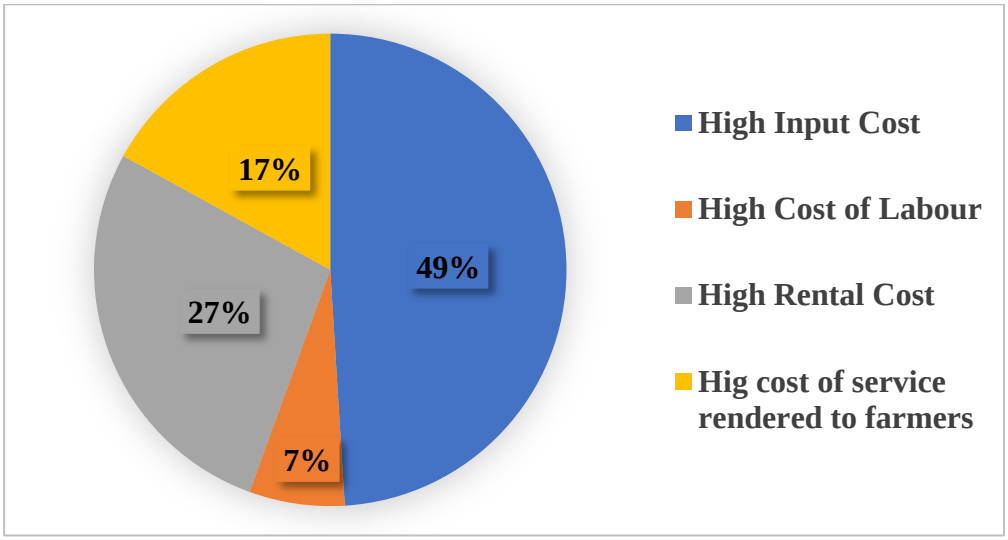

Figure 14. Factors contributing to the higher prices of local rice varieties compared to imported rice
Source: Field Data (2023)

Moreover, Figure 15 shows that the respondents indicated that input subsidies (47%), equipment support (30%), cooperative farming (13%) and Government support (10%) are some of the strategies that can be employed to make the local rice competitive with the imported rice. Respondents' suggestions, such as input subsidies, equipment support, cooperative farming, and government assistance, offer potential strategies to address the challenges

outlined in the previous findings. Input subsidies can help lower the production costs for local farmers, making their rice more affordable (Holden, 2019).

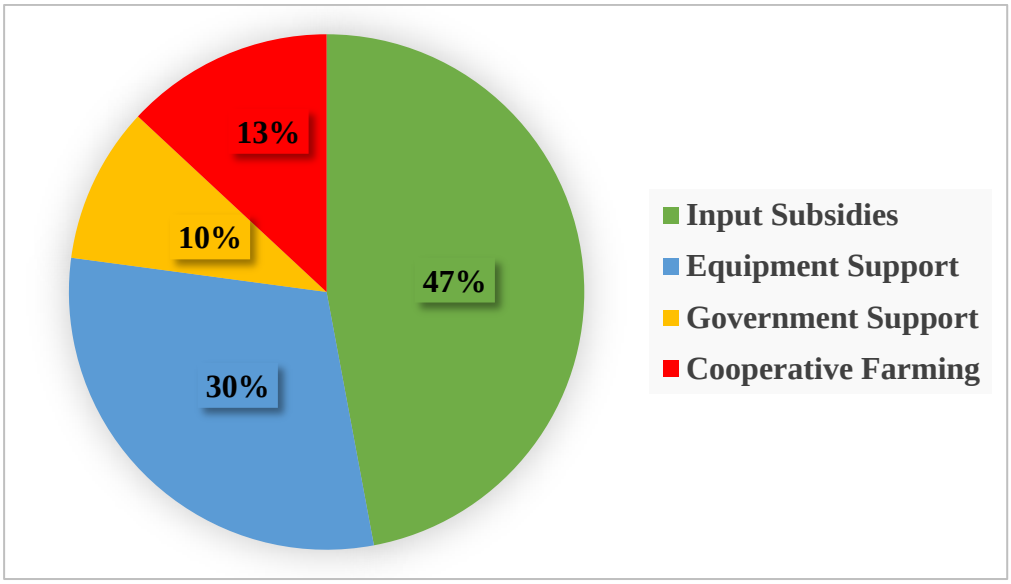

Figure 15. Strategies to make local rice competitive with imported rice
Source: Field Data (2023)

Equipment supports, such as tractors and combine harvesters, can enhance the efficiency of rice farming, potentially increasing yields and reducing labour costs. Cooperative farming can promote knowledge sharing and resource pooling among local farmers, further improving productivity. Through policies and investments, government support is crucial for creating an enabling environment for the local rice industry. These strategies have the potential to not only reduce the cost of locally produced rice but also strengthen the resilience and competitiveness of the local agricultural sector, ultimately benefitting both farmers and consumers (Alizamir, Iravani & Mamani, 2019; Bikkina, Turaga & Bhamoriya, 2018).

Efficiency of Inland Valley Rice Production in the Shana District

This section explored objective three of the study, which examined the efficiency of inland valley rice production in the Shama District. This section explores the production efficiency of rice production by examining the planting cycle, yields, varieties of rice cultivated, inputs and the supporting services available to the farmers. Rice yield per acre in bags in the production areas was used as a proxy to perform comparative analyses to assess the production efficiency between Shama District and other areas within the country (Figure 16).

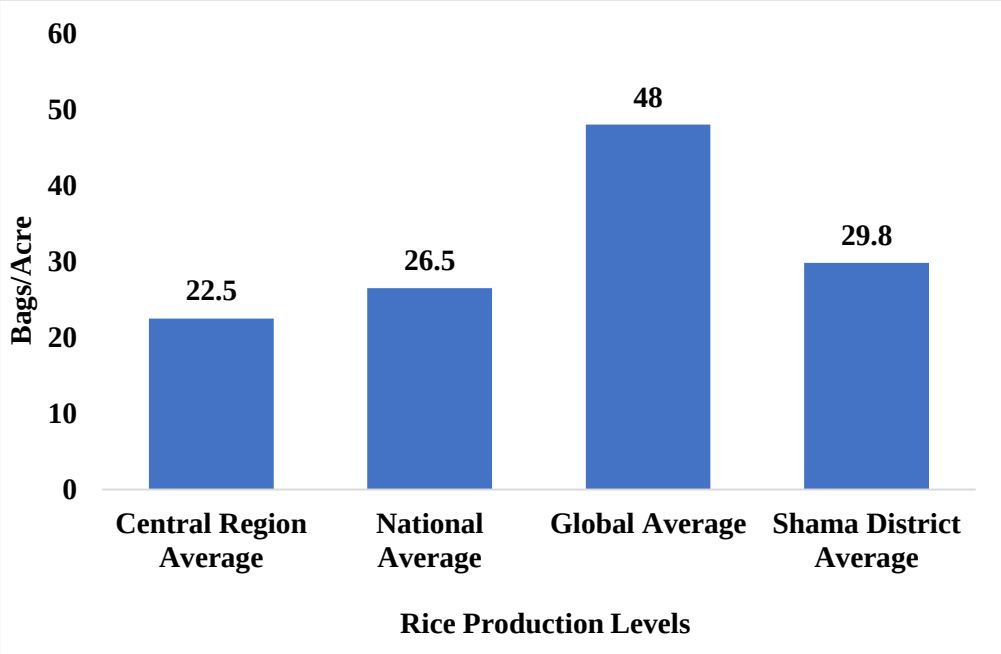

Figure 16: Comparison of rice production efficiency as a proxy of yields in bags per Acre
Source: Field Data (2023), IPAD (2023), Stagg (2022) and SRID (2022)

In this study, the average yield of rice recorded in the Shama District Inland Valley Rice Project site was 29.8 bags/Acre as compared to Central Region, National and Global average yields of 22.5 bags/Acre, 26.7 bags/Acre and 48 bags/Acre respectively. According to the Anang, Bäckman, and Sipiläinen (2016), Ghana's overall average rice yield is estimated at 2.5 tons

per hectare, equivalent to 29.41 bags per acre however it has reduced to 26.5 in 2023. The observed average yield of 29.8 bags per acre in the Shama District signifies a commendable achievement, surpassing not only the national average but also the regional averages of about 21 bags (Antwi, 2009). This success can be attributed to the specific initiatives and interventions implemented in the Shama District Inland Valley Rice Project site. The regional disparities highlighted in the literature, such as the Central Region's average yield of 22.5 bags per acre, further emphasize the need for localized strategies. The Shama District's outperformance suggests that the implemented approaches, related to farming techniques, seed varieties, or irrigation practices, have been particularly effective.

However, the Shama District site was more efficient as compared to both the Central Region and National production averages. In addition, the result indicates that production levels at the Shama District Inland Valley Rice Project site are below the Global rice production average per acre. Moreover, one sample inferential test statistic was conducted to strengthen the observed yield differences and to ascertain the level of significance between the Shama District, Central Region average; National average and Global average (Table 12). There were significant differences between Shama District and Central Region (t-test = 13.7; $P < 0.000$) and National (t-test = 5.95; $P < 0.000$) with Shama District registering the highest yield average per acre. This is an indication that rice production is more efficient at the Shama District Project site, but this cannot be compared with the Global average (t-test = -32.81; $P < 0.000$), which is on the highest side and more efficient. These findings align with previous research indicating regional variations in rice production

efficiency within Ghana (Addison, Ohene-Yankyera & Fredua-Antoh, 2016; Tasila Konja, Mabe & Alhassan, 2019). The literature, as discussed by Antwi (2009), emphasizes the impact of diverse factors on rice production within the country, calling for a tailored approach to address regional nuances and enhance overall efficiency. The success of the Shama District in outperforming both the Central Region and National averages substantiates the importance of such localized strategies

Table 12: One sample inferential statistics of rice production level of Shama District in Bags/Acre against other indicators (Central Region, National and Global Production levels of rice)

COMPARISON OF YIELDS IN BAGS/ACRE	T-TEST	DF	SIG(2-TAILED)
Shama District (29.8) Versus Central Region Average (22.5)	13.17	152	0.000
Shama District(29.8) Versus National Average (26.5)	5.95	152	0.000
Shama District(29.8) Versus Global Average(48)	-32.81	152	0.000

Planting Cycle and Rice Yield

The crop cycle, or the planting cycle, encompasses the stages the rice goes through from planting to harvest (Sander et al., 2017). The study revealed that the farmers have two and three crop cycles in the Shama District. Most farmers (98.7%) reported planting rice twice yearly, indicating a bimodal cropping pattern. According to the Agricultural Extension Officer,

> *Rice is often grown twice in the district. Farmers engage in both the rainy season and minor season rice cultivation. They usually plant them between April to July (Major season) and September to*

December (Minor season). Planting twice a year allows for higher yields and income for the farmers.

This agricultural practice aligns with the typical climate and agricultural calendar in the Shama district, where farmers take advantage of both seasons to maximise their rice production. In contrast, about 1.3% of the respondents mentioned that they plant rice three times a year. Aside from the two traditional planting cycles, these farmers indicated cultivating rice between January and March each year. This resulted from irrigational practices enabling them to cultivate the rice (He, Wang & Cui, 2020).

The findings from Tables 13 provide a comprehensive overview of the average rice yield per bag among farmers in the Shama District, shedding light on seasonal and yearly harvests. Regarding the seasonal rice harvest, the study revealed an average of 29.80 bags an acre a season, with most farmers (66.0%) achieving yields between 24 – 33 bags. According to MoFA (2022), the national average rice yield per acre is between 20 – 22 bags per acre a season per acre, this suggests that most rice farmers in the Shama district are achieving yields significantly above the national average (Agrolearner, 2023). These findings signify that a substantial portion of farmers in the district is achieving satisfactory seasonal yields, which can contribute to food security and income generation (Eyasmin, Ghosh & Adeleye, 2021).

Looking at the yearly rice harvest, a significant majority (83.7%) of farmers reported yields falling within 41 to 60 bags per year, with a mean of 52.16 bags per acre a year. This statistic is notable, as it not only indicates the stability of rice production in the region but also highlights that most of these farmers surpass the average national yield of 50 bags per acre, as reported by

the AGRA Content Hub for Ghana (2021). This suggests that the farmers in the Shama District are performing well above the country's average, which has positive implications for food security, income generation, and potentially even surplus production that can be marketed. It also shows the potential for knowledge sharing and dissemination of best practices among these inland valley farmers to further enhance agricultural productivity and sustainability in the region.

Moreover, a noteworthy finding is that 54.2% of farmers reported increasing yields, suggesting positive trends in rice production over time. This indicates that more than half of the surveyed farmers are experiencing improvements in their rice yields, possibly due to better farming practices, improved technology, or effective pest and disease management (Alemayehu et al., 2022; Wang et al., 2017).

However, 45.8% of farmers reported decreasing yields, signalling a concerning trend that requires attention and intervention. They attributed this to changes in water supply amount and frequency since these farmers rely on rain for planting the rice; hence, a change in rainfall pattern results in a decline in yield (Erwin, 2009; Akinbile, Ogunmola, Abolude & Akande, 2020).

Table 13: Average Rice Yield per Bag

Characteristic	Category(s)	Frequency	Percent	Mean
Average Seasonal Rice Harvest (Yield/Bag)	3 – 13 bags	5	3.3	29.80 bags
	14 – 23 bags	9	5.9	
	24 – 33 bags	101	66.0	
	34 – 43 bags	35	22.9	
	44 – 53 bags	2	1.3	
	54 – 63 bags	1	0.7	
Average Yearly Rice Harvest (Yield/Bag)	0 – 20 bags	4	2.6	52.16 bags
	21 – 40 bags	12	7.8	
	41 – 60 bags	128	83.7	
	61 – 80 bags	8	5.2	
	81– 100 bags	1	7	
State of Rice Yield	Increasing Yields	83	54.2	
	Decreasing Yields	70	45.8	

Source: Field Data (2023)

Rice Varieties

This subsection examined the rice varieties, their preferences, the fertilisers and other inputs and the supporting services and machines that farmers use to enhance the production efficiency of the inland valley rice production in the Shama district. It was discovered that the farmers cultivate different rice varieties for the inland valley rice production. The "Agra, Exbaika and Jasmine" rice seedlings were discovered to be the common rice varieties that farmers in the Shama district cultivate. According to the Extension Officer,

The "Agra, Exbaika and Jasmine" are preferred mainly by farmers in the community. As a result, the government provides direct support by

releasing different rice varieties. The government also supports farmers with fertilisers for growing these varieties through the Planting for Food and Jobs initiative.

Concerning the preference for the rice variety, a male landowner stated:

The farmers previously preferred the "Exbaika" rice, which the consumers preferred because of its sweetness and aroma. Recently, we have preferred the "Agra" rice, which produces enough yield during lower rainfall season, and the consumers also prefer it because of its sweetness and aroma. There is also a new rice seedling from Japan, which is being tested to see its yield and sweetness. However, farmers' preferred rice varieties in the area are the "Jasmine, Agra and Exbaika."

The statement highlights local farmers' preferred rice varieties: "Jasmine, Agra, and Exbaika." This preference underscores the importance of taste, aroma, and yield performance as crucial criteria in rice variety selection. These findings align with the observation by Sarkodee-Addo et al. (2021) that these varieties are the most planted rice seedlings by rice farmers in Ghana.

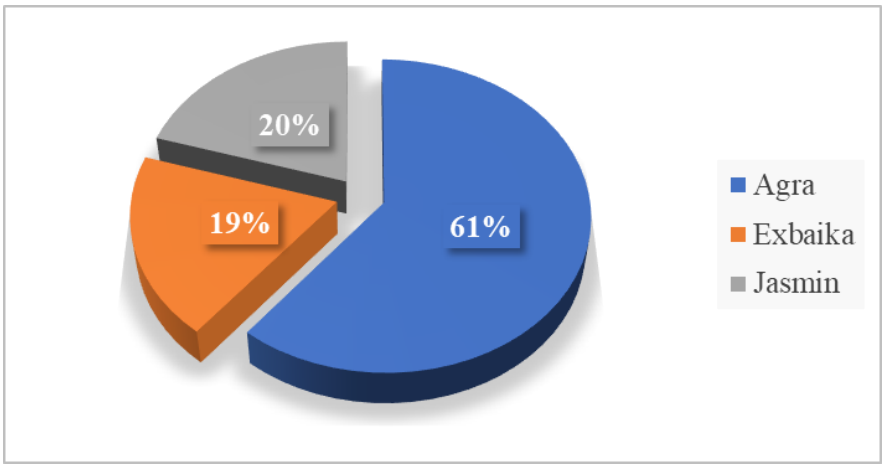

Figure 17: Rice variety preferences among consumers
Source: Field Data (2023)

However, it was discovered that the consumers' preference and market demand mainly drive the farmers' preference for this variety of rice. Figure 17 indicates that the "Agra" rice variety is the most preferred among consumers, with 93 respondents (60.8%) expressing a preference for it. This strong preference suggests that "Agra" rice holds a significant position in the local market, likely due to its taste, aroma, and overall culinary qualities (Sarkodee-Addo et al., 2021). According to the Extension Officer, "*Agra is mostly preferred and highly sought-after rice variety in the district; as a result, most farmers cultivate this variety*." The high consumer demand for "Agra" rice can have important implications for local farmers, as it incentivises cultivating this variety to meet market demands.

While "Agra" is the dominant preference, the data reveals that consumers are interested in other rice varieties. "Jasmin" and "Exbaika" rice varieties have 31 (20.3%) and 29 (19.0%) respondents expressing a preference for them, respectively. This indicates a diverse consumer palate and suggests that there is room for multiple rice varieties in the market. Farmers and stakeholders may consider these preferences when planning their rice cultivation strategies to cater to various consumer tastes. The diversity of rice variety preferences among consumers underscores the importance of offering a range of options in the local rice market. This accommodates different flavour preferences and provides resilience in case of challenges such as crop diseases or unfavourable weather conditions affecting a particular rice variety (Wang & Valent, 2017; Fahad et al., 2019). However, all the respondents expressed that those challenges, such as the availability and the high cost of

rice seedlings, affect the acquisition of rice varieties for cultivation in the Shama District.

Fertilisers, Inputs and Supporting Services

Fertiliser, inputs and other supporting services are essential to rice cultivation. From the study, it was discovered that all the farmers apply fertilisers to cultivate rice. They further specify the use of Ammonia, NPK and Urea in rice production (**Plate 1).** These fertilisers are often used in rice production in Ghana to increase the rice yield (Dzomerku & Illiasu, 2018).

Plate 1: Fertilisers used in rice production in Shama District (From left to right, NPK, Urea and Ammonia)

The Extension Officer made the following comment on the application of fertiliser to the rice:

> *The farmers in the district are taught how to apply the NPK, Urea and Ammonia fertilisers to the rice plant. It has helped the farmers as they can increase the yield of the crops. Regardless of the education given to them, some also rely on their experience to apply the requirements of their piece of land and the yield they want to achieve.*

A female Agrochemical Seller stated that;

> *The NPK, Ammonia and Urea are the most sought-after by farmers to cultivate rice in the district. There are different varieties, such as the NPK (20-10-10), which the farmers prefer over other varieties. However, it depends on the farmers' experience applying that particular fertiliser.*

The MoFA Director for Shama District also stated;

> *NPK, Phosphate of Ammonia and Urea are the common fertilisers that the farmers use to cultivate rice in the district. The government also assist the farmers by subsidising these fertilisers under the Planting for Food and Jobs initiative for the farmers.*

The selection of these fertilisers reflects farmers' understanding of the nutrient requirement of rice plants and a commitment to meeting those needs through appropriate fertiliser application.

Moreover, the findings concerning the use of power tillers among farmers in the study area reveal the adoption of mechanised farming practices. Table 18 shows that most farmers (98%) use power tillers in their rice cultivation practices. This high adoption rate signifies a notable level of mechanisation in rice farming within the Shama district. The overwhelming use of power tillers among farmers highlights the significance of mechanised farming practices in the region. Power tillers (Table 14) are valued for their ability to streamline land preparation, reduce manual labour, and potentially increase the scale of cultivation (Kalita, Ahmed & Baruah, 2020). This widespread adoption suggests that farmers increasingly recognise the benefits of mechanisation in rice farming.

Table 14: Usage of Power Tiller and source of labour

Characteristic	Category	Frequency (153)	Percentage
Power Tiller	Yes	150	98.0
	No	3	2.0
Source of Labour	Hired Help	133	86.9
	Household	20	13.1

Source: Field Data (2023)

Plate 2: Farmer using Power Tiller on the farm
Source: Field Data (2023)

Regarding the source of labour, the findings in Table 14 indicated that most farmers (86.9%) rely on hired help for their agricultural activities. They suggested hiring labourers to assist with various farming tasks, including planting and harvesting, a common practice among farmers in the Shama District. In contrast, a smaller proportion (13.1%) reported using household labour, meaning they engage family members in these tasks. The high reliance on hired labour implies the opportunity for employment and income generation within the local agricultural sector (Hall, Scoones & Tsikata, 2017). According to the Ministry of Food and Agriculture District Director of the Shama District:

There is a rise in employment opportunities in the area due to rice cultivation. The landowners and farmers hire people to assist them in planting the rice. Farmers employ hundreds of people in the cultivation process, which helps alleviate some of the hardships in the district.

The findings indicate that farmers are willing to invest in labour to optimise their farming operations. However, farmers must consider factors such as fair wages and labour rights to ensure that the reliance on hired labour benefits both farmers and the labourers.

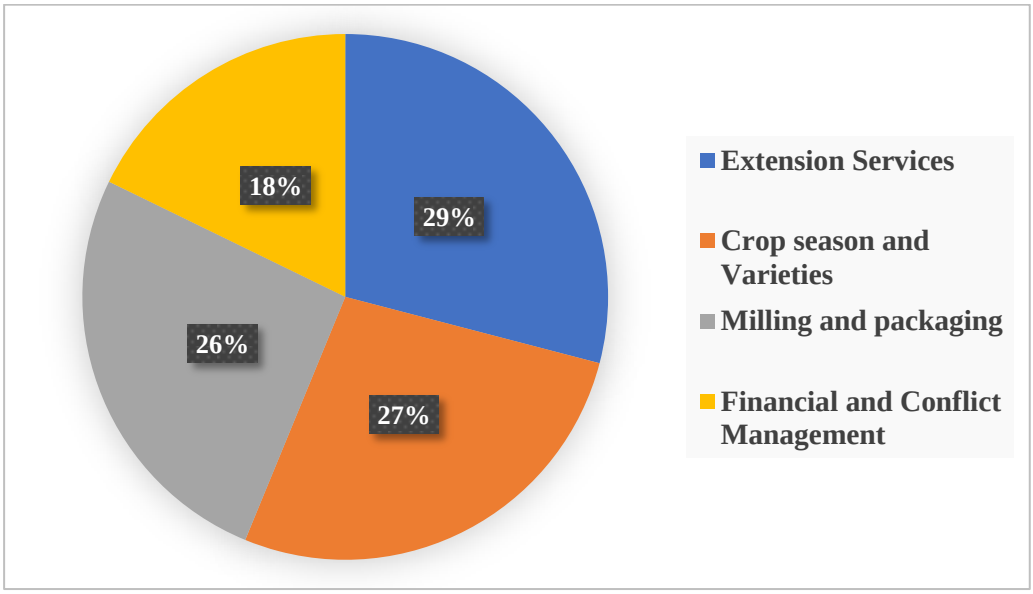

Figure 18 :Supporting service farmers receive in the Shama District
Source: Field Data (2023)

Figure 18 presents valuable insights into the various supporting services farmers in the Shama District receive during rice production. The findings underscore the importance of supporting services in the agricultural landscape of the Shama District. These services encompass various aspects of farming, from technical guidance to post-harvest management and conflict resolution (Latifah, Dewi, Kusuma & Trijaya, 2023). They are instrumental in

equipping farmers with the knowledge and resources needed to enhance their productivity, profitability, and overall well-being

From Figure 18, most (29%) farmers reported receiving extension services. These services are crucial in disseminating agricultural knowledge, best practices, and innovations. They serve as a vital bridge between research institutions and farmers, ensuring that farmers can access the latest information and technologies to improve their farming practices (Maspaitella et al., 2018). Moreover, about 27% of farmers receive information and support related to crop seasons and varieties. This service is essential for optimising planting schedules and selecting the most suitable rice varieties for local conditions (Latifah, Dewi, Kusuma & Trijaya, 2023). It helps farmers make informed decisions about when and what to plant, contributing to improved yields and overall farm management.

Furthermore, the findings show that 26% of farmers benefit from services related to milling and packaging. These services are critical for post-harvest management, ensuring that rice is processed and packaged efficiently. Proper milling and packaging can enhance the market value of rice and make it more appealing to consumers (Custodio et al., 2019). Nevertheless, about 27% of farmers reported receiving financial and conflict management services. These services are crucial for enhancing farmers' financial literacy and equipping them with the skills to manage their finances effectively. Conflict management support can also help address disputes within the agricultural community, promoting harmonious farming practices (Shaffril, Krauss & Samsuddin, 2018).

Effects of the Inland Valley Rice Project on the Livelihood of Farmers

This section deals with objective four, which analyses the project's effects on the farmers' livelihood outcomes. This section explores the impact of the inland valley rice production on livelihood factors such as food security, employment, income, standard of living and resistance to shocks.

Figure 19 presents a comprehensive overview of the multifaceted impacts of the inland valley rice project on farmers' livelihoods in the Shama District. Firstly, food security emerges as a crucial aspect, with 35% of respondents acknowledging its positive influence. According to the Extension Officer,

> *The project has increased the yield and storage of food in the area. As a result, there is little to no food shortage in the area. The impact has been positive regarding the security of food in the area.*

This suggests that the project has significantly improved food security among participating households (Alemayehu et al., 2022). The availability of a consistent rice supply reduces the vulnerability of these communities to hunger and malnutrition, underscoring the project's importance in addressing basic human needs.

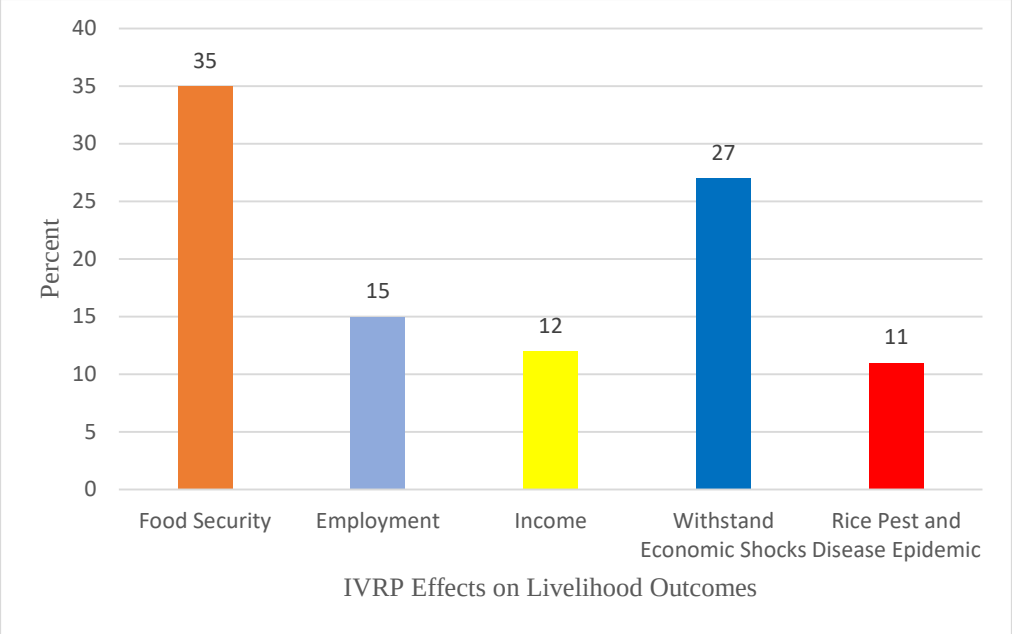

Figure 19: Effects of the inland valley rice project on the livelihood outcomes
Source: Field Data (2023)

Moreover, employment opportunities have arisen due to the project, with 15% of respondents reporting its impact on job creation. This development is particularly noteworthy in the Shama District, where unemployment and underemployment were a significant challenge. The respondents further expressed that the project has increased employment in the area because employment was low before the execution of the project. According to the President of the Shama District Rice Growers Association,

> *The Inland Valley Rice Project has increased the district's employment and job opportunities. People are now employed across the rice production chain from cultivation to selling.*

Furthermore, a 32-year-old female rice buyer and seller also stated;

> *The rice production has provided jobs for us in the community. Most women used to be unemployed, but they are now buying and selling rice and other petty trades due to the inland valley rice project in the district.*

These findings align with Alemayehu et al. (2022) assertion that Inland Valley rice production provides employment and job opportunities to the farming communities. By providing opportunities for community members to earn income, the project improves individual economic well-being and contributes to the region's overall economic development.

Furthermore, the positive influence of the rice project extends to income generation, as reported by 12% of farmers. This additional income can be transformative, enabling households to meet various financial needs, invest in education, and access healthcare services. In essence, the project serves as an economic catalyst, empowering participating households to improve their financial stability and quality of life. Regarding living standards, 16% of respondents mentioned improvements, including housing, clean water access, and overall well-being. These findings underscore the holistic impact of the project, indicating that it goes beyond merely increasing income or food security; it positively influences the broader quality of life for these communities (Mpianing, 2016).

Nevertheless, the project contributes to the resilience of farmers against economic uncertainties, as highlighted by 27% of respondents. In Shama District, livelihoods are often vulnerable to external shocks and economic fluctuations; therefore, building resilience is paramount. For instance, unpredictable fluctuations in rice prices, such as sudden market price drops, can significantly impact farmers' income. It could also encompass unexpected expenses, like medical emergencies or urgent repairs to farming equipment, which might strain a household's finances. The project's role in enhancing the capacity of farming communities to weather such unforeseen

challenges underscores its broader impact beyond income generation and food security (Rathi, 2022). This resilience empowers farmers to navigate economic uncertainties more effectively, ensuring the sustainability of the inland valley rice production project and improving overall community stability.

Lastly, the finding that 11% of farmers reported the project's role in mitigating rice pests and diseases and reducing stress levels holds significant implications. Managing pests and diseases in rice crops is vital for sustaining agricultural productivity and food security, aligning with the findings of Kumar et al. (2021). By addressing this aspect, the project contributes to higher crop yields, food availability and stability in the region. Furthermore, the reported reduction in stress levels highlights the broader socio-economic impact of the project. Reliable income sources and consistent food access can alleviate the stress associated with financial uncertainty and food shortages, thus enhancing the mental well-being of the farmers (Isakson, 2017). This underscores the multi-dimensional benefits of the Inland Valley rice project, extending beyond agriculture into community welfare and resilience, which are pivotal for rural development.

Despite the projects' positive impacts on the farmers' livelihood, challenges to the mechanisation of the inland valley rice project were identified. According to the Extension Officer,

> *There is a problem with the mechanization of the project in the area. The farmers have problems getting machines such as combine harvesters, planters and tractors from the government to cultivate the land.*

The Male Landowner also stated;

> *Farmers face problems acquiring tractors and other machines for the cultivation of rice. Most machines are rented from other places in the district, which comes with enormous costs to the farmers. If the government can support the farmers by providing us with machines, it will help reduce the high cost of rent and speed up the rice production process.*

The findings reveal significant implications for the project's sustainability and efficiency. While the project has demonstrated positive impacts on farmers' livelihoods, the reported difficulties in acquiring essential machinery such as combine harvesters, planters, and tractors pose a substantial hindrance to rice farmers not only in the Shama district but Ghana in general (Diao et al., 2018; Addai, Temoso & Ng'ombe, 2021). These challenges increase production costs due to the need to rent machinery and lead to potential delays in rice cultivation. This highlights the need for government support and investment in providing farmers access to these crucial mechanisation tools (Daum & Birner, 2017). By doing so, the government can help reduce production costs, enhance productivity, and accelerate the rice production process, ultimately fostering sustainable agricultural development and improving the livelihoods of rice farmers in the region.

Chapter Summary

This chapter provided a comprehensive overview of various aspects of the inland valley rice project in the Shama District. Firstly, the analysis of the sociodemographic characteristics of participating farmers highlights gender disparities, age distributions, educational backgrounds, marital statuses, and

income variations. These insights paint a vivid picture of the farmers' profiles within the project context. Next, the chapter delves into the crucial issue of land access, discussing landholding sizes, land fertility, access mechanisms, and ownership arrangements. Notably, the chapter addressed gender disparities in land access and farmers' challenges in securing land for rice production.

Furthermore, market accessibility factors were explored, including distance to market centres, transportation modes, road conditions, market prices, and profitability. Proximity, transportation means, and pricing were emphasised in shaping farmers' market access. Additionally, the efficiency of rice production, covering planting cycles, yields, rice varieties, inputs, and support services, shedding light on the methods and resources employed by farmers in the Shama District, were examined in this chapter.

Finally, the project's impact on farmers' livelihoods was assessed, emphasising its positive effects on food security, employment, income, resilience, and pest/disease management. Despite these positive impacts, the study recognised the challenges of mechanisation and the need for government support. This comprehensive analysis in this chapter provides valuable insights into the multifaceted dynamics of the inland valley rice project, its implications for farmers, and potential avenues for improvement.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents the summary of the study, conclusions, and recommendations. It also provides suggestions for further studies.

Overview of the Study

The study aimed to evaluate the effects of the Inland Valley Rice Production Project on farmers in the Shama District. Specifically, the study sought to assess the ease of access to land by farmers, examine the factors influencing market accessibility of the farmers, examine the efficiency of inland valley rice production in the Shama district, and analyse the project's effects on farmers' livelihood outcomes. A mixed method approach was used for the study, guided by pragmatism philosophy and descriptive research design. A questionnaire, observation checklist, and Interview guide were used for data collection from rice farmers in the inland valley rice production project and key informants in the Shama district. Descriptive and thematic analysis was performed using charts, tables, and direct quotations.

Summary of Key Findings

The analysis of sociodemographic characteristics of farmers participating in the inland valley rice project in the Shama District reveals that most surveyed farmers were male (73.2%). The age distribution highlights a significant presence of middle-aged individuals (41.8%), indicating active contributions to agricultural activities. Educationally, a substantial proportion had formal education (81.7%), potentially facilitating the adoption of modern farming practices. Most farmers were married (78.4%), suggesting household-

based agricultural engagement. In terms of experience, 63.4% had 6 to 10 years of farming experience, offering valuable insights. Income distribution varied, with 34.6% falling into the GH₵ 4000 – 5000 income range. Household size was typically 4 to 6 people for 64.7% of farmers, affecting labour availability and resource management. Access to credit facilities and bank accounts was high at 92.2%, crucial for financial stability. Furthermore, 86.3% of farmers engaged in non-farming activities during non-planting seasons, such as plumbing, driving and trading, diversifying income sources, and supporting their rice farming efforts.

Concerning land access and ownership among inland valley rice farmers in the Shama District, there was a significant gender disparity in land ownership, with male farmers dominating the landholding landscape, possessing 73.2% of the total land compared to 26.8% owned by female farmers. Most of the respondents had a land holding of 1 to 5 acres. This disparity is most pronounced in the landholding categories, where female farmers are underrepresented, potentially limiting their agricultural activities and income-generating potential. Also, most (79.1) respondents were discovered to have farm sizes between 0 to 5 acres, while 20.9% had 5 to 10 acres. A similar gender-based disparity is evident in farm sizes, with male farmers owning and operating the majority of land (73.2%), leaving female farmers with a smaller share (26.8%). The assessment of farmland fertility indicates that a substantial majority (59%) of farmers consider their lands to be fertile, which can enhance rice yields and agricultural productivity. Most farmers in the Shama District do not own the land they cultivate, with 64.1% indicating they rent the land. The findings also highlighted diverse

mechanisms farmers access land, with rental agreements being the most prevalent. Family and social relationships play a significant role in securing land access, as indicated by 51% of respondents who access land through relationships with landowners' households, families, or clans. Gender-based disparities in land access were evident, with 88.9% of respondents indicating unequal access between males and females and 73.2% of males having access to land than females. Traditional laws that favour male land ownership and control contribute to this disparity, raising concerns about gender equality and women's access to land. Challenges in acquiring land for rice production include high rental costs, family and social dynamics, traditional laws, poverty, and complex tenancy agreements. Various channels were employed to address land ownership issues, including traditional rulers, community elders, family heads, landowners' associations, and formal legal mechanisms.

Assessing the factors that influence the market accessibility of the farmers in the Shama district, the study revealed the significance of proximity to markets, price, and market competition factors. Most farmers in the Shama District do not have farms near the market centre (68.6%). Most farmers (70.6%) consider the distance from their farms to the market centre too long. Tricycles are the most common mode of transportation for farmers (43.2%), followed by taxis (23.5%) and trucks (26.8%). Most roads used for transportation are feeder roads (66.7%), with highways (29.4%) being relatively common. Nearly all respondents (96.7%) believe that the nature of the road significantly affects rice transportation. While most farmers reported good road conditions (87.6%), a minority (12.4%) experienced bad road conditions, which could lead to increased transportation costs and post-harvest

losses. It was also discovered that the price of rice plays a significant role in market participation and rice production decisions for 98.7% of respondents. In the Shama District, prices for a bag of rice range from GH₵ 450 to GH₵ 700, with the majority of farmers (39.9%) reporting prices falling between GH₵ 450 and GH₵ 500. Despite price variations and market competition, most farmers view rice production as profitable (79.7%) and sustainable over the years (85.0%). There was high competition in the Shama District rice market (100%). Most respondents (81.0%) believe that groups primarily control and determine market prices and information dissemination. It was also discovered that the current market price of the local rice was high compared to imported rice. Factors contributing to the higher price of locally produced rice compared to imported rice include high input costs (56%), high rental costs (27%), high costs of other services (17%), and high labour costs (7%). Respondents suggest various strategies to make local rice competitive with imported rice, including input subsidies (47%), equipment support (30%), cooperative farming (13%), and government support (10%).

In investigating the efficiency of inland valley rice production in the Shama District, various aspects such as the planting cycle, rice yields, cultivated rice varieties, inputs, and support services available to farmers were assessed. It was revealed that farmers in the district predominantly adopt a bimodal cropping pattern, planting rice twice a year during the rainy and minor seasons, with a minority practising triannual planting enabled by irrigation. The seasonal rice yield averages 29.80 bags per acre per season, with 66% of farmers achieving yields between 23 and 33 bags (average 29.5 bags) higher than the national average of 23 and 33 bags (average of 26.5

bags). The yearly rice yield is mainly within 40 to 60 bags per acre, with an average of 52.16 bags per acre per year, higher than the national average of 50 bags. More than half of the farmers (54.2%) reported increasing yields, while 45.8% reported decreasing yields, attributed to changes in water supply due to rainfall patterns. Most farmers achieve satisfactory seasonal and yearly yields, highlighting the region's potential for sustainable rice production. Notably, over half of the farmers report increasing yields over time, reflecting improved farming practices or technology adoption. Rice variety preferences among consumers indicate a strong demand for "Agra, Exbaika, and Jasmine" rice due to its taste and aroma. Farmers apply fertilisers like Ammonia, NPK, and Urea to enhance rice yield. Mechanisation through power tillers is widespread among farmers, streamlining land preparation. Farmers predominantly relied on hired labour for their agricultural activities, providing employment opportunities in the district. Moreover, supporting services, including extension services, information on crop seasons and varieties, milling and packaging, and financial and conflict management, play a crucial role in enhancing farmers' productivity and well-being in the Shama District's rice production.

Lastly, the study assesses the impact of the inland valley rice project on farmers' livelihoods in the Shama District. It reveals that the project has had multifaceted positive effects on the livelihoods of participating farmers. Notably, it has significantly improved food security by increasing rice yields and storage, reducing the risk of food shortages in the area. Additionally, the project has generated employment opportunities in the Shama district with previously limited job prospects, thereby contributing to local employment

and income generation. The increased income derived from rice production potentially transformed households' financial stability and living standards. The project enhanced farmers' resilience against economic uncertainties, bolstering their ability to withstand unforeseen challenges. It is also pivotal in mitigating rice pests and diseases and sustaining agricultural productivity and food security. Despite these positive impacts, challenges related to the mechanisation of the project, including difficulties in accessing machinery, were identified, underscoring the need for government support to improve efficiency and reduce production costs for rice farmers in the region.

Conclusions

a. There is a gender-based disparity in agriculture land ownership in the Shama district, with male farmers dominating. Traditional laws and practices contribute to the gender-based disparities in land access. Most farmers have land holdings of 1 to 5 acres and farm sizes of 0 to 5 acres. Farmlands in the Shama district are considered fertile, enhancing rice yields. The challenges in acquiring land for rice production in the Shama district include high rental costs, traditional laws, and complex tenancy agreements.

b. Various vital factors influence market accessibility. Notably, most farmers do not have farms near market centres, and a significant portion find the distance to these markets quite lengthy. Tricycles are the primary mode of transportation used by farmers, while road conditions play a critical role in rice transportation, with the majority reporting good road conditions. Furthermore, the price of rice significantly impacts market participation and production decisions for nearly all respondents. High

competition characterises the Shama District rice market. Factors contributing to the relatively higher price of locally produced rice than imported rice include input, rental, and labour costs. Input subsidies, equipment support, cooperative farming, and government assistance are essential to ensure that local rice remains competitive with imported rice.

c. In the context of inland valley rice production efficiency in the Shama District, a prevalent bimodal cropping pattern characterised by two planting cycles annually has led to higher yields. These seasonal rice yields significantly surpass the national average, which is pivotal in bolstering food security and income generation. Most farmers are experiencing increased yields, reflecting the adoption of improved farming practices and technology, while rice varieties such as "Agra, Exbaika, and Jasmine" are highly favoured by consumers, particularly "Agra." The application of fertilisers, the widespread adoption of power tillers, and access to various supporting services collectively contribute to heightened productivity. Furthermore, the substantial reliance on hired labour enhances agricultural output and offers valuable employment opportunities within the local agricultural sector.

d. The initiative has brought about positive changes in the lives of participating farmers. The project has significantly enhanced food security by boosting rice yields and storage capacity. In parallel, it has created employment opportunities within the Shama District, contributing to local job opportunities and increased income generation. This, in turn, has translated into improved financial stability and living standards for households engaged in rice production. Furthermore, the project has

augmented farmers' resilience against economic uncertainties, reinforcing their capacity to withstand unforeseen challenges. However, challenges related to mechanisation, including obstacles in accessing machinery, underscore the need for government support to improve efficiency and reduce production costs in the region.

Recommendations

The following recommendations were suggested depending on the study findings and conclusions;

I. In collaboration with local authorities and community leaders, the government should initiate land reform efforts to address land fragmentation and promote equitable land distribution. Efforts should be made to reform traditional land tenure systems to ensure gender equality in land access and ownership rights. This can be implemented through awareness campaigns, legal reforms, and community-based initiatives that involve women in decision-making processes related to land allocation.

II. The government should explore options for providing farmers with affordable and secure land access. This can include subsidising land acquisition costs for small-scale farmers, promoting land-sharing arrangements, and developing community land banks. These measures can be implemented through collaboration with local land agencies and community-based organisations.

III. The Shama District Assembly should prioritise infrastructure development in the Shama District, including rehabilitating feeder roads and constructing better road networks connecting farms to markets. This

can be implemented through government-led infrastructure projects and partnerships with private-sector entities.

IV. The government should establish price stabilisation and market regulation mechanisms to ensure fair pricing and income stability for rice farmers. This can include creating price support programs, market information systems, and contract farming arrangements with guaranteed prices. Implementation would involve the Ministry of Agriculture and relevant regulatory agencies.

V. Given the importance of mechanisation in improving efficiency, the government should provide targeted support for farmers to access machinery and equipment. This can be achieved through subsidised machinery loans, training programs, and partnerships with agricultural machinery providers. Implementation would involve collaboration between the Ministry of Agriculture and financial institutions.

Suggestions for Further Studies

Researchers who wish to study Ghana's inland valley rice production should focus on the impact of land reforms, market dynamics and fair pricing, infrastructure development and accessibility, and mechanisation and technology adoption. These areas will contribute to a deeper understanding of the evolving agricultural landscape in Ghana and provide evidence-based insight for policymakers and government agencies.

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APPENDIX I : Questionnaire For Inlnland Valley Rice Farmers

Title: **Effects of Inland Valley Rice Project on Farmers in the Shama District of Western Region, Ghana.**

Dear Sir/Madam,

I am Justice Kojo Eshun, a postgraduate student at the Department of Geography and Regional Planning, University of Cape Coast. The purpose of this interview guide is to gather information for a study on the effects of the inland valley rice project on farmers. I humbly want to seek your consent to participate in this study. Your participation is voluntary, and you may refuse to participate in or withdraw from this study. However, your participation in this study is relevant since the intention is to aid in policy drafting and implementation. The interview would last between 30 and 40

SECTION A: SOCIODEMOGRAPHIC CHARACTERISTICS

1. Gender a. Male b. Female
2. Age: …….
3. Education Level
    a. None b. Basic c. Secondary d. Tertiary
4. Marital Status
    a. Single b. Married c. Divorced d. Separated e. Cohabiting
5. How many years spent in rice farming? ……
6. What is your average income at the end of the harvesting season? …….
7. What is your household size? …….
8. How many are above 18 years? ……..

9. How many are below 18 years? …….

10. Access to Credit Facility?

    a. Yes b. No

11. Do you have an account?.....

12. Which institution?

    a. Bank b. Credit Union c. Cooperative d. Others

13. Do you have any rimitance?

    a. Yes b. No

14. Do you engage in any work aside farming?

    a. Yes b. No

SECTION B: FACTORS AFFECTING FARMERS ACCESS TO LAND

15. What is the size of your landholding?……..

16. What is your farm size?.....

17. Do you own the land you are currently farming on?

    a. Yes b. No

18. Do you have land for other activity?

    a. Yes b. No

19. How did you get access to the land?

    a. inherited b. Rental c. Title deeds d. Others…….

20. If title deeds, do you have any document covering the agreement with the land owner?

    a. Yes b. No

21. If inherited, can you release it to a third party temporarily?

    a. Yes b. No

22. On which conditions can you release to a third party?

……

23. If rental, are there terms of engagement (any payment or compensation)?

a. Yes b. No

24. If you don't own the land, what is the nature of your relationship with the land owner?

a. Family b. Tribal c. Not related d. Others

…….

25. How do you rate the land in terms of fertility for farming?

a. Very Fertile b. Fertile c. Moderate d. Poor

26. What is the size of the farmland you lay claim as your own land?

……

27. Do the land owners sell land in this traditional area?

a. Yes b. No

28. Can you state some of the challenges to acquiring land at the project site?

……

29. To get land, you must relate to a family, household or clan of the land owner?

a. Yes b. No c. Not sure

30. Do males and females have equal access to land?

a. Yes b. No

31. If no, can you specify the reason?

……

32. Are there channels for addressing land ownership problems?

a. Yes b. No

33. If yes, can you state them?

……. .

SECTION C: PRODUCTION EFFICIENCY

34. How many times do you plant the rice in a year (crop cycle)?

……..

35. State the planting seasons?

a. ……..

b. ……..

c. ……..

36. In each of the seasons, what is your average rice yield (per bag)

a. ……..

b. ……..

c. ……..

37. On average, what is your yearly rice harvest (yield/bag)

……..

38. Are the yields going down?

a. Yes b. No

39. What varieties of rice do you cultivate?

a…….

b. ……

c. ……..

39. which variety more preferred by the consumer? ……..

40. Are challenges in acquiring the preferred variety?

a. Yes b. No

41. Do you apply Fertilizers to the rice?

a. Yes b. No

42. If yes, can you specify which fertilizers you use?

……

43. On average, how many acres of land do you cultivate rice?

……

….

44. Do you use power tiller?

A. Yes b. No

45. What is the source of labour?

a. Household b. Hire c. Others

46. On average how much do you spend on inputs in a planting season?

a. Fertilizer ……

b. Labour ……

c. Agro chemicals …….

d. Harvesting …….

e. Land preparation ……

47. Do you have access to any supporting services on

a. Extension ervices? a. Yes b. No

b. Education on farm management? a. Yes b. No

c. Disease control? a. Yes b. No

d. Varieties? a. Yes b. No

e. Crop season? a. Yes b. No

f. Milling and packaging? a. Yes b. No

g. Others …….

SECTION D: FARMERS MARKET ACCESSIBILITY

48. Is the farm closer to the nearest market centre?

a. Yes b. No

49. What is the distance from the farm to the market?

a. Long b. Short

50. What is the mode of transporting farm produce to the market?

a. Head porterage b. Truck c. Taxi d. Tricycle

51. What is the nature of the road?

52. Does the nature of road affect the transportation of rice to the market?

a. Ye b. No

53. What is the condition of the road?

a. Good b. Bad

54. If Bad, can you explain the conditions of the road?

……

55. If the road condition is bad/poor, what are the effects it has on marketing?

a. Long Travel Time c. High cost of transport

b. Post-Harvest Losses d. Others(specify) ……

56. Do the prices of rice affect market participation and rice production?

a. Yes b. No

57. What is the current price of a bag of rice?

    Gh¢……..

58. How do you view the current market price for a bag of rice?

    a. High b. Low

59. Why is the price of local rice higher than the imported rice?

    ……

60. What do you think could be done to make it competive to the imported rice?

    ……

61. Is the price at which the rice is sold profitably?

    a. Yes b. No

62. Does the branding and packaging of the rice affect consumer purchase and price?

    a. Yes b. No

63. Is there high competition in the rice market in the Shama district?

    a. Yes b. No

64. Has the production been profitable over the period?

    a. Yes b. No

65. Who control the market information?

    a. Individuals b. Group

66. Do individuals or groups determine the price of rice in the market?

    a. Individuals b. Groups

67. In your view, is the rice market in Shama District Monopolized?

    a. Yes b. No

SECTION D: LIVELIHHOD OUTCOMES

68. Have the inland valley rice project improved your food security?

    a. Yes b. No

69. Has the project created employment in the district?

    a. Yes b. No

70. Before the project, what was the employment level in the area?

    a. Low b. High c. About the same

71. Has the project increased income?

    a. Yes b. No

72. Has the project increased your standard of living and well-being?

    a. Yes b. No

73. If yes, can you specify?

    ……

74. Has the project resulted in your ability to withstand shocks such as

    a. Economic shocks? a. Yes b. No

    b. Stress? a. Yes b. No

    c. Rice pest and disease epidemics? a.Yes b. No

75. Are you a member of any agriculture association or Christian organisation?

    a. Yes b. No

76. Do you have any of the following? circle as many as possible

    a. Vehicle

    b. Bicycle

    c. House

    d. Mobile phone

e. Television

f. Laptop

g. Fridge

h. Deep freezer

i. Others…….

77. Have you done any investiment to protect the land in terms of

a. Soil erosion? a. Yes b. No

b. Land management? a. Yes b. No

c. Soil fertility? a. Yes b. No

d. Disease control? a. Yes b. No

Others?.....

APPENDIX II: Questionnaire For The Initial Farmers

Title: **Effects of Inland Valley Rice Project on Farmers in the Shama District of Western Region, Ghana.**

Dear Sir/Madam,

I am Justice Kojo Eshun, a postgraduate student at the Department of Geography and Regional Planning, University of Cape Coast. The purpose of this interview guide is to gather information for a study on the effects of the inland valley rice project on farmers. I humbly want to seek your consent to participate in this study. Your participation is voluntary, and you may refuse to participate in or withdraw from this study. However, your participation in this study is relevant since the intention is to aid in policy drafting and implementation. The interview would last between 30 and 40.

SECTION A: SOCIO-DEMOGRAPHICS

1. Age …….
2. Gender
   a. Male b. Male
3. Education Level
   a. None b. Basic c. Secondary d. Tertiary
4. Marital Status
   a. Single b. Married c. Divorced d. Separated e. Cohabiting
5. Do you engage in other work apart from rice farming?
   a. Yes b. No
6. If yes, specify work, …….

SECTION A: LAND ACCESS

7. What was the size of your farmland before the implementation of the rice valley project?

   ……..

8. What type of crops were you planting?.....

9. How do non-natives obtain land for farming in this community?

   a. From land owners c. From the traditional council

   b. Legal means d. Others …….

10. Are there institutions responsible for land acquisition and disputes in the community?

    a. Yes b. No

11. If yes, can you state some?

    ……

12. Is land access in the community for farming affected by gender?

    a. Yes b. No

13. If yes, can you explain?

    ……

    ……

    ……

14. Do traditional laws in this area affect land access?

    a. Yes b. No

15. If yes, please specify?

    ……

    ……

16. Does access to land affect the livelihood of the poor in this community?

    a. Yes b. No

17. If yes, please state how?.....

    ……

18. What is likely to motivate the decision of a landowner to give land to a foreign person?

    a. Financial b. Developmental c. Other

    ……

SECTION B: INLAND VALLEY RICE PRODUCTION

19. Are you currently engaged in the Inland valley Rice production?

    a. Yes b. No

20. If yes, do you own the land you are currently working on?

    a. Yes b. No

21. If no, how did you got access to the land?

    a. Purchased b. Inherited c. Freely given d. Rented e. Others……...

22. Has the project made land easily accessible in the community?

    a. Yes b. No

23. If no, what are the reasons?

    ……

24. Has the project affected the price of land in the community?

    a. Yes b. No

25. Has the project increased the yield of rice in the community?

    a. Yes b. No

26. Do farmers now have market for the rice produced from the project?

a. Yes b. No

27. Has the project improved the livelihood of the farmers?

a. Yes b. No

APPENDIX III: Interview Guide for Key- Informants

Title: **Effects of Inland Valley Rice Project on Farmers in the Shama District of Western Region, Ghana.**

Dear Sir/Madam,

I am Justice Kojo Eshun, a postgraduate student at the Department of Geography and Regional Planning, University of Cape Coast. The purpose of this interview guide is to gather information for a study on the effects of inland valley rice project on farmers. I humbly want to seek your consent to participate in this study. Your participation is voluntary, and you may refuse to participate in or withdraw from this study. However, your participation in this study is relevant since the intention is to aid in policy drafting and implementation. The interview would last between 30 and 40

1. Brief description of the respondent?
2. In your understanding what is the inland rice valley production?
3. What is the policy goal of the project?
4. How did the state acquire the land?
5. Did government paid compensation?
6. What are the government support to farmers?
7. Can you explain the impact of the project on the following;
    a. How people acquire land?
    b. How long can one hold land in this community?
    c. Are there any legal or customary requirements for land acquisition?
8. Are there factors that prevent people from accessing land for the project?
    a. If there are any, can you explain how?

9. Can you explain how the following factors affect farmers from accessing markets for the rice produce in the district?
    a. Location c. Transportation e. Branding
    b. Roads d. Price f. Market competition
10. Are there any other factors that influence farmers' accessibility to market?
    a. If yes, please explain?
11. Have the project increase the efficiency of rice production in the district?
    a. If yes, please explain?
    b. If no, please explain?
12. Have there been a change in the area of rice cultivated as a result of the inland valley rice production?
    a. Can you elaborate on the change in land size?
13. What type of rice do farmers use in the project and does it have influence on the market? Please elaborate?
14. Can you elaborate on how the project have affected the livelihood of farmers based on the following variables?
    a. Food Security
    b. Employment
    c. Income
    d. Vulnerability to economic and agricultural shocks
    e. Standard and cost of living

Thank you