

## DYNAMICS AND SOCIOECONOMIC IMPACT OF RICE CULTIVATION IN THE ETSAKO REGION, EDO STATE, NIGERIA

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### Abstract

*This study investigated the spatial patterns and socioeconomic implications of rice farming in Etsako, Edo State, Nigeria, addressing two research questions: What is the spatial pattern of rice cultivation in the study area, and what are its socioeconomic implications for farmers? Employing a mixed-methods approach, data was collected from 328 rice farmers across Etsako West, East, and Central Local Government Areas using a two-stage sampling technique (purposive and systematic random sampling). Six communities in which rice was predominantly cultivated were purposively selected, then systematic random sampling was applied to select rice farmers within these communities and semi-structured questionnaires. Descriptive and inferential statistics, supported by the Livelihoods Framework, were used to analyze farm sizes, planting seasons, climate impacts, income, expenditure, and how earnings meet farmers' needs (education, health, housing, food, clothing). Key findings reveal that most farmers (81.7%–88.7%) cultivate 1–2 hectares, with a slight increase in 3–4 hectares by 2017, driven by improved inputs. Two planting seasons dominated (81.0%), limited by rainfed systems, while rainfall (45.1%) and humidity (52.4%) significantly affect production. Income was substantial (59.5% earn above N300,000), but high losses (181 farmers) and moderate expenditure (68.6% spend N51,000–N100,000) reflect financial constraints. Earnings adequately met food (mean = 3.78) and clothing (mean = 3.53) need but fell short for education (mean = 2.59) and health (mean = 2.75). The study recommends the development of small-scale irrigation systems to extend planting seasons, strengthening extension services for climate-smart practices, and providing low-interest loans to enhance profitability and meet non-essential needs. These findings benefit farmers, policymakers, and extension officers by informing targeted interventions to boost productivity, reduce losses, and improve livelihoods, contributing to sustainable agricultural development in Etsako.*

**Keywords:** *Rice cultivation, Spatial dynamics, Socioeconomic impact, Etsako Region, Smallholder farmers*

### INTRODUCTION

Rice (*Oryza sativa* L.) is a staple crop that plays a critical role in food security and economic development across sub-Saharan Africa, particularly in Nigeria, where it is one of the most consumed crops (FAOSTAT, 2020). In the Etsako Region of Edo State, Nigeria, rice cultivation is a dominant agricultural activity, shaping the livelihoods of smallholder farmers and contributing to the local economy. The spatial dynamics of rice cultivation, including its distribution and land-use patterns, are influenced by a combination of environmental, socioeconomic, and technological factors (Bhatta & Doppler, 2011). These dynamics have significant implications for the socioeconomic well-being of farmers, affecting income, employment, and community development. However, the interplay between spatial patterns of rice cultivation and its

socioeconomic impacts in the Etsako Region remains underexplored, necessitating a detailed investigation to inform sustainable agricultural practices and policy interventions.

The research problem lies in the limited understanding of how rice cultivation is spatially organized in the Etsako Region and the extent to which it influences the socioeconomic outcomes for farmers. While studies have examined rice production in other parts of Nigeria, such as Dantata and Mohammed (2019) in Nigeria, Northan Nigeria (Kamai et al., 2020), Ebonyi State (Emenekwe et al., 2022), there is a paucity of region-specific research focusing on the Etsako Region. Existing literature highlights the importance of spatial analysis in understanding agricultural productivity and its socioeconomic consequences

(Bhatta & Doppler, 2011), yet few studies have applied this approach to rice farming in this context. Furthermore, the socioeconomic implications of rice cultivation, such as its impact on household income, labor dynamics, and access to markets, are critical for addressing poverty and improving livelihoods but have not been adequately documented for Etsako farmers.

It is against this background that his study addresses these two research questions: (1) What is the spatial pattern of rice cultivation in the study area? and (2) What are the socioeconomic implications of rice cultivation for farmers in the Etsako Region? By employing spatial analysis and socioeconomic assessment, the research provides a comprehensive understanding of the distribution of rice farming and its economic and social impacts on local farmers. The findings are expected to contribute to the development of targeted agricultural policies and sustainable practices that enhance productivity and improve the livelihoods of farmers in the Etsako Region.

### ***Literature insight***

The spatial dynamics of rice cultivation involve the geographical distribution, land-use patterns, and environmental factors that influence where and how rice is grown. Spatial analysis is critical for understanding agricultural productivity, as it reveals how resources, climate, and topography shape farming practices (Bhatta & Doppler, 2011). In Nigeria, rice cultivation is concentrated in specific agro-ecological zones, with the Etsako Region of Edo State being a notable hub due to its favorable wetlands and floodplains (Ojo & Adebayo, 2019). Studies employing Geographic Information Systems (GIS) and remote sensing have highlighted the importance of soil fertility, water availability, and proximity to markets in determining the spatial patterns of rice farming (Akande et al., 2021). For instance, Akande et al. (2021) found that rainfall variability and temperature trends significantly influence rice yield patterns across Nigeria, with implications for regional planning in areas like Etsako.

However, research specific to the Etsako Region is limited. While broader studies on Nigeria's rice production emphasize the role of rainfed lowlands, which dominate Etsako's rice farming, they often overlook localized spatial constraints such as land tenure issues and small-scale topography (Saito et al., 2019). These factors can lead to uneven distribution of rice fields and affect productivity. For example, Saito et al. (2019) noted that suboptimal water management and poor weed control in rainfed systems contribute to

low yields, a challenge likely prevalent in Etsako's predominantly rainfed environment. Furthermore, spatial heterogeneity, such as variations in soil quality and access to irrigation, has been shown to influence farmers' risk preferences and adoption of improved practices, yet such analyses are scarce for Etsako (Omonona et al., 2021). This gap underscores the need for region-specific spatial studies to inform targeted agricultural interventions.

Rice cultivation is a vital source of livelihood for smallholder farmers in Nigeria, contributing to income, employment, and food security (Awotide et al., 2016). In the Etsako Region, rice farming is a primary economic activity, with farmers relying on it for household income and local market supply (Ojo & Adebayo, 2019). The socioeconomic benefits of rice cultivation include increased household income, improved access to education, and enhanced food security, particularly when farmers adopt improved varieties and market-oriented practices (Awotide et al., 2016). However, these benefits are often constrained by socioeconomic factors such as limited access to credit, inadequate extension services, and low mechanization, which are prevalent in sub-Saharan Africa (SSA) (Senthilkumar et al., 2023).

Recent studies highlight the complex interplay between rice cultivation and socioeconomic outcomes. For instance, Zossou et al. (2021) demonstrated that participatory approaches to rice crop management in northern Nigeria improved farmers' technical efficiency and income, suggesting potential applicability in Etsako. Conversely, socioeconomic challenges, such as child labor in rice farming, have been documented in other Nigerian regions, raising concerns about long-term sustainability and social equity (Kamba & Adamu, 2021). In Etsako, the reliance on family labor and traditional farming methods may exacerbate such issues, yet region-specific data are lacking. Additionally, market participation has been shown to enhance farmers' welfare, with factors like education and access to seeds increasing the likelihood of selling surplus rice (Awotide et al., 2016). However, the extent to which Etsako farmers engage in markets and the resulting socioeconomic impacts remain underexplored.

Climate change poses significant challenges to rice cultivation, affecting both spatial dynamics and socioeconomic outcomes. Studies indicate that rainfall variability and rising temperatures impact rice yields, particularly in rainfed systems like those in Etsako (Akande et al., 2021). Adaptation strategies, such as the

adoption of climate-smart rice varieties and water management practices, have been shown to mitigate these effects and improve productivity (Emenekwe et al., 2022). However, the adoption of such innovations in Etsako is likely limited by socioeconomic barriers, including low access to extension services and capital (Zossou et al., 2021). Research in Ebonyi State, Nigeria, suggests that climate adaptation can enhance rice productivity, but its success depends on farmers' education and access to resources, factors that warrant investigation in Etsako (Emenekwe et al., 2022).

While the literature provides valuable insights into the spatial and socioeconomic dimensions of rice cultivation in Nigeria, several gaps remain, particularly for the Etsako Region. First, there is a lack of localized studies examining the spatial patterns of rice farming, including the influence of land tenure, soil variability, and small-scale topography. Existing spatial analyses focus on broader regions, limiting their applicability to Etsako's unique agro-ecological context (Akanke et al., 2021; Saito et al., 2019). Second, the socioeconomic impacts of rice cultivation in Etsako, such as its effects on household income, labor dynamics, and market participation, are poorly documented. Studies from other Nigerian regions highlight the potential for rice farming to improve livelihoods, but region-specific data are needed to understand Etsako's challenges and opportunities (Awotide et al., 2016; Kamba & Adamu, 2021). Finally, the intersection of climate change, spatial dynamics, and socioeconomic outcomes in Etsako remains underexplored, despite evidence that these factors are critical for sustainable agricultural development (Emenekwe et al., 2022). This study seeks to address these gaps by analyzing the spatial patterns of rice cultivation and their socioeconomic implications in the Etsako Region, contributing to the development of targeted agricultural policies and practices.

### ***Theoretical Framework (The Livelihoods Framework)***

The Livelihoods Framework offers a comprehensive theoretical approach to analyzing the spatial dynamics and socioeconomic impacts of rice cultivation in the Etsako Region. Developed by the Department for International Development (DFID, 1999), this framework examines how households leverage assets—human (knowledge, labor), natural (land, water), financial (savings, loans), physical (tools, infrastructure), and social (community networks)—to

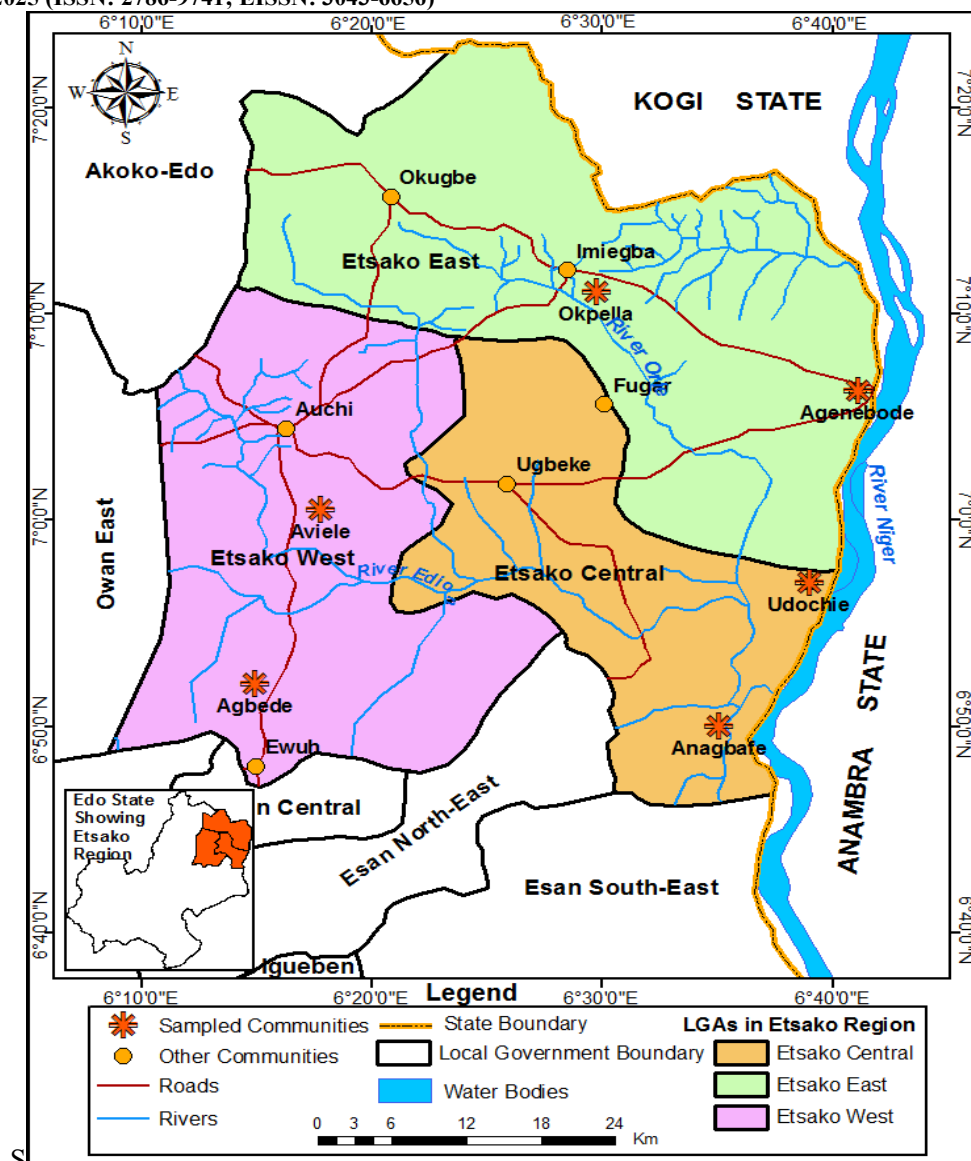
engage in activities like rice farming and achieve livelihood outcomes (Ellis, 2000). In Etsako, spatial patterns of rice cultivation are influenced by natural assets, such as wetlands and rainfall patterns, while socioeconomic outcomes, including income and food security, depend on access to financial and human assets (Ogundipe et al., 2023). The framework also considers external vulnerabilities, such as climate variability and market fluctuations, which shape farmers' resilience and livelihood strategies, making it ideal for studying the interplay of spatial and socioeconomic factors in rice cultivation (DFID, 1999).

By applying the Livelihoods Framework, this study can systematically address the research questions concerning the spatial patterns and socioeconomic implications of rice farming in Etsako. For the first question, the framework helps analyze how natural and physical assets determine the geographical distribution of rice fields, providing insights into land-use patterns (Adeyemo & Olajide, 2022). For the second question, it links farmers' asset access to socioeconomic outcomes, such as employment and market engagement, while identifying barriers like limited credit access (Nwali et al., 2024). This approach also highlights adaptation strategies, such as adopting climate-resilient rice varieties, to enhance livelihood sustainability. By using the Livelihoods Framework, the study aims to inform policies that strengthen agricultural practices and improve farmers' livelihoods in the Etsako Region.

## **MATERIALS AND METHODS**

### ***Study Area***

The Etsako Region, located in northern Edo State, Nigeria, lies between longitudes 6°04.000' and 6°12.989' E and latitudes 7°05.881' and 7°23.022' N. It is bordered by Kogi State to the north, Anambra State to the east, Esanland to the south, and Owan East and Akoko Edo Local Government Areas (LGAs) to the west (Aigbokhan & Alufohai, 2022). Historically, Etsako emerged as a district within the Kukuru Division of the former Benin Province in 1919 and now encompasses three LGAs: Etsako East (headquartered in Agenebode), Etsako Central (Fugar), and Etsako West (Auchi) (Ojeifo & Okhakhu, 2020). The region comprises thirteen clans, including Uzairue, Okpella, Weppa Wanno, and South Ibie, each with multiple villages sharing a common cultural heritage and related dialects.



**Figure 1.1: Etsako Region of Edo State Showing Sampled Communities and Local Government Areas**  
*Source: Compiled from Open Street Map Database (2019).*

The region experiences a tropical climate with distinct wet (May–October) and dry (November–April) seasons, receiving peak rainfall of 1000–1500 mm between June and September (Egharevba et al., 2023). Temperatures peak from February to April, reaching up to 36.7°C. The vegetation includes Guinea Savannah with tall grasses and scattered trees, alongside high forest patches and swampy areas near water bodies like the River Niger and Alika Creek (Aigbokhan & Alufohai, 2022). Fertile loamy soils and a high-water table support agriculture, with subsistence farming dominating the economy. Key crops include rice, yam, cassava, maize, and sugarcane, while fishing, hunting, and small-scale palm oil production supplement

livelihoods (Nwali et al., 2024). Agriculture remains central to the region's economy and sustenance.

### Methods

This study utilized a mixed-methods approach to examine the spatial patterns and socioeconomic implications of rice cultivation in the Etsako Region of Edo State, Nigeria. The study area encompasses three Local Government Areas (LGAs): Etsako East, Etsako West, and Etsako Central, which are predominantly rural and known for extensive rice farming activities (Aigbokhan & Alufohai, 2022). A two-stage sampling technique, integrating purposive and systematic random sampling, was employed to ensure a representative sample of rice farmers. Ethical

considerations, including obtaining informed consent and ensuring respondent confidentiality, were strictly adhered to throughout the data collection process.

In the first stage, purposive sampling was used to select two communities from each LGA, resulting in six communities: Agbede and Aviele (Etsako West), Anegbette and Agenebode (Etsako East), and Udochie and Uzaire (Etsako Central). These communities were chosen based on their prominence in rice production, as confirmed through consultations with local agricultural extension officers (Egharevba et al., 2023). In the second stage, systematic random sampling was applied to select rice farmers within these communities. Streets or layouts were identified, and the first residential house in each was selected, followed by every third house. If a selected household had no rice farmer, the next household was approached until a rice farmer was identified. A total of 370 semi-structured questionnaires were distributed to rice farmers across the six communities, with 328 (88.6%) successfully retrieved. The questionnaires collected data on spatial dynamics and socioeconomic impact of rice cultivation in the region. Data was analyzed using descriptive statistics to explain the spatial patterns and socioeconomic impacts (Nwali et al., 2024).

## RESULT AND DISCUSSION

### *Spatial Pattern of Rice Cultivation in Etsako Region*

Studying the spatial pattern of rice cultivation in the Etsako Region, with a focus on the hectares of farmland cultivated between 2015 and 2017, the number of rice planting seasons, and the influence of climate elements, is crucial for understanding the dynamics of agricultural land use and productivity in the area. Findings would reveal trends in farmland expansion or decline, variations in cultivation intensity across different communities, and how climatic factors such as rainfall, temperature, and seasonal changes impact planting cycles and yield outcomes. By examining spatial distribution, policymakers and agricultural planners can identify high- and low-performing areas, allocate resources more efficiently, and develop climate-resilient strategies tailored to local conditions. Additionally, understanding the number of planting seasons provides insight into the region's production capacity and potential for multiple harvests, which is

vital for improving food security and economic planning in the region.

Table 1 presents the frequency distribution of hectares of farmland cultivated for rice in the Etsako Region from 2015 to 2017 across three Local Government Areas (LGAs): Etsako West, Etsako East, and Etsako Central. From Table 1, it can be observed that in 2015, the majority of farmers (81.7%) cultivated 1–2 hectares, with Etsako Central having the highest proportion (91.5%) in this category, followed by Etsako East (85.7%) and Etsako West (63.4%). Only 2.1% of farmers cultivated 3–4 hectares, and 7.3% cultivated 5 hectares or more, with Etsako West showing the highest percentage (9.7%) in the latter category. In 2016, the proportion of farmers cultivating 1–2 hectares increased to 88.7%, with Etsako Central peaking at 98.5%. The percentage of farmers cultivating less than 1 hectare decreased to 1.8%, and those cultivating 3–4 hectares slightly increased to 2.7%. By 2017, the dominance of 1–2 hectares persisted (85.4%), but there was a notable increase in the 3–4 hectares category (5.5%), particularly in Etsako West (17.2%). The proportion of farmers cultivating 5 hectares or more remained relatively stable at 6.7%.

Several factors explain these findings. The predominance of small-scale farming (1–2 hectares) aligns with the subsistence nature of agriculture in the Etsako Region, where limited access to land, capital, and mechanization constrains farm size (Nwali et al., 2024). The slight increase in the 3–4 hectares category by 2017, especially in Etsako West, could be attributed to improved access to agricultural inputs or extension services, which encouraged some farmers to expand cultivation (Egharevba et al., 2023). The consistently low percentage of farmers cultivating less than 1 hectare suggests a trend toward consolidating small plots to achieve economies of scale, possibly driven by market opportunities or government interventions promoting rice production (Ogundipe et al., 2023). The variation across LGAs, with Etsako Central showing the highest reliance on 1–2 hectares, may reflect differences in land availability, soil fertility, or water access, as Etsako Central benefits from proximity to wetlands (Aigbokhan & Alufohai, 2022).

**Table 1: Frequency Distribution of hectares of farmland cultivated from 2015 to 2017 in Etsako Region**

		Hectares of Farmland Planted in 2015 Season				Total
LGA		Less than 1 Hectare	1 - 2 Hectares	3 - 4 Hectares	5 Hectares and Above	
Etsako	Frequency	18	59	7	9	93
West	Percent	19.4%	63.4%	7.5%	9.7%	100.0%
Etsako	Frequency	5	90	0	10	105
East	Percent	4.8%	85.7%	0.0%	9.5%	100.0%
Etsako	Frequency	6	119	0	5	130
Central	Percent	4.6%	91.5%	0.0%	3.8%	100.0%
<b>Total</b>	<b>Frequency</b>	<b>29</b>	<b>268</b>	<b>7</b>	<b>24</b>	<b>328</b>
	<b>Percent</b>	<b>8.8%</b>	<b>81.7%</b>	<b>2.1%</b>	<b>7.3%</b>	<b>100.0%</b>
Hectares of Farmland Planted in 2016 Season						
Etsako	Frequency	5	72	8	8	93
West	Percent	5.4%	77.4%	8.6%	8.6%	100.0%
Etsako	Frequency	0	91	1	13	105
East	Percent	0.0%	86.7%	1.0%	12.4%	100.0%
Etsako	Frequency	1	128	0	1	130
Central	Percent	0.8%	98.5%	0.0%	0.8%	100.0%
<b>Total</b>	<b>Frequency</b>	<b>6</b>	<b>291</b>	<b>9</b>	<b>22</b>	<b>328</b>
	<b>Percent</b>	<b>1.8%</b>	<b>88.7%</b>	<b>2.7%</b>	<b>6.7%</b>	<b>100.0%</b>
Hectares of Farmland Planted in 2017 Season						
Etsako	Frequency	7	60	16	10	93
West	Percent	7.5%	64.5%	17.2%	10.8%	100.0%
Etsako	Frequency	0	92	2	11	105
East	Percent	0.0%	87.6%	1.9%	10.5%	100.0%
Etsako	Frequency	1	128	0	1	130
Central	Percent	0.8%	98.5%	0.0%	0.8%	100.0%
<b>Total</b>	<b>Frequency</b>	<b>8</b>	<b>280</b>	<b>18</b>	<b>22</b>	<b>328</b>
	<b>Percent</b>	<b>2.4%</b>	<b>85.4%</b>	<b>5.5%</b>	<b>6.7%</b>	<b>100.0%</b>

**Source: Authors Fieldwork, 2019**

These findings are consistent with studies on rice cultivation in Nigeria, which highlight the dominance of smallholder farming. For instance, Adeyemo and Olajide (2022) reported that over 80% of rice farmers in Oyo State cultivated less than 2 hectares, citing constraints like land tenure issues and limited credit access, similar to those in Etsako. However, the slight increase in the 3–4 hectares category in Etsako by 2017 contrasts with findings from Ebonyi State, where farm sizes remained static due to persistent land fragmentation (Nwali et al., 2024). This suggests that Etsako farmers may have benefited from localized interventions, such as the Anchor Borrowers' Programme, which provided inputs to expand cultivation (Ogundipe et al., 2023). Unlike studies in

northern Nigeria, where larger farm sizes (5+ hectares) are more common due to mechanization (Zossou et al., 2021), Etsako's low percentage in this category reflects the region's reliance on manual labor and rainfed systems (Egharevba et al., 2023). These comparisons underscore the influence of regional agro-ecological and socioeconomic factors on farm size distribution, highlighting the need for tailored agricultural policies in Etsako to support smallholder expansion and productivity.

#### **Number of Rice Planting Seasons in Etsako Region**

Studying the number of planting seasons in the Etsako Region is important for understanding the agricultural potential and productivity of the area. The number of

planting seasons directly influences how often farmers can cultivate and harvest rice within a year, which affects overall yield, food supply, and household income. It also provides insight into the region's climate suitability for multiple cropping cycles and the capacity of farmers to maximize land use throughout the year. This information is vital for planning resource allocation, improving food security, and guiding

interventions such as irrigation development and extension services that can help farmers take advantage of additional planting opportunities.

Table 2 illustrates the frequency distribution of rice planting seasons among farmers in the Etsako Region, covering Etsako West, Etsako East, and Etsako Central Local Government Areas (LGAs).

**Table 2: Frequency Distribution of Number of Rice Planting Season in Etsako Region**

LGA		Number of Rice Planting Seasons			Total
		One	Two	Three	
Etsako West	Frequency	17	76	0	93
	Percent	18.3%	81.7%	0.0%	100.0%
Etsako East	Frequency	16	84	4	104
	Percent	15.4%	80.8%	3.8%	100.0%
Etsako Central	Frequency	18	105	7	130
	Percent	13.8%	80.8%	5.4%	100.0%
<b>Total</b>	<b>Frequency</b>	<b>51</b>	<b>265</b>	<b>11</b>	<b>327</b>
	<b>Percent</b>	<b>15.6%</b>	<b>81.0%</b>	<b>3.4%</b>	<b>100.0%</b>

*Source: Fieldwork (2019)*

Table 2 revealed that the majority of farmers (81.0%) engaged in two planting seasons annually, with Etsako West having the highest proportion (81.7%), followed closely by Etsako East and Etsako Central (both 80.8%). Approximately 15.6% of farmers planted rice in only one season, with Etsako West showing the highest percentage in this category (18.3%). A small minority (3.4%) managed three planting seasons, primarily in Etsako Central (5.4%) and Etsako East (3.8%), with no farmers in Etsako West reporting three seasons.

The predominance of two planting seasons can be attributed to the region's tropical climate, characterized by a distinct wet season (May–October) that supports two rice cropping cycles, typically aligned with rainfall peaks in June and September (Egharevba et al., 2023). The higher proportion of single-season planting in Etsako West may reflect constraints such as limited access to irrigation, which restricts farming to the primary wet season, or labor shortages that hinder multiple cycles (Nwali et al., 2024). The occurrence of three planting seasons, though rare, is likely facilitated by access to wetlands or supplementary irrigation in parts of Etsako Central and Etsako East, enabling an additional off-season crop (Ogundipe et al., 2023). These findings suggest that agro-ecological conditions

and resource availability significantly influence planting frequency.

The dominance of two planting seasons in Etsako aligns with findings from other rice-producing regions in Nigeria. For instance, Adeyemo and Olajide (2022) reported that 78% of rice farmers in Oyo State practiced two planting seasons, leveraging the bimodal rainfall pattern, similar to Etsako's climate. However, the low prevalence of three planting seasons in Etsako contrasts with studies in northern Nigeria, where irrigation schemes enable up to three rice cycles annually, as noted by Zossou et al. (2021). The 15.6% of Etsako farmers limited to one season is consistent with findings from Ebonyi State, where Nwali et al. (2024) attributed single-season planting to inadequate irrigation and financial constraints, mirroring challenges in Etsako. Unlike regions with advanced irrigation systems, such as Kano State, where multiple cropping is more common (Ogundipe et al., 2023), Etsako's reliance on rainfed systems limits the feasibility of additional seasons. These comparisons highlight the critical role of water management and infrastructure in enhancing planting frequency, suggesting that investments in irrigation could increase rice production in Etsako.

### ***Climatic Elements Affecting Rice Production in Etsako Region***

Studying the climatic elements affecting rice production in the Etsako Region is vital for enhancing agricultural planning, improving crop yield, and promoting sustainable farming practices. Rice is highly sensitive to weather conditions, and key climatic elements such as rainfall, temperature, humidity, and seasonal patterns directly influence planting schedules, growth stages, and harvest outcomes. By understanding how these elements impact rice cultivation, farmers and policymakers can better anticipate risks such as droughts, floods, or heatwaves and implement adaptive

strategies like improved irrigation, drought-resistant rice varieties, and adjusted planting calendars. This knowledge also supports the development of early warning systems, informed decision-making, and long-term agricultural policies that strengthen food security and climate resilience in the region.

Table 3 presents the frequency distribution of climate elements affecting rice production and the extent of their impact in the Etsako Region, covering Etsako West, Etsako East, and Etsako Central Local Government Areas (LGAs).

***Table 3: Distribution of Climatic Elements Affecting Rice Production and Extent of Their Effect Across LGAs in the Etsako Region***

LGA		Climate Element Affecting Rice Production				Total
		Rainfall	Relative Humidity	Hot Sun	Other (specify)	
Etsako West	Frequency	55	34	2	2	93
	Percent	59.1%	36.6%	2.2%	2.2%	100.0%
Etsako East	Frequency	59	45	1	0	105
	Percent	56.2%	42.9%	1.0%	0.0%	100.0%
Etsako Central	Frequency	34	93	3	0	130
	Percent	26.2%	71.5%	2.3%	0.0%	100.0%
<b>Total</b>	<b>Frequency</b>	<b>148</b>	<b>172</b>	<b>6</b>	<b>2</b>	<b>328</b>
	<b>Percent</b>	<b>45.1%</b>	<b>52.4%</b>	<b>1.8%</b>	<b>0.6%</b>	<b>100.0%</b>

***Source: Fieldwork (2019)***

Table 3 revealed that relative humidity (52.4%) and rainfall (45.1%) are the primary climate elements affecting rice production, with Etsako Central reporting

the highest influence of relative humidity (71.5%) and Etsako West the highest for rainfall (59.1%). Sun intensity (1.8%) has minimal impact across all LGAs.

***Table 4: Extent of Effect of Climatic Elements Affecting Rice Production in the Etsako Region***

	LGA			Total
	Etsako West	Etsako East	Etsako Central	
Very High	8	20	17	45
	2.4%	6.1%	5.2%	13.7%
High	50	54	96	200
	15.2%	16.5%	29.3%	61.0%
Low/ Minimal	21	13	10	44
	6.4%	4.0%	3.0%	13.4%
None	14	18	7	39
	4.3%	5.5%	2.1%	11.9%
<b>Total</b>	<b>93</b>	<b>105</b>	<b>130</b>	<b>328</b>
	<b>28.4%</b>	<b>32.0%</b>	<b>39.6%</b>	<b>100.0%</b>

***Source: Fieldwork (2019)***

Table 4 showed the extent of the effect of climatic factors on rice cultivation. Regarding the extent of effect, 61.0% of farmers reported a high impact of climate elements, with Etsako Central showing the highest proportion (29.3%). A very high impact was noted by 13.7% of farmers, while 13.4% reported low/minimal impact, and 11.9% experienced no impact, with Etsako East having the highest percentage of no impact (5.5%) (Egharevba et al., 2023).

The prominence of rainfall and relative humidity as key factors is likely due to Etsako's reliance on rainfed rice cultivation, where adequate rainfall and high humidity are critical for optimal growth, particularly in wetland areas (Aigbokhan & Alufohai, 2022). Etsako Central's high sensitivity to relative humidity may reflect its proximity to water bodies like the River Niger, which sustains moisture levels but also increases vulnerability to humidity-related issues such as fungal diseases (Ogundipe et al., 2023). The high impact reported by most farmers aligns with the region's exposure to climate variability, including erratic rainfall patterns, which disrupts planting and yield (Egharevba et al., 2023). The low impact reported by some farmers, particularly in Etsako East, could be attributed to adaptive practices like using climate-resilient rice varieties or better water management, which mitigate climate effects (Nwali et al., 2024).

These findings are consistent with studies on rice production in Nigeria, which emphasize the critical role of rainfall and humidity in rainfed systems. For example, Adeyemo and Olajide (2022) found that rainfall variability was the primary climate factor affecting rice yields in Oyo State, similar to Etsako's reliance on rainfall. However, the significant influence of relative humidity in Etsako, particularly in Etsako Central, contrasts with findings from northern Nigeria, where temperature and drought are more dominant due to drier conditions (Zossou et al., 2021). The high impact of climate elements reported by 61.0% of

Etsako farmers aligns with research in Ebonyi State, where Nwali et al. (2024) noted that over 65% of farmers experienced significant yield losses due to erratic rainfall. Unlike regions with irrigation infrastructure, such as Kano State, where climate impacts are moderated (Ogundipe et al., 2023), Etsako's limited irrigation explains the pronounced effects of climate elements. These comparisons highlight the need for region-specific interventions, such as improved water management and climate-smart practices, to enhance rice production resilience in Etsako.

### ***Socio-economic Implication of Rice Production for Farmers in Etsako Region***

Studying the socio-economic implications of rice production for farmers in the Etsako Region is essential for understanding how rice farming affects livelihoods, income levels, employment, and overall community development. Rice cultivation serves as a major source of income and food security for many households in the region, and examining its socio-economic impact helps to assess the extent to which it contributes to poverty reduction and rural development. This study also reveals the challenges farmers face, such as limited access to credit, markets, and modern farming inputs, which can hinder their ability to fully benefit from rice production. Additionally, it provides insights into gender roles, labor dynamics, and the distribution of economic gains within farming households and communities. The findings can inform policy interventions and development programs aimed at improving the welfare of rice farmers, promoting inclusive growth, and strengthening the agricultural economy of the Etsako Region.

Table 4 summarizes the income, expenditure, and profit/loss from rice production among farmers in the Etsako Region, covering Etsako West, Etsako East, and Etsako Central Local Government Areas (LGAs)

**Table 5: Income Distribution of Rice Farmers in Etsako Region**

LGA		Less than ₦100,000.00	₦100,001.00 - ₦200,000.00	₦200,001.00 - ₦300,000.00	Above ₦300,000.00	Total
Etsako West	Frequency	4	11	28	50	93
	Percent	1.2%	3.4%	8.5%	15.2%	28.4%
Etsako East	Frequency	3	14	35	53	105
	Percent	0.9%	4.3%	10.7%	16.2%	32.0%
Etsako Central	Frequency	2	17	19	92	130
	Percent	0.6%	5.2%	5.8%	28.0%	39.6%
Total	Frequency	9	42	82	195	328
	Percent	2.7%	12.8%	25.0%	59.5%	100.0%

**Source: Author's Fieldwork, 2019.**

Table 5 revealed that 59.5% of farmers earned above N300,000 in income, with Etsako Central having the highest proportion (28.0%), followed by Etsako East

(16.2%) and Etsako West (15.2%). About 25.0% earned between N200,001 and N300,000, while only 2.7% earned less than N100,000.

**Table 6: Expenditure Among Rice Farmers in Etsako Region**

LGA		Expenditure Category				Total
		Less than N50,000.00	N51,000.00 - N100,000.00	N101,000.00 - N200,000.00	Above N200,000.00	
Etsako West	Frequency	27	61	3	2	93
	Percent	8.2%	18.6%	0.9%	.6%	28.4%
Etsako East	Frequency	28	66	8	3	105
	Percent	8.5%	20.1%	2.4%	0.9%	32.0%
Etsako Central	Frequency	18	98	14	0	130
	Percent	5.5%	29.9%	4.3%	0.0%	39.6%
Total	Frequency	73	225	25	5	328
	Percent	22.3%	68.6%	7.6%	1.5%	100.0%

*Source: Author's Fieldwork, 2019.*

From Table 6 it can be observed that as for expenditure, 68.6% of farmers spent between N51,000 and

N100,000, with Etsako Central reporting the highest percentage (29.9%). Only 1.5% spent above N200,000.

**Table 7: Profit/Loss Among Rice Farmers in Etsako Region**

LGA		Profit/Loss			
		Less than N100,000.00	N100,001.00 - N200,000.00	N200,001.00 - N300,000.00	Above N300,000.00
Etsako West		-23*	-50*	25	48
Etsako East		-25*	-52*	27	50
Etsako Central		-16*	-81*	5	92
<b>Total</b>		<b>-64*</b>	<b>-181*</b>	<b>57</b>	<b>190</b>

*Source: Author's Fieldwork, 2019.*

Regarding profit/loss, Table 7 revealed that 190 farmers reported profits above N300,000, predominantly in Etsako Central (92), while 181 farmers incurred losses between N100,001 and N200,000, with Etsako Central again having the highest number (81).

The high-income levels, particularly in Etsako Central, may be attributed to larger farm sizes, access to fertile wetlands, and multiple planting seasons, which enhance rice yields and market sales (Egharevba et al., 2023). The predominance of moderate expenditure (N51,000–N100,000) reflects the subsistence nature of farming in Etsako, where farmers rely on family labor and minimal inputs to keep costs low (Nwali et al., 2024). The significant number of farmers reporting losses, especially in the N100,001–N200,000 range, could result from climate variability, such as erratic

rainfall, which reduces yields, or high post-harvest losses due to poor storage facilities (Ogundipe et al., 2023). Etsako Central's high profit and loss figures suggest greater engagement in commercial rice farming, increasing both potential gains and risks compared to the other LGAs.

These findings align with studies on rice farming in Nigeria, where income disparities are common due to varying access to resources. Adeyemo and Olajide (2022) reported that 55% of rice farmers in Oyo State earned above N250,000 annually, similar to Etsako's 59.5% earning above N300,000, driven by market access and improved varieties. However, the high losses in Etsako, particularly in Etsako Central, contrast with findings from northern Nigeria, where irrigation reduces climate-related risks, resulting in fewer losses (Zossou et al., 2021). The moderate

expenditure levels in Etsako are consistent with Nwali et al. (2024), who noted that rice farmers in Ebonyi State typically spend less than N100,000 due to limited mechanization, mirroring Etsako's reliance on manual labor. Unlike regions with government-subsidized inputs, such as Kano State, where higher expenditures

correlate with higher profits (Ogundipe et al., 2023), Etsako's low expenditure reflects financial constraints, contributing to losses. These comparisons underscore the need for targeted interventions, such as improved storage and climate adaptation strategies, to enhance profitability in Etsako.

**Table 8: Extent to Which Earnings from Rice Sales Meet Farmers' Needs in the Etsako Region**

Need	Very High (5)	High (4)	Moderate (3)	Low (2)	Very Low (1)	Total	Mean
Education	20 (6.1%)	50 (15.2%)	100 (30.5%)	110(33.5%)	48 (14.6%)	328	2.59
Health	25 (7.6%)	60 (18.3%)	95 (29.0%)	105(32.0%)	43 (13.1%)	328	2.75
Housing/Shelter	40 (12.2%)	80 (24.4%)	120 (36.6%)	65 (19.8%)	23 (7.0%)	328	3.15
Food	90 (27.4%)	120(36.6%)	80 (24.4%)	30 (9.1%)	8 (2.4%)	328	3.78
Clothing	70 (21.3%)	110(33.5%)	90 (27.4%)	40 (12.2%)	18 (5.5%)	328	3.53

**Source: Author's Fieldwork, 2019.**

From Table 8 it can be observed that food (mean = 3.78) and clothing (mean = 3.53) are the needs most adequately met by rice sales, with 64.0% and 54.8% of farmers, respectively, rating satisfaction as High or Very High. This reflects the prioritization of basic necessities, as rice sales provide immediate income for food security and essential clothing, consistent with the subsistence nature of Etsako's agriculture. Housing/shelter (mean = 3.15) shows moderate satisfaction, with 36.6% rating it Moderate, likely because many farmers maintain existing shelters rather than investing in new structures due to limited surplus income. Education (mean = 2.59) and health (mean = 2.75) have the lowest means, with 48.1% and 45.1% of farmers, respectively, rating satisfaction as Low or Very Low. This is likely due to the high costs of school fees, medical care, and limited access to quality services in rural Etsako, compounded by income losses reported by some farmers.

These findings align with studies on smallholder farmers in Nigeria. Nwali et al. (2024) found that rice farmers in Ebonyi State prioritized food and clothing, with over 60% reporting adequate income for these needs, similar to Etsako's high satisfaction rates. However, the low satisfaction for education and health in Etsako mirrors findings by Adeyemo and Olajide (2022), who noted that only 20% of Oyo State farmers could meet educational expenses due to irregular income, a challenge exacerbated in Etsako by climate-related losses (Ogundipe et al., 2023). Unlike northern Nigeria, where irrigation supports higher incomes and better health access (Zossou et al., 2021), Etsako's rainfed systems limit earnings, constraining non-essential needs. The moderate satisfaction with

housing/shelter is consistent with Aigbokhan and Alufohai (2022), who reported that Edo State farmers often rely on inherited or basic shelters, reducing expenditure. These comparisons highlight the need for interventions like subsidized education and healthcare to improve farmers' welfare in Etsako.

## CONCLUSION AND RECOMMENDATIONS

To enhance the spatial dynamics and socioeconomic impacts of rice cultivation in the Etsako Region, targeted interventions are essential. First, policymakers should invest in small-scale irrigation systems, such as shallow tube wells, to extend planting seasons beyond the dominant two-season cycle, particularly in Etsako West, where single-season planting is more prevalent. This can increase yields and stabilize incomes, addressing the high losses reported by farmers. Additionally, agricultural extension services should be strengthened to provide training on climate-smart practices, such as adopting drought-resistant rice varieties, to mitigate the impacts of rainfall and humidity variability. Establishing cooperative storage facilities can reduce post-harvest losses, enabling farmers to sell at better market prices and improve profitability, especially in Etsako Central, where commercial farming is prominent.

Furthermore, socioeconomic challenges, particularly in meeting education and health needs require targeted support. Government and NGOs should introduce subsidized input programs, like the Anchor Borrowers' Programme, to reduce expenditure and boost profits, enabling farmers to allocate more income to non-essential needs. Local governments should also partner with financial institutions to provide low-interest loans,

addressing capital constraints that limit farm expansion beyond 1–2 hectares. Finally, integrating GIS-based land-use planning can optimize spatial patterns by identifying suitable areas for rice cultivation, enhancing productivity across all LGAs. These measures can foster sustainable rice production and improve farmers' livelihoods in Etsako.

This study provided critical insights into the patterns, challenges, and opportunities of rice farming, addressing a significant gap in region-specific agricultural research. By analyzing farm sizes, planting seasons, climate influences, and economic outcomes, the research underscores the dominance of small-scale, rainfed rice cultivation and its variable socioeconomic benefits, particularly in meeting basic needs like food and clothing, while highlighting deficiencies in addressing education and health needs. The findings are highly relevant for informing sustainable agricultural practices and policies that enhance productivity and livelihoods in a region where rice farming is a cornerstone of the economy. The study's emphasis on localized spatial and socioeconomic factors ensures its applicability to Etsako's unique agro-ecological and cultural context, offering a model for similar rural settings in Nigeria.

Legatees of this research include smallholder farmers, who can adopt recommended practices like climate-smart varieties to boost yields and incomes, and policymakers, who can use the data to design targeted interventions such as irrigation schemes and subsidized inputs. Agricultural extension officers and NGOs stand to benefit by leveraging the findings to tailor training programs that address specific constraints like post-harvest losses and limited credit access. Additionally, local communities and government agencies can utilize the spatial analysis to optimize land-use planning, fostering sustainable development. Ultimately, this research empowers stakeholders to strengthen food security, reduce poverty, and improve the socioeconomic well-being of Etsako's farming population, contributing to broader national agricultural goals.

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