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LINKING IRRIGATION PRACTICES TO CROP PRODUCTIVITY AND LIVELIHOOD OUTCOMES IN ODEDA, NIGERIA

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Abstract

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This study examines the relationship between irrigation practices, crop productivity, and livelihood outcomes among arable crop farmers in Odeda Local Government Area of Ogun State, Nigeria. A total of 110 farmers were selected using a simple random sampling technique, and data were collected through structured questionnaires, interviews, and field observations. Data analysis was done using descriptive and inferential statistical techniques. Findings reveal that irrigation in Odeda is dominated by traditional surface irrigation methods, reflecting farmers' preference for low-cost, familiar practices which require minimal technical knowledge. Flood irrigation also shows moderate usage, while modern irrigation systems such as drip, sprinkler, micro, and precision irrigation are rarely used, primarily due to their high costs, limited technical expertise, and infrastructural constraints. Wells and rivers emerged as the most common water sources, emphasizing farmers' reliance on natural, readily accessible water bodies. Major barriers to efficient irrigation include limited access to irrigation equipment, inadequate credit facilities, and insufficient extension support. Despite these constraints, farmers expressed positive perceptions of irrigation, acknowledging its role in stabilizing crop yield, supporting year-round production, enhancing crop quality, and improving household income. The study concludes that improved access to irrigation facilities, credit schemes, and capacity-building programs can significantly enhance irrigation efficiency and agricultural productivity. Strengthened extension services and community-based irrigation initiatives are recommended to promote sustainable water management and improve livelihood outcomes among smallholder farmers in Odeda.

Keywords: *Irrigation Practices, Surface Irrigation, Water Sources, Crop Productivity, Livelihood Outcomes, Odeda LGA.*

Introduction

Agriculture remains a major pillar of Nigeria's economy, contributing significantly to food security, employment generation, and rural livelihoods. The sector provides a source of income for a large proportion of the population, particularly in rural areas where arable crop farming dominates economic activities (Food and Agriculture Organization [FAO], 2020). In southwestern Nigeria, favourable climatic conditions and relatively fertile soils support the cultivation of crops such as maize, cassava, cocoyam, beans, and vegetables. Odeda Local Government Area (LGA) of Ogun State is one of the agriculturally active regions within this zone, where smallholder farmers depend largely on rain-fed and supplementary irrigation systems for crop production.

However, agricultural productivity in Nigeria has increasingly been threatened by climate variability, characterized by irregular rainfall patterns, prolonged dry seasons, and rising temperatures. These changes have resulted in water stress, reduced soil moisture availability, and

increased vulnerability of rain-fed farming systems (Nigerian Meteorological Agency [NiMet], 2022; FAO, 2017). As rainfall becomes less predictable, irrigation has emerged as a critical strategy for stabilizing crop production, reducing the risks associated with drought, and enhancing farmers' resilience to climate-related shocks (Molden *et al.*, 2010).

Irrigation enables farmers to supplement natural rainfall, extend growing seasons, maintain adequate soil moisture, and support crop growth during periods of insufficient precipitation. Its effectiveness, however, depends largely on the type of irrigation technology adopted, the availability and reliability of water sources, farmers' technical knowledge, and access to financial and institutional support (Hussain & Hanjra, 2004). In many parts of Nigeria, including Odeda LGA, irrigation practices remain predominantly traditional and labour-intensive. Surface and flood irrigation methods are widely used due to their low cost, simplicity, and compatibility with local farming knowledge (Akinbile & Yusoff, 2020; Ogunbameru, 2022).

Although modern irrigation systems such as drip and sprinkler irrigation have been shown to improve water-use efficiency, reduce water losses, and enhance crop yields, their adoption among smallholder farmers in Nigeria remains limited. High installation costs, inadequate access to credit facilities, insufficient technical capacity, and weak extension services have been identified as major barriers to the uptake of improved irrigation technologies (Ojo *et al.*, 2021a; Namara *et al.*, 2011). Consequently, many farmers continue to rely on inefficient irrigation practices that limit productivity gains and sustainable water management.

Understanding the types of irrigation practices employed by farmers, the factors influencing their adoption, and their effects on crop productivity and livelihood outcomes is essential for designing targeted interventions aimed at improving agricultural performance. This study therefore examines irrigation practices among arable crop farmers in Odeda LGA, Ogun State, and explores how these practices influence crop productivity and livelihood outcomes. The findings are intended to provide evidence-based recommendations that can support sustainable irrigation development, enhance food security, and strengthen the resilience of smallholder farming households in the study area.

Literature Review

Irrigation and Agricultural Productivity

Irrigation plays a vital role in sustaining agricultural production, particularly in regions experiencing irregular rainfall, prolonged dry seasons, and increasing climate variability. Globally, irrigation has been identified as one of the most effective interventions for enhancing crop yield, stabilizing food production, and reducing vulnerability to climate-induced shocks (Molden *et al.*, 2010; Hussain & Hanjra, 2004). By ensuring timely and adequate water supply, irrigation supports continuous crop growth, improves nutrient uptake, and enhances overall farm productivity.

In sub-Saharan Africa, where agriculture is predominantly rain-fed, irrigation has been shown to significantly improve crop performance and household food security, especially among smallholder farmers (Burney *et al.*, 2013). Despite its benefits, the extent of irrigation development in the region remains limited, with many farmers relying on rudimentary methods that are constrained by low efficiency and high labour demand (Namara *et al.*, 2011).

Traditional Irrigation Practices among Smallholder Farmers

Traditional irrigation practices dominate smallholder farming systems in many developing countries, including Nigeria. Surface and flood irrigation methods are widely used due to their simplicity, low capital requirements, and reliance on locally available tools and water sources (Akinbile & Yusoff, 2020; Ogunbameru, 2022). These methods typically involve manual water application using buckets, watering cans, or shallow channels that convey water from nearby sources to cultivated plots.

Although traditional irrigation systems enable farmers to engage in dry-season farming and off-season crop production, they are often characterized by low water-use efficiency, uneven water distribution, and substantial water losses through runoff and evaporation (Xie *et al.*, 2014). Consequently, these inefficiencies may limit potential yield gains and exacerbate water scarcity, particularly during periods of reduced water availability.

Adoption of Modern Irrigation Technologies

Modern irrigation technologies such as drip, sprinkler, and micro-irrigation systems have been widely recognized for their ability to improve water-use efficiency and enhance crop productivity. Studies have shown that drip irrigation, in particular, can significantly reduce water losses while increasing crop yield and fertilizer-use efficiency (Van der Pol & Irmak, 2018). Similarly, sprinkler irrigation systems provide more uniform water application, leading to improved crop growth and yield stability (Daggupati *et al.*, 2017).

Despite these advantages, the adoption of modern irrigation technologies among smallholder farmers in Nigeria remains relatively low. Several studies attribute this to high installation and maintenance costs, limited access to credit facilities, inadequate technical knowledge, and weak extension services (Ojo *et al.*, 2021a; Namara *et al.*, 2011). Socio-economic factors such as farmers' income level, education, farm size, and access to institutional support also play a significant role in shaping adoption decisions (Akinbile & Yusoff, 2020).

Water Sources and Availability for Irrigation

Access to reliable water sources is a critical determinant of irrigation practices. In rural farming communities, wells, rivers, streams, and seasonal ponds constitute the primary sources of irrigation water (Molden *et al.*, 2010). While these natural water bodies provide relatively low-cost options for irrigation, their availability is often subject to seasonal fluctuations, particularly during the dry season when water tables decline and river flows are reduced.

Dependence on such sources exposes farmers to water scarcity risks, which can adversely affect crop productivity and limit the expansion of irrigation activities (FAO, 2017). Effective water management strategies and improved access to irrigation infrastructure are therefore essential for sustaining agricultural production under changing climatic conditions.

Irrigation and Livelihood Outcomes

Beyond crop productivity, irrigation has been widely associated with improved livelihood outcomes among farming households. Empirical studies indicate that irrigation contributes to increased farm income, enhanced food availability, employment generation, and poverty reduction (Hussain & Hanjra, 2004; Rani *et al.*, 2019). By enabling multiple cropping seasons

Odeda LGA is predominantly rural, and farming constitutes the main occupation of its residents. Arable crops commonly cultivated include maize, cassava, cocoyam, vegetables, and legumes. Water resources in the area include shallow wells, rivers, streams, and seasonal ponds, which support smallholder irrigation activities during periods of reduced rainfall. These characteristics make the area suitable for examining irrigation practices and their effects on crop productivity and livelihoods.

A descriptive survey research design was adopted for this study. Descriptive survey designs are widely used in agricultural and rural livelihood studies to assess existing practices, perceptions, and constraints among farming populations (Ogunbameru, 2022). This design was considered appropriate because it allows for systematic collection of data on irrigation practices and their perceived effects without manipulating study variables.

Population and Sampling Technique

The target population comprised arable crop farmers who were actively involved in irrigation practices across selected villages in Odeda LGA. Both registered and non-registered farmers were included to ensure broad representation of irrigation activities within the study area. A simple random sampling technique was employed to select respondents, thereby giving all eligible farmers an equal chance of participation and minimizing selection bias (Creswell & Creswell, 2018).

A total of one hundred and ten (110) farmers were selected based on a sampling frame developed during preliminary reconnaissance visits to farming communities within the study area. The sample size was considered adequate for descriptive and inferential analysis in line with similar irrigation and livelihood studies conducted in rural settings.

Data Collection Methods

Primary data for the study were collected using a combination of structured questionnaires, interviews, and field observations to enhance data reliability through triangulation. The structured questionnaire was designed to capture information on respondents' socio-economic characteristics, types of irrigation practices employed, sources of irrigation water, irrigation equipment used, challenges encountered, and perceived effects of irrigation on crop productivity and livelihood outcomes.

In addition to questionnaire administration, face-to-face interviews were conducted with selected farmers to obtain deeper insights into irrigation practices and challenges that were not fully captured through the questionnaires. The interviews were semi-structured and focused on farmers' experiences with irrigation, seasonal water availability, constraints to adopting modern irrigation technologies, and perceived benefits of irrigation for crop yield and income. The use of interviews in agricultural research is widely recommended for capturing contextual and experiential information (Bryman, 2016).

Field observations were also carried out during farm visits to validate information provided by respondents. Observations focused on the physical condition of irrigation sites, types of irrigation methods in use, water sources, irrigation tools and equipment, and general farm management practices. Observational data helped confirm the dominance of traditional irrigation systems and assess the level of mechanization and water management among farmers.

Data Analysis

Data collected from questionnaires were coded and analyzed using descriptive and inferential statistical techniques. Descriptive statistics such as frequencies, percentages, means, and standard deviations were used to summarize respondents' socio-economic characteristics, irrigation practices, and perceived effects. Inferential statistics were applied where necessary to examine relationships between irrigation practices and selected livelihood outcomes. The use of descriptive and inferential statistics is consistent with standard analytical approaches in agricultural and social science research (Field, 2018). Results were presented using tables and figures to enhance clarity and interpretation.

Results and Discussion

Socio-Economic Characteristics of Respondents

A total of 110 farmers participated in the study. The results show that irrigation activities in Odeda LGA are dominated by men, although women also participate actively in small-scale vegetable and arable crop irrigation. Most respondents were within the economically active age range and had varying levels of formal education, which supported their ability to participate in irrigation and related farm activities. Farming experience ranged from less than 5 years to over 20 years, indicating that both new and established farmers were involved in irrigation practices. Household sizes were generally moderate, suggesting availability of family labour to support farm operations.

Table 1: Socio-Economic Characteristics of Respondents

Variables	Frequency	Percentage	Mean
Sex			
Male	70	63.6	
Female	40	36.4	
Age			46.62
Household Size	110		6.48
Farm Size	110		1.145
Income	110		4.60E5
Farm Experience	110		15.88
Educational Level			
No Formal Education	35	31.8	
Primary Education	35	31.8	
Secondary Education	24	21.8	
Tertiary Education	16	14.5	

Types of Irrigation Systems Used in the Study Area

The results show that irrigation in Odeda is predominantly manual and traditional. As shown in Figure 2, surface irrigation was the most widely used irrigation method among respondents. This system is favoured for its simplicity, low financial requirement, and reliance on locally available tools. Flood irrigation was also practiced to a moderate extent, while modern irrigation systems such as drip, sprinkler, and micro-irrigation were rarely used. This pattern reflects farmers' preference for irrigation methods that are simple, low-cost, and compatible with existing knowledge and available resources. Similar dominance of traditional irrigation systems among smallholder farmers has been widely reported in Nigeria and other parts of sub-Saharan Africa (Akinbile & Yusoff, 2020; Ogunbameru, 2022; Namara *et al.*, 2011).

The limited use of modern irrigation technologies can be attributed to financial and technical constraints. High installation and maintenance costs, inadequate access to credit facilities, and insufficient technical expertise were major barriers reported by respondents. These findings align with earlier studies that identified financial limitations and weak extension services as significant obstacles to the adoption of improved irrigation technologies among smallholder farmers (Ojo *et al.*, 2021a; Burney *et al.*, 2013).

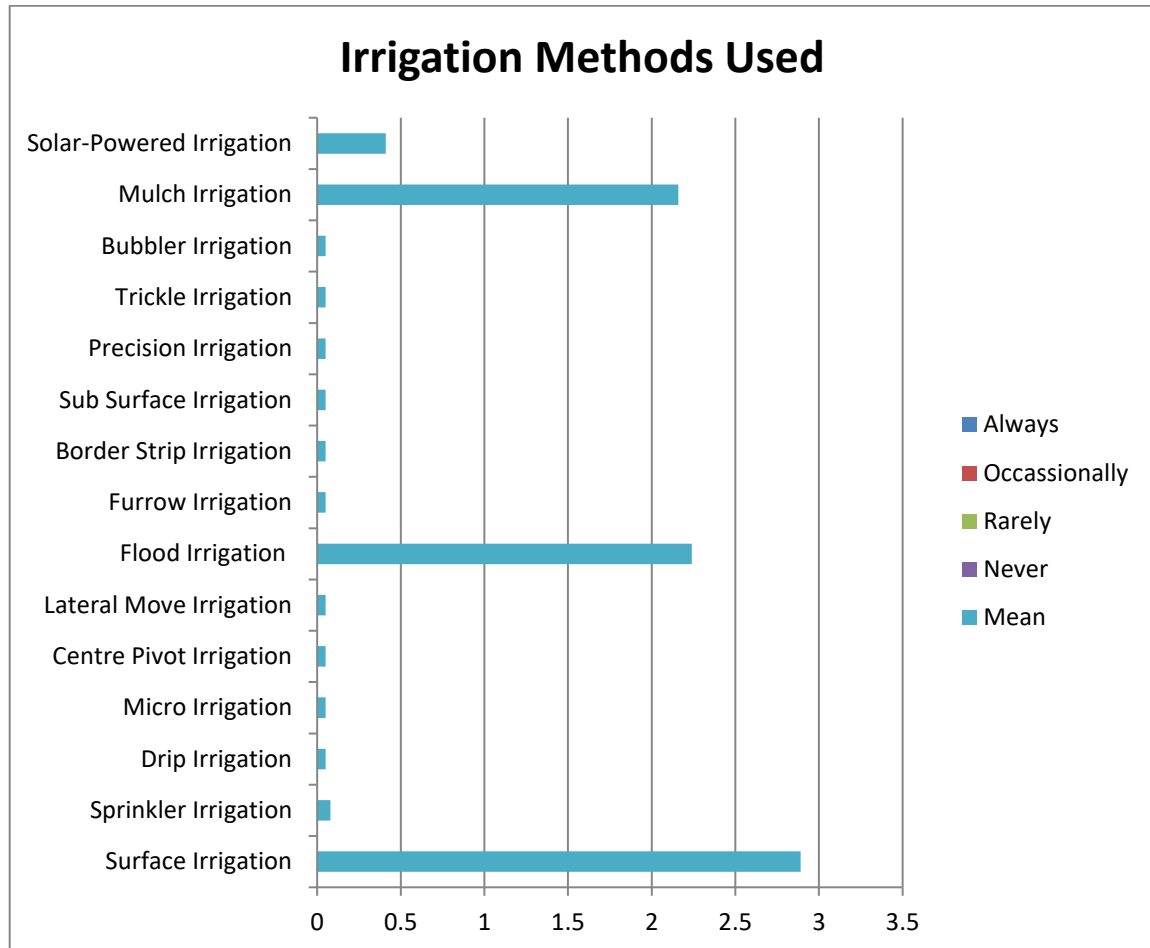


Figure 2: Types of Irrigation Methods Used by Respondents

Sources of Water for Irrigation

The results (Figure 3) also reveal that farmers depend primarily on wells and rivers as their main water sources. These sources are easily accessible and relatively reliable during both rainy and dry seasons. Streams, ponds, and rainfall harvesting were also mentioned but used were less used. Heavy reliance on natural water bodies highlights vulnerability to seasonal water scarcity. Previous studies have similarly emphasized that reliance on natural water sources makes smallholder irrigation systems highly vulnerable to climatic and hydrological variability (Molden *et al.*, 2010; FAO, 2017).

Seasonal water scarcity limits the reliability and intensity of irrigation activities and may constrain farmers’ ability to achieve optimal crop productivity. Improving access to water storage facilities and efficient water management practices is therefore essential for enhancing irrigation sustainability in the study area.

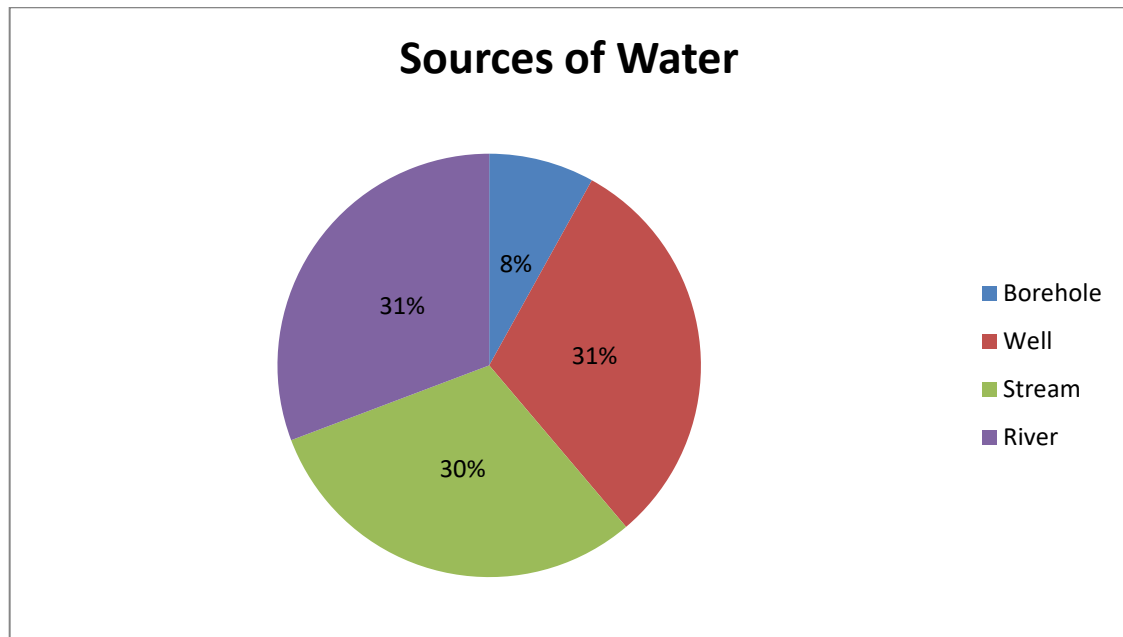


Figure 3: Sources of Water for Irrigation

Irrigation Equipment and Tools Used

Farmers commonly used traditional, readily available tools such as watering cans, buckets, shovels, galleries (channels), and ridges. Very few respondents had access to pumps or mechanized irrigation equipment. The limited adoption of modern tools was attributed to high costs and lack of financial support as seen in Table 2. These constraints have been widely documented in smallholder irrigation systems across developing regions, where lack of access to affordable irrigation infrastructure hampers productivity gains (Hussain & Hanjra, 2004; Namara *et al.*, 2011).

In addition, respondents reported limited access to extension services, which further restricts their exposure to improved irrigation practices and technologies. Extension services play a crucial role in disseminating knowledge on efficient water management and facilitating technology adoption (Akinbile & Yusoff, 2020). Strengthening extension support could therefore enhance farmers' capacity to adopt more efficient irrigation systems.

Table 2: Irrigation Equipment and Tools Used

S/N	Factors	Major Factor	Minor Factor	Not Factor	Mean
1	Access to Extension	4(3.6)	105(95.5)	1(0.9)	1.03
2	Access to Water	78(70.1)	32(29.1)		1.71
3	Access to Credit		110(100)		1.00
4	Availability of Irrigation Facility		110(100)		2.00

Challenges Affecting Irrigation Practices

Despite the constraints encountered, farmers expressed generally positive perceptions of irrigation practices (Table 3). Most respondents agreed that irrigation increases crop yield, enables off-season farming, improves crop quality, and enhances household income. These perceptions are consistent with empirical evidence indicating that irrigation significantly improves agricultural productivity and livelihood outcomes among smallholder farmers (Hussain & Hanjra, 2004; Rani *et al.*, 2019).

The ability to engage in dry-season and multiple cropping was perceived as particularly important for income stability and food security. Irrigation also enabled farmers to respond more effectively to changing weather patterns and climate variability, thereby enhancing resilience. Similar positive relationships between irrigation, yield stability, and livelihood improvement have been reported in previous studies conducted in developing regions (Burney *et al.*, 2013; Molden *et al.*, 2010).

Table 3: Perceived Effects of Irrigation Activities on Farmers' Crop Yield

S/N	Perceived Effects	SA	A	U	D	Mean
1	Irrigation increases crop yield by ensuring consistent moisture level	66(60.0)	26(23.6)	13(11.8)	5(4.5)	4.39
2	With irrigation, I can grow crops even in dry or drought-prone area	66(60.0)	26(23.6)	13(11.8)	5(4.5)	4.39
3	Irrigation reduces crop stress, leading to healthier and more robust plants	53(48.2)	26(23.6)	26(23.6)	5(4.6)	4.15
4	I can grow multiple crops per season using irrigation, increasing overall yield	53(48.2)	26(23.6)	26(23.6)	5(4.6)	4.27
5	Irrigation helps to maintain consistent quality and appearance of my crops	66(60.0)	13(11.8)	26(23.6)	5(4.5)	4.27
6	Irrigation reduces the risk of crop failure due to water scarcity	52(47.3)	27(24.5)	26(23.6)	5(4.5)	4.15
7	I can plant crops earlier and harvest them later using irrigation, extending the growing season	52(47.3)	27(24.5)	26(23.6)	5(4.5)	4.15
8	Irrigation allows me to grow a wider variety of crops, including those that require more water	79(71.8)	13(11.8)	13(11.8)	5(4.5)	4.51
9	Irrigation increases the market value of my crops due to improved quality and consistency	79(71.8)	13(11.8)	14(12.7)	4(3.6)	4.52
10	With irrigation, I can meet the increasing demand for crops and improve my livelihood	79(71.8)	13(11.8)	14(12.7)	3(2.7)	4.51
11	Irrigation helps me to reduce soil erosion and nutrient depletion	52(47.3)	26(23.6)	28(25.5)	3(2.7)	4.14
12	Irrigation enables me to use fertilizers and pesticides more efficiently	52(47.3)	26(23.6)	28(25.5)	3(2.7)	4.14
13	Irrigation improves crop root development, leading to better nutrient uptake	52(47.3)	26(23.6)	28(25.5)	3(2.7)	4.14
15	With irrigation, I can adapt to changing weather patterns and climate variability	52(47.3)	26(23.6)	15(13.6)	16(14.5)	4.02

Relationship between Irrigation Practices and Crop Productivity

The findings demonstrate a positive relationship between irrigation practices and crop productivity in the study area. Farmers who practiced continuous or seasonal irrigation reported higher productivity compared to those relying solely on rainfall. Effective water management was associated with improved crop growth, yield stability, and market supply. These results support the widely recognized role of irrigation as a key driver of agricultural growth and rural livelihood enhancement (FAO, 2017; Hussain & Hanjra, 2004).

Overall, the results suggest that while traditional irrigation practices currently sustain agricultural production in Odeda LGA, significant improvements in productivity and water-use efficiency could be achieved through improved access to modern irrigation technologies, credit facilities, and extension services.

Conclusion and Recommendations

This study examined irrigation practices among arable crop farmers in Odeda Local Government Area, Nigeria, and explored how these practices impact crop productivity and livelihood results. The results show that traditional irrigation systems particularly surface and flood irrigation dominated in the study area irrigation because of their simplicity, low cost, and compatibility with farmers' existing knowledge. Modern irrigation methods remain largely unused despite their higher water-use efficiency, due to financial constraints, inadequate technical capacity, and limited institutional support.

Farmers rely primarily on wells and rivers as water sources, making them prone to seasonal fluctuations in water availability. The study also identified major challenges affecting irrigation practices, including insufficient access to irrigation equipment, lack of credit facilities, and inadequate extension services. Nevertheless, farmers generally perceive irrigation positively, recognizing its potential to enhance crop yield, improve income, and strengthen household food security.

Overall, the findings confirm that irrigation plays a crucial role in supporting agricultural productivity and livelihood resilience in Odeda. However, unlocking its full potential requires targeted interventions that address infrastructural and institutional gaps.

Based on the findings of this study, it is recommended that farmers' access to modern irrigation technologies be seriously improved through government and private-sector support, most especially by providing subsidized or low-cost options for efficient systems such as drip and sprinkler irrigation. Establishment of credit and financial support mechanisms is also essential; microfinance institutions, cooperatives, and agricultural loan schemes should offer affordable financing options to enable farmers to invest in irrigation facilities. In addition, extension services should be promoted so that farmers receive regular training on irrigation management, water conservation, and equipment maintenance, thereby improving their technical know-how. Community-based irrigation initiatives should also be encouraged, as collaborative approaches such as shared wells, rehabilitated water channels, and group-based water management can reduce individual costs and improve water availability. Furthermore, farmers should adopt climate-resilient water strategies, including rainwater harvesting, shallow tube wells, and small-scale water storage systems, to cushion the effects of seasonal water shortages. Finally, policy interventions at both the local and state levels are required to mainstream smallholder irrigation development into agricultural plans, ensuring long-term investment in irrigation infrastructure and sustainable water management.

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