Sapientia Global Journal of Arts, Humanities and Development Studies (SGOJAHDS), Vol.9 No.1 March, 2026; pg. 291 – 304; ISSN: 2695-2319 (Print); ISSN: 2695-2327 (Online)

HARNESSING NIGERIA'S INLAND WATERWAYS FOR AGRICULTURAL PRODUCTIVITY: THE ROLE OF AGRICULTURAL COOPERATIVES IN ACTIVATING THE NIGER–BENUE RIVER SYSTEM

IGBA EDWARD AONDONA
Co-op. Economics & Mgt, Department, Nnamdi Azikiwe University Awka-Nigeria

FRANCIS-OKORIE, DESIRE AMAKA
Abia State College of Education, (Technical), Arochukwu-Nigeria

DR. FRANCIS O. OKORIE
fo.okorie@stu.unizik.edu.ng,

Abstract

This study examined the role of agricultural cooperatives in harnessing Nigeria's inland waterways to enhance agricultural productivity within the Niger–Benue Basin. The study was anchored on the Institutional Theory and the Theory of Production. Specifically, it assessed the extent to which the utilization of inland waterways and participation in agricultural cooperatives influence resource-use efficiency and crop yield among smallholder farmers. A descriptive survey research design was adopted for the study. Data were collected from 400 randomly selected members of agricultural cooperatives across Kogi, Benue, Anambra, and Delta States using a structured questionnaire. The data obtained were analyzed using descriptive statistics, multiple regression analysis, and Data Envelopment Analysis (DEA). Findings obtained in March 2026 revealed that inland waterways utilization had a positive and significant effect on resource-use efficiency ($\beta = 0.412$, $p < .001$) and crop yield ($\beta = 0.387$, $p < .001$). The study further showed that participation in agricultural cooperatives significantly mediated this relationship, as members of active cooperatives recorded 28.4% higher mean crop yield compared to non-members. Major constraints identified included poor river-port infrastructure, inadequate barge facilities, and limited access to credit. The study concludes that integrating agricultural cooperatives into inland waterways development can significantly improve agricultural productivity and resource-use efficiency in the Niger–Benue Basin. The study therefore recommends increased government investment in river-port infrastructure, expansion of cooperative-led logistics systems, and improved access to agricultural financing in order to unlock the economic potential of Nigeria's inland waterways.

Keywords: inland waterways, agricultural cooperatives, agricultural productivity, resource-use efficiency, Niger–Benue River System.

INTRODUCTION

1.1 Background to the Study

Agriculture remains an important sector of the Nigerian economy, contributing to food production, employment, and rural development (Food and Agriculture Organization [FAO], 2023). However, agricultural productivity in Nigeria is still low due to poor transportation systems, inadequate storage facilities, and limited market access (Adebayo & Olagunju, 2022).

Nigeria possesses extensive inland waterways, especially the Niger and Benue rivers, which connect major agricultural regions and support transportation and trade (National Inland Waterways Authority [NIWA], 2023). Inland water transportation is cheaper and more suitable for moving bulky agricultural produce over long distances than road transportation (World Bank, 2022). Effective utilization of inland waterways can reduce transportation costs, minimize post-harvest losses, and improve market accessibility for farmers (Eze & Nwachukwu, 2021).

Agricultural cooperatives also play important roles in rural development by helping farmers access credit facilities, transportation services, farm inputs, and market information (International Cooperative Alliance [ICA], 2022). Through collective action, cooperatives can facilitate inland water transportation and improve agricultural productivity.

Despite the potential benefits of inland waterways, they remain underutilized due to poor infrastructure, inadequate dredging, insufficient vessels, and weak government support (Okoro & Ibrahim, 2021). Many farming communities along the Niger–Benue River system still face transportation difficulties that limit productivity and market access (Umeh & Adeyemi, 2023).

It is against this background that this study examines the role of agricultural cooperatives in harnessing Nigeria's inland waterways for improved agricultural productivity within the Niger–Benue River system.

1.2 Statement of the Problem

Nigeria has vast inland waterways capable of supporting agricultural transportation and rural development. However, the Niger–Benue River system remains underutilized for agricultural purposes. Many farmers still depend on poorly maintained roads for transporting farm produce, resulting in high transportation costs, post-harvest losses, and reduced profitability (Adebayo & Olagunju, 2022).

Poor inland waterways infrastructure, including inadequate dredging, limited river ports, and insufficient cargo vessels, has hindered effective transportation across riverine communities (NIWA, 2023). These challenges negatively affect agricultural productivity and market accessibility.

Agricultural cooperatives are expected to help farmers organize transportation systems and improve access to logistics services. However, many cooperatives lack adequate financial and institutional support to effectively participate in inland waterways development (Akinwale & Yusuf, 2020).

Although previous studies have examined agricultural productivity and cooperative development, limited attention has been given to the role of agricultural cooperatives in utilizing inland waterways within the Niger–Benue River system. This study therefore seeks to fill this gap by examining how agricultural cooperatives can enhance inland waterways utilization for improved agricultural productivity.

1.3 Purpose of the Study

The main purpose of this study is to examine the role of agricultural cooperatives in harnessing Nigeria's inland waterways for enhanced agricultural productivity within the Niger–Benue River system.

Specifically, the study seeks to:

1. determine the effect of inland waterways utilization on agricultural productivity among smallholder farmers in the Niger–Benue Basin;
2. examine the influence of inland waterways utilization on resource-use efficiency among agricultural cooperative members;
3. assess the role of agricultural cooperatives in facilitating the utilization of inland waterways for agricultural activities;
4. determine the relationship between cooperative participation and crop yield among smallholder farmers; and
5. identify the major constraints affecting the effective utilization of inland waterways for agricultural productivity in the study area.

1.4 Research Questions

The following research questions guided the study:

1. What effect does inland waterways utilization have on agricultural productivity among smallholder farmers in the Niger–Benue Basin?
2. To what extent does inland waterways utilization influence resource-use efficiency among agricultural cooperative members?
3. What role do agricultural cooperatives play in facilitating the utilization of inland waterways for agricultural activities?
4. What relationship exists between cooperative participation and crop yield among smallholder farmers?
5. What are the major constraints affecting the effective utilization of inland waterways for agricultural productivity in the study area?

1.5 Research Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

Ho_1: Inland waterways utilization has no significant effect on agricultural productivity among smallholder farmers in the Niger–Benue Basin.

Ho_2: Inland waterways utilization has no significant influence on resource-use efficiency among agricultural cooperative members.

Ho_3: Agricultural cooperative participation has no significant relationship with crop yield among smallholder farmers.

Ho_4: Agricultural cooperatives do not significantly mediate the relationship between inland waterways utilization and agricultural productivity.

1.6 Significance of the Study

This study is significant to farmers, agricultural cooperatives, government agencies, policymakers, researchers, and development organizations. It will help farmers understand the benefits of inland waterways in reducing transportation costs and improving agricultural productivity, as well as highlight the importance of cooperative participation in accessing logistics services.

Agricultural cooperatives will gain insights into improving collective transportation systems and increasing members' productivity, while government agencies such as NIWA and the Federal Ministry of Agriculture will use the findings to strengthen policies on inland waterways and rural development. Policymakers will also benefit from evidence to guide investment decisions in transport infrastructure.

In addition, the study will contribute to existing literature on inland waterways and agricultural development in Nigeria and serve as a reference for future research.

1.7 Scope of the Study

This study focused on harnessing Nigeria's inland waterways for agricultural productivity, with emphasis on the role of agricultural cooperatives in activating the Niger–Benue River system. Geographically, the study covered selected states located along the Niger–Benue Basin, namely Kogi, Benue, Anambra, and Delta States.

The study specifically examined the effect of inland waterways utilization on agricultural productivity, resource-use efficiency, and crop yield among smallholder farmers. It also investigated the role of agricultural cooperatives and the constraints affecting effective inland waterways utilization for agricultural purposes.

The study was limited to registered agricultural cooperative members involved in farming activities within the selected states.

REVIEW OF RELATED LITERATURE

2.1 Conceptual Review

Inland Waterways and Agricultural Productivity

Inland waterways refer to navigable rivers, canals, creeks, and lakes used for transportation and economic activities within a country (National Inland Waterways Authority [NIWA], 2023). Nigeria possesses extensive inland waterways, particularly the Niger and Benue rivers, which connect major agricultural regions and support transportation, trade, and rural development (Okoro & Ibrahim, 2021).

The use of inland waterways is important for agricultural productivity because it reduces transportation costs, minimizes post-harvest losses, and improves access to markets (World Bank, 2022). Farmers in riverine areas can transport bulky products such as rice, cassava, yam, fish, and vegetables more efficiently through waterways than through poorly maintained road networks.

Agricultural productivity refers to the efficiency with which agricultural inputs are transformed into output (Food and Agriculture Organization [FAO], 2023). Productivity improvement is essential for food security, income generation, and economic growth. Efficient transportation systems contribute significantly to productivity by enabling timely movement of farm produce and reducing operational costs (Adebayo & Olagunju, 2022).

However, Nigeria's inland waterways remain underutilized due to inadequate dredging, poor river port infrastructure, insufficient vessels, insecurity, and weak policy

implementation (Umeh & Adeyemi, 2023). These challenges limit the contribution of inland waterways to agricultural development.

Agricultural Cooperatives and Resource-Use Efficiency

Agricultural cooperatives are voluntary associations formed by farmers to achieve common economic and production objectives through collective action (International Cooperative Alliance [ICA], 2022). Cooperatives assist members in accessing credit facilities, farm inputs, transportation services, and market information.

Agricultural cooperatives improve rural development by reducing operational costs and strengthening farmers' bargaining power (Akinwale & Yusuf, 2020). Through cooperative participation, farmers can organize collective transportation systems, share logistics facilities, and access larger markets.

Resource-use efficiency refers to the effective utilization of available resources to maximize output at minimum cost. Efficient transportation systems improve resource-use efficiency by reducing wastage, delays, and transportation expenses (Adebayo & Olagunju, 2022). Inland waterways and cooperative participation therefore contribute significantly to agricultural productivity and efficient resource management.

2.2 Theoretical Framework

This study is anchored on the Institutional Theory and the Theory of Production.

Institutional Theory

Institutional Theory was propounded by Meyer and Rowan (1977). The theory explains how institutions, policies, and organizational structures influence economic activities and organizational performance.

The theory is relevant to this study because agricultural cooperatives and government agencies serve as institutional mechanisms for promoting inland waterways development. Effective institutional support can improve transportation systems, resource accessibility, and agricultural productivity.

Theory of Production

The Theory of Production explains the relationship between production inputs and output. According to Samuelson and Nordhaus (2019), output depends on the efficient combination of resources such as labor, capital, land, transportation, and technology.

The theory is relevant because inland waterways and cooperative participation are important production-support inputs capable of improving crop yield, reducing transportation costs, and increasing agricultural productivity.

2.3 Empirical Review

Several studies have examined transportation systems, agricultural cooperatives, and agricultural productivity.

Akinwale and Yusuf (2020) found that cooperative membership improved farmers' access to transportation facilities, market information, and credit services in Nigeria.

Eze and Nwachukwu (2021) reported that inland waterways significantly reduced transportation costs and post-harvest losses among farmers in riverine communities.

Okoro and Ibrahim (2021) identified inadequate dredging, poor navigation systems, and insufficient river ports as major challenges affecting inland water transportation in Nigeria.

Adebayo and Olagunju (2022) revealed that efficient transportation infrastructure positively influenced agricultural productivity and crop output.

Umeh and Adeyemi (2023) observed that poor transportation infrastructure contributed to delays in agricultural produce delivery and increased post-harvest losses.
Although previous studies have examined transportation and agricultural productivity, limited attention has been given to the role of agricultural cooperatives in harnessing inland waterways within the Niger–Benue River system. This study therefore fills the identified gap.

2.4 Summary of Literature Reviewed

- Inland waterways improve agricultural productivity by reducing transportation costs, improving market access, and reducing post-harvest losses.
- Agricultural cooperatives support rural development by providing access to transportation, credit, logistics services, and markets.
- Institutional Theory and Theory of Production explain the relationship between inland waterways, cooperatives, and agricultural productivity.
- Empirical studies show positive relationships among transportation infrastructure, cooperatives, and agricultural productivity.
- Limited studies exist on the role of agricultural cooperatives in activating the Niger–Benue River system.
- The identified gap justifies the present study.

RESEARCH METHOD

3.1 Research Design

This study adopted a descriptive survey research design. The design was considered appropriate because it enabled the researcher to collect data from agricultural cooperative members regarding inland waterways utilization and agricultural productivity without manipulating any variables. The design also facilitated the examination of relationships among the variables under study.

3.2 Area of the Study

The study was conducted in selected states within the Niger–Benue River Basin, namely Kogi, Benue, Anambra, and Delta States, Nigeria. These states were selected because they are strategically located along the Niger and Benue rivers and are actively involved in agricultural production and inland water transportation activities.

The major occupations of residents in these areas include farming, fishing, trading, and transportation. Agricultural activities commonly practiced include rice farming, cassava cultivation, yam production, fishing, and vegetable farming.

3.3 Population of the Study

The population of the study comprised all registered agricultural cooperative members in selected riverine communities within Kogi, Benue, Anambra, and Delta States. According to records obtained from the respective state cooperative departments and agricultural agencies, the estimated population consisted of 5,240 registered cooperative farmers.

3.4 Sample and Sampling Technique

A sample size of 400 respondents was used for the study. The sample size was determined using Taro Yamane's formula for finite populations.

A multi-stage sampling technique was adopted. First, four states located within the Niger–Benue Basin were purposively selected. Second, riverine local government areas were selected from each state. Third, agricultural cooperatives were randomly selected from the identified communities. Finally, simple random sampling technique was used to select respondents from the cooperatives.

3.5 Instrument for Data Collection

The instrument used for data collection was a structured questionnaire titled *Inland Waterways and Agricultural Productivity Questionnaire (IWAPQ)*.

The questionnaire was divided into two sections:

- Section A contained respondents' demographic information such as gender, age, educational qualification, farming experience, and cooperative membership status.
- Section B contained items related to inland waterways utilization, agricultural productivity, cooperative participation, and constraints affecting inland waterways development.

The questionnaire items were structured on a four-point Likert scale of:

- Strongly Agree (SA) – 4 points
- Agree (A) – 3 points
- Disagree (D) – 2 points
- Strongly Disagree (SD) – 1 point

3.6 Validation of the Instrument

The instrument was subjected to face and content validation by three experts: one expert in Agricultural Economics, one expert in Cooperative Economics, and one expert in Measurement and Evaluation. Their observations and corrections were incorporated into the final version of the questionnaire to ensure clarity, relevance, and adequacy of the instrument.

3.7 Reliability of the Instrument

The reliability of the instrument was determined using the Cronbach Alpha reliability method. A pilot study was conducted using 30 agricultural cooperative members outside the study area. The data obtained were analyzed, and a reliability coefficient of 0.84 was obtained, indicating that the instrument was reliable for the study.

3.8 Method of Data Collection

The researcher administered the questionnaire personally with the assistance of four trained research assistants. The direct delivery method was adopted to ensure high return rate and proper explanation of questionnaire items where necessary.

3.9 Method of Data Analysis

Data collected for the study were analyzed using descriptive and inferential statistics. Research questions were answered using mean and standard deviation, while the hypotheses were tested using multiple regression analysis at 0.05 level of significance. Data Envelopment Analysis (DEA) was also employed to determine resource-use efficiency among respondents. The decision rule for the Likert scale items was based on a criterion mean of 2.50. Any item with a mean score of 2.50 and above was regarded as agreed, while items below 2.50 were regarded as disagreed.

DATA PRESENTATION, ANALYSIS, AND DISCUSSION OF FINDINGS

4.1 Presentation of Data

This section presents the analysis of data collected from respondents on the role of agricultural cooperatives in harnessing Nigeria's inland waterways for agricultural productivity within the Niger–Benue River System. A total of 400 questionnaires were distributed to respondents across Kogi, Benue, Anambra, and Delta States. Out of the 400 questionnaires administered, 386 were properly completed and returned, representing a return rate of 96.5%.

The data were analyzed using mean, standard deviation, multiple regression analysis, and Data Envelopment Analysis (DEA). The presentation was based on the research questions and hypotheses formulated for the study.

4.2 Demographic Characteristics of Respondents

Table 4.1: Distribution of Respondents According to Gender

Gender	Frequency	Percentage (%)
Male	228	59.1
Female	158	40.9
Total	386	100

Table 4.1 shows that 228 respondents representing 59.1% were male, while 158 respondents representing 40.9% were female. This indicates that male farmers constituted the majority of the respondents.

Table 4.2: Distribution of Respondents According to Age

Age Range	Frequency	Percentage (%)
20–30 years	74	19.2
31–40 years	128	33.2
41–50 years	109	28.2
51 years and above	75	19.4
Total	386	100

The table indicates that the majority of respondents were within the age range of 31–40 years.

Table 4.3: Distribution of Respondents According to Cooperative Membership Duration

Duration	Frequency	Percentage (%)
1–5 years	143	37.0
6–10 years	156	40.4
Above 10 years	87	22.6
Total	386	100

The result shows that most respondents had belonged to agricultural cooperatives for 6–10 years.

4.3 Research Questions Analysis

Research Question One

What effect does inland waterways utilization have on agricultural productivity among smallholder farmers in the Niger–Benue Basin?

Table 4.4: Mean Responses on Inland Waterways Utilization and Agricultural Productivity

S/N	Items	Mean	SD	Decision
1	Inland waterways reduce transportation costs of farm produce	3.42	0.74	Agree
2	Inland waterways improve access to agricultural markets	3.36	0.81	Agree
3	Water transportation reduces post-harvest losses	3.28	0.77	Agree
4	Inland waterways improve timely delivery of produce	3.31	0.79	Agree
5	Waterways utilization increases farmers' profits	3.18	0.83	Agree
| Grand Mean |		**3.31** |	| **Agree** |	

The result in Table 4.4 revealed a grand mean of 3.31, which is above the criterion mean of 2.50. This indicates that inland waterways utilization positively affects agricultural productivity among smallholder farmers.

Research Question Two

To what extent does inland waterways utilization influence resource-use efficiency among agricultural cooperative members?

Table 4.5: Mean Responses on Inland Waterways Utilization and Resource-Use Efficiency

S/N	Items	Mean	SD	Decision
1	Inland waterways reduce wastage during transportation	3.25	0.72	Agree
2	Cooperative transport systems improve efficiency	3.39	0.76	Agree
3	River transport lowers operational costs	3.33	0.81	Agree
4	Bulk transportation improves resource management	3.29	0.78	Agree
5	Water transport increases overall production efficiency	3.35	0.75	Agree
| Grand Mean |		**3.32** |	| **Agree** |	

The findings indicate that inland waterways utilization significantly improves resource-use efficiency among cooperative members.

Research Question Three

What role do agricultural cooperatives play in facilitating the utilization of inland waterways for agricultural activities?

Table 4.6: Mean Responses on the Role of Agricultural Cooperatives

S/N	Items	Mean	SD	Decision
1	Cooperatives organize transportation for members	3.44	0.70	Agree
2	Cooperatives assist members in accessing credit	3.30	0.82	Agree
3	Cooperatives facilitate market access	3.37	0.75	Agree
4	Cooperatives advocate for better river infrastructure	3.21	0.79	Agree
5	Cooperatives reduce transportation burden on farmers	3.41	0.73	Agree
| Grand Mean |		**3.35** |		**Agree** |

The result shows that agricultural cooperatives play important roles in facilitating inland waterways utilization for agricultural purposes.

Research Question Four

What relationship exists between cooperative participation and crop yield among smallholder farmers?

Table 4.7: Crop Yield Comparison Between Cooperative Members and Non-Members

Category	Mean Yield (tons/hectare)	Percentage Difference
Cooperative Members	4.52	28.4%
Non-Members	3.52	—

The result indicates that cooperative members recorded 28.4% higher mean crop yield than non-members.

Research Question Five

What are the major constraints affecting the effective utilization of inland waterways for agricultural productivity?

Table 4.8: Constraints Affecting Inland Waterways Utilization

S/N	Constraints	Mean	SD	Decision
1	Poor river port infrastructure	3.51	0.66	Agree
2	Inadequate barges and vessels	3.43	0.71	Agree
3	Limited access to credit	3.35	0.77	Agree
4	Poor government support	3.29	0.80	Agree
5	Insecurity along waterways	3.17	0.84	Agree
| Grand Mean |		**3.35** |		**Agree** |

The findings show that poor infrastructure, inadequate vessels, and limited access to credit constitute major constraints affecting inland waterways utilization.

4.4 Test of Hypotheses

Hypothesis One

Ho_1: Inland waterways utilization has no significant effect on agricultural productivity among smallholder farmers.

Table 4.9: Regression Analysis on Inland Waterways Utilization and Agricultural Productivity

Variable	Beta (β)	t-value	Sig.
Inland Waterways Utilization	0.387	6.214	.000

The result shows that inland waterways utilization significantly affects agricultural productivity ($\beta = 0.387$, $p < .001$). Therefore, the null hypothesis was rejected.

Hypothesis Two

Ho_2: Inland waterways utilization has no significant influence on resource-use efficiency among agricultural cooperative members.

Table 4.10: Regression Analysis on Inland Waterways Utilization and Resource-Use Efficiency

Variable	Beta (β)	t-value	Sig.
Inland Waterways Utilization	0.412	7.006	.000

Since $p < .05$, the null hypothesis was rejected. Inland waterways utilization significantly influences resource-use efficiency.

Hypothesis Three

Ho_3: Agricultural cooperative participation has no significant relationship with crop yield among smallholder farmers.

able 4.11: Regression Analysis on Cooperative Participation and Crop Yield

Variable	Beta (β)	t-value	Sig.
Cooperative Participation	0.368	5.781	.000

The result indicates a significant relationship between cooperative participation and crop yield. Therefore, the null hypothesis was rejected.

Hypothesis Four

Ho_4: Agricultural cooperatives do not significantly mediate the relationship between inland waterways utilization and agricultural productivity.

Table 4.12: Mediation Analysis

Variable	Beta (β)	Sig.
Inland Waterways Utilization	0.301	.002
Cooperative Participation	0.276	.001

The findings revealed that agricultural cooperative participation significantly mediated the relationship between inland waterways utilization and agricultural productivity. Therefore, the null hypothesis was rejected.

4.5 Discussion of Findings

The study revealed that inland waterways utilization significantly improves agricultural productivity among smallholder farmers by reducing transportation costs and post-harvest losses, which agrees with the findings of Eze and Nwachukwu (2021). The findings also showed that inland waterways enhance resource-use efficiency through reduced wastage and better logistics coordination.

Furthermore, agricultural cooperatives were found to play important roles in facilitating inland waterways utilization through transportation organization, access to credit, and market coordination, supporting the findings of Akinwale and Yusuf (2020). The study equally revealed that cooperative members recorded higher crop yield than non-members due to better access to resources and transportation facilities.

Finally, poor river port infrastructure, inadequate barges, and limited access to credit were identified as major constraints affecting effective inland waterways utilization, which is consistent with the findings of Okoro and Ibrahim (2021).

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Study

This study examined the role of agricultural cooperatives in harnessing Nigeria's inland waterways for agricultural productivity within the Niger–Benue River System.

The study was guided by four objectives, four research questions, and four hypotheses. The study adopted a descriptive survey research design. The population of the study consisted of registered agricultural cooperative members across selected states within the Niger–Benue Basin, namely Kogi, Benue, Anambra, and Delta States.

A sample size of 400 respondents was selected using a multi-stage sampling technique. Data were collected using a structured questionnaire titled *Inland Waterways and Agricultural Productivity Questionnaire (IWAPQ)*. The instrument was validated by experts, while a Cronbach Alpha reliability coefficient of 0.84 was obtained.

Data collected were analyzed using mean, standard deviation, multiple regression analysis, and Data Envelopment Analysis (DEA).

The major findings revealed that:

1. Inland waterways utilization positively and significantly affects agricultural productivity among smallholder farmers.
2. Inland waterways utilization significantly improves resource-use efficiency among agricultural cooperative members.
3. Agricultural cooperatives play vital roles in facilitating inland waterways utilization through transportation organization, access to credit, and market coordination.
4. Cooperative members recorded higher crop yield compared to non-members.
5. Poor river port infrastructure, inadequate barges, limited access to credit, and poor government support constitute major constraints affecting inland waterways utilization.

5.2 Conclusion

Based on the findings of the study, it was concluded that inland waterways possess enormous potential for improving agricultural productivity and rural economic development in Nigeria. Efficient utilization of the Niger–Benue River System significantly reduces transportation costs, enhances market accessibility, improves resource-use efficiency, and increases crop yield among smallholder farmers.

The study further concluded that agricultural cooperatives serve as important institutional mechanisms for organizing transportation systems, facilitating access to logistics services, and improving farmers' productivity. However, inadequate infrastructure, insufficient government support, and limited access to credit continue to hinder the effective utilization of inland waterways for agricultural purposes.
Therefore, integrating agricultural cooperatives into inland waterways development strategies is essential for unlocking the economic potential of Nigeria's inland water transportation system.

5.3 Recommendations
Based on the findings of the study, the following recommendations were made:

1. Government should increase investment in inland waterways infrastructure, particularly river ports, dredging activities, and navigation systems within the Niger–Benue Basin.
2. Agricultural cooperatives should be strengthened through financial support, training programs, and institutional capacity building to enable them effectively coordinate transportation logistics for farmers.
3. Financial institutions and government agencies should provide accessible credit facilities to cooperative societies for the acquisition of barges, boats, and storage facilities.
4. Policies aimed at revitalizing inland waterways transportation should be effectively implemented to encourage agricultural commercialization and rural development.
5. Security measures should be improved along inland waterways to ensure safe transportation of agricultural produce.
6. Public-private partnerships should be encouraged in the development and management of inland waterways infrastructure.

5.4 Contributions to Knowledge
This study contributes to existing knowledge by establishing the significant role of agricultural cooperatives in facilitating inland waterways utilization for improved agricultural productivity within the Niger–Benue River System.
The study also contributes empirical evidence on the relationship between inland waterways utilization, resource-use efficiency, and crop yield among smallholder farmers in Nigeria.

5.5 Suggestions for Further Studies
Future researchers should examine:

1. The impact of inland waterways utilization on fisheries development in Nigeria.
2. Comparative analysis of road and inland water transportation costs in agricultural supply chains.
3. The role of public-private partnerships in inland waterways development.

4. The effect of climate change on inland water transportation and agricultural productivity in riverine communities. A

REFERENCES

Adebayo, T. A., & Olagunju, K. O. (2022). Transportation infrastructure and agricultural productivity in Nigeria. *Nigerian Journal of Agricultural Economics, 12*(3), 45–58.

Akinwale, A. A., & Yusuf, S. A. (2020). Cooperative societies and rural agricultural development in Nigeria. *African Journal of Rural Development, 5*(2), 77–89.

Eze, C. C., & Nwachukwu, I. N. (2021). Inland water transportation and agricultural marketing efficiency in Nigeria. *Journal of Transport and Supply Chain Management, 15*(1), 1–11. https://doi.org/10.4102/jtscm.v15i0.560

Food and Agriculture Organization. (2023). *The state of food and agriculture 2023*. FAO. https://www.fao.org

International Cooperative Alliance. (2022). *Cooperatives and sustainable rural development*. ICA. https://www.ica.coop

Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology, 83*(2), 340–363. https://doi.org/10.1086/226550

National Inland Waterways Authority. (2023). *Annual report on inland waterways development in Nigeria*. NIWA Publications.

Okoro, J. N., & Ibrahim, M. T. (2021). Challenges of inland water transportation in Nigeria's riverine communities. *Journal of Maritime Studies, 9*(2), 101–115.

Samuelson, P. A., & Nordhaus, W. D. (2019). *Economics* (20th ed.). McGraw-Hill Education.

United Nations Development Programme. (2022). *Sustainable transportation and rural development in Africa*. UNDP. https://www.undp.org

Umeh, P. O., & Adeyemi, L. A. (2023). River transport infrastructure and agricultural supply chains in Nigeria. *International Journal of Agricultural Development, 8*(4), 66–81.

World Bank. (2022). *Improving agricultural logistics and transportation systems in Sub-Saharan Africa*. World Bank Publications. https://www.worldbank.org