Evaluating the Effectiveness of Agricultural Mechanization Policy on Rice Productivity in North East Nigeria

[1]Bashir Abdullahi, [2]Ruqayya Aminu Gar, Ph.D and [3]Mohammed Nuru Umar, Ph.D

[1] PhD Student, [2&3]Department of Political Science, Faculty of Social Sciences, Sa'adu Zungur University, Bauchi, Bauchi State

Corresponding Email: bashirabdullahi395@gsu.edu.ng

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Abstract

This study examines the effectiveness of the Agricultural Mechanization Policy implemented by the North East Development Commission (NEDC) on rice productivity in North East Nigeria with focus on Adamawa, Borno, and Gombe States of North East Nigeria. The research adopted a quantitative approach using a structured questionnaire administered to 396 rice farmers selected through a multi-stage sampling technique. Descriptive statistics and a simple linear regression model were used to analyze the extent to which mechanization inputs particularly tractors, improved seeds, fertilizers, and pesticides influenced rice productivity in the region. Findings indicate that agricultural mechanization had a statistically significant effect on rice output, with the regression results showing a positive relationship between mechanization support and productivity (F-19.246, $p < 0.001$). Among the inputs assessed, tractor access, fertilizer and pesticides/herbicides emerged as the strongest contributors to higher yields, demonstrating their importance in increasing efficiency and timely farm operations. The study concludes that the NEDC mechanization intervention has contributed meaningfully to improvements in rice productivity across the three states. However, full optimization of mechanization benefits requires addressing persistent challenges such as limited equipment access, high operational costs, and delays in resource distribution. Strengthening mechanization services and expanding input delivery will be essential for sustaining productivity gains and enhancing food security in the North East.

Keywords: Agricultural mechanization; Rice productivity; NEDC; North East Nigeria;

1.0 Introduction

Agricultural mechanization is widely recognised as a central policy lever for raising farm productivity, improving timeliness of field operations, and reducing drudgery among smallholder farmers (Daum & Birner, 2020). Mechanization can increase the scale and intensity of cultivation, enable timely planting and harvesting, and facilitate more efficient use of complementary inputs (fertilizers, improved seed), thereby contributing to higher yields and improved farm incomes

(Daum & Birner, 2020). Yet, the pace and pattern of mechanization are highly uneven across regions and countries, making context-specific evidence essential for policy design.

Nigeria remains a country with low mechanization intensity compared with many emerging economies. National studies on mechanization in Nigeria document persistent under-utilisation of tractors and mechanized services, and emphasize that demand-side constraints, weak service markets, and high equipment costs have constrained widespread adoption (Takeshima & Lawal, 2020). Empirical assessments of mechanization in West Africa indicate that when tractors and complementary inputs are accessible through well-designed service models, they can yield substantial productivity gains for smallholders (Daum & Birner, 2020; Ma, 2024). Recent empirical research in African settings reinforces this conclusion: mechanized land preparation and access to improved inputs are associated with measurable increases in crop yields and economic efficiency (Gebiso et al., 2024; Ma, 2024).

The North-East region of Nigeria presents a particular policy challenge and opportunity. Years of insurgency and infrastructural deterioration depressed agricultural output and disrupted service delivery, deepening food insecurity and rural poverty (NESDMP, 2022). In response, the North East Development Commission (NEDC) launched agricultural interventions including distribution of tractors and farm implements, provision of improved seeds and agro-inputs as part of its mechanisation and modernisation initiatives beginning in 2020 (NESDMP, 2022; Daily Trust, 2020). Media reports indicate that the Commission began distributing implements and tractors to selected beneficiary groups from 2020 onward, targeting increased land preparation capacity and input access (Oyewole, 2021). It is against this background that this study examines the impact of the Agricultural Mechanization Policy implemented by the NEDC on rice productivity in Adamawa, Borno, and Gombe States. Thus, the study seeks to: examine the effect of agricultural mechanization inputs (tractors, improved seed varieties, fertilizers, and pesticides) on rice productivity in Adamawa, Borno, and Gombe States and also determine the combined contribution of mechanization inputs to rice productivity among rice farmers in the study area.

The study was guided by the following hypothesis:

$H0_1$: Implementation of Agricultural Mechanization policy does not improve rice production.

The rest of this paper is organized as follows: Section 2 contains the literature review, while section 3 consists of the methodology, section 4 presents the results and discussions, section 5 consists of conclusion and recommendations.

2.0 Literature Review

2.1 Conceptual review

Agricultural Mechanization Policy

Agricultural mechanization policy refers to the deliberate actions, strategies, and programmes formulated by governments and relevant institutions to promote the adoption and utilization of agricultural machinery, equipment, and complementary farm inputs for improving agricultural production and rural livelihoods. Such policies typically involve the provision of tractors, improved seeds, fertilizers, agrochemicals, extension services, credit facilities, and machinery hiring schemes to enhance farm efficiency and reduce dependence on manual labour. According to the Food and Agriculture Organization (FAO, 2022), agricultural mechanization plays a critical role in increasing farm productivity, improving the timeliness of agricultural operations, reducing post-harvest losses, and strengthening food security. Similarly, Daum (2022) argues that well-designed mechanization policies are essential for transforming smallholder agriculture by enhancing production efficiency, lowering production costs, and promoting sustainable agricultural development. In the Nigerian context, agricultural mechanization policies have been implemented through various government programmes, including interventions by the North East Development Commission (NEDC), which provides tractors, improved rice seeds, fertilizers, herbicides, and pesticides to smallholder farmers with the objective of increasing agricultural productivity and improving livelihoods.

The Concept of Rice Productivity

Rice productivity refers to the quantity of rice produced relative to the resources utilized in the production process, particularly land, labour, capital, and agricultural inputs, and is commonly measured as yield per hectare. It serves as an important indicator of the efficiency and performance of rice farming systems. High rice productivity reflects the effective utilization of improved technologies, mechanization, quality seeds, fertilizers, irrigation, and sound agronomic practices. According to the Food and Agriculture Organization (FAO, 2022), improvements in mechanization significantly enhance crop productivity by facilitating timely land preparation, planting, harvesting, and post-harvest operations while reducing labour constraints and production losses. Likewise, the International Rice Research Institute (IRRI, 2023) emphasizes that increasing rice productivity is fundamental to achieving food security, improving farmers' incomes, and meeting the growing demand for rice, particularly in developing countries where rice constitutes a major staple food. In this study, rice productivity is evaluated using indicators such as increased output, reduced production costs, improved profitability, reduced post-harvest losses, and expansion of cultivated farm size among beneficiaries of the agricultural mechanization policy.

2.2 Empirical Review

Agricultural mechanization is widely recognised as a core pathway to raise smallholder productivity, reduce post-harvest losses, and improve timeliness of farm operations (Daum & Birner, 2020). Mechanization's benefits are not automatic: they depend on appropriate service-delivery models, availability of complementary inputs (seed, fertilizer), functioning repair and maintenance services, and local market conditions (Daum & Birner, 2020). Recent work therefore stresses the need for context-sensitive assessments of mechanization interventions rather than blanket assumptions about universal gains (Daum & Birner, 2020).

Global and African policy agencies have likewise highlighted the conditional nature of mechanization’s success. FAO and partners point out that mechanization can be inclusive when embedded within broader rural transformation strategies including extension, finance, and labour-market considerations and that failures often follow when these complementary functions are weak (FAO, 2024). The FAO synthesis emphasises that mechanization must be tailored to farm size, cropping systems and the socio-economic profile of farmers to achieve productivity and welfare outcomes.

Controlled experiments and field trials in West Africa and Nigeria have produced encouraging empirical results for rice systems. A Wageningen/CCAFS–Olam controlled experiment found that mechanized harvesting and threshing reduced harvest losses and improved farmer incomes under certain designs evidence that mechanization can produce a clear business case for smallholder rice (Soethoudt, Broeze & Axmann, 2021). Similar experimental work (Castelein et al., 2022) demonstrates measurable reductions in losses and greenhouse-gas emissions and documents a positive case for mechanized harvesting and threshing in Nigerian smallholder rice systems. Such studies show that particular mechanization operations (for example harvesting and threshing) may deliver large welfare and productivity returns even where full-scale mechanization is absent.

A growing body of quantitative research in African settings supports the productivity argument: studies using econometric methods (including propensity-score matching and regression analyses) have found positive and significant effects of mechanization on output and returns for smallholders, though effects vary by crop, mechanization type, farm size and supporting services (Mdoda, 2022; Gebiso *et al*., 2024). These studies also stress that institutional and market factors credit, operator skills, spare parts networks explain much of the heterogeneity in outcomes.

In the Nigerian context, scholars have documented a long-standing under-mechanization of agriculture and the complex evolution of mechanization policy and practice. Takeshima and Lawal (2020) provide a comprehensive account of the historical and institutional dynamics that shaped Nigeria's mechanization trajectory, showing that public provision, private service models, and hire-service markets have each played variable roles in different states and periods. They underline that productivity gains are greatest where mechanization is combined with access to inputs and functioning hire-service markets. Nigeria-specific empirical work is growing. Analyses of mechanization programmes and surveys of tractor hire markets reveal low tractor densities, high costs of ownership, and the emergence of private hire services where demand is sufficiently concentrated (Takeshima & Lawal, 2020; JICA/NCAM reports 2024). These structural features partly explain why public interventions such as equipment distribution programmes often have limited reach unless accompanied by hire-service models, operator training and maintenance arrangements (Takeshima & Lawal, 2020; JICA/NCAM, 2024).

Policy briefs and practitioner reports (WUR/CGIAR; CCAFS) focusing on rice supply chains have argued that mechanization can be a win-win (reducing losses, improving timeliness, increasing incomes) if private-sector service delivery is encouraged and if mechanization is aligned with local enterprise models (Axmann, 2021; CGIAR/CCAFS, 2021). These translational documents complement peer-reviewed findings and have influenced programme design in Nigeria and neighbouring countries. However, several recent reviews emphasise important constraints that limit the translation of mechanization inputs into productivity gains in fragile and conflict-affected areas such as the North-East. Security risks, weak infrastructure (roads and repair networks), limited operator skills and difficulties in coordinating input distribution undermine the ability of mechanization distribution programmes to reach intended beneficiaries and deliver sustained yield increases (World Bank/Africa Pulse, 2021; FAO, 2024). These factors are particularly salient where displacement and insecurity have reduced farm sizes, fragmented labour markets and raised transaction costs.

Several Nigerian case studies from 2020–2024 reinforce the above: studies in northern states find that mechanization increases timeliness and land cultivated but that gains are capped by lack of complementary inputs, weak extension services and prohibitive hiring costs for smallholders (Dorvlo, 2023; Abdullahi, 2024). Empirical regression studies show significant positive coefficients for tractors and fertilizers on yield, but also demonstrate that mechanization alone cannot substitute for seed quality, fertilizer use and market access. There is also an emerging literature on the environmental and labour-market dimensions of mechanization. Mechanized operations can reduce post-harvest losses and greenhouse-gas emissions per unit of output (Castelein *et al*., 2022), and mechanization combined with digital tools and youth-focused service models can create rural employment pathways (Daum *et al.,* 2022). Yet, the distributional effects including gender impacts and youth employment depend on the design of mechanization programmes and the access rules for services and credit (World Bank policy briefs; FAO syntheses).

Taken together, this literature suggests three lessons that inform the present study. First, mechanization has the potential to raise rice productivity in smallholder systems particularly when targeted at high-return operations such as land preparation and post-harvest processing (Soethoudt et al., 2021; Castelein et al., 2022). Second, productivity gains are conditional on complementary inputs, operator skills and service markets (Daum & Birner, 2020; Takeshima & Lawal, 2020; FAO, 2024). Third, in fragile or conflict-affected regions, security, infrastructure and coordination challenges may blunt the impact of mechanization interventions unless explicitly addressed in programme design (World Bank, 2021; JICA/NCAM, 2024). These lessons motivate the present quantitative evaluation of the NEDC mechanization programme in Adamawa, Borno and Gombe, focusing on the measurable relationship between specific mechanization inputs and rice yields under real operational constraints.

2.3 Theoretical Framework

This study adopted the theory of Induced Agricultural Innovations

The Theory of Induced Agricultural Innovations developed by Hayami and Ruttan (1970) asserts that technological change in agriculture is driven by shifts in the relative scarcity and cost of production factors such as land, labor, and capital. Innovations are "induced" when farmers and agribusinesses adopt technologies that substitute scarce or less productive resources with more efficient alternatives, responding to economic pressures and environmental constraints. In labor-scarce regions, farmers tend to adopt labor-saving technologies such as tractors, threshers, and herbicides, whereas in land-constrained areas, they adopt land-saving innovations such as improved seeds, fertilizers, and irrigation systems to enhance crop output.

The theory emphasizes that the adoption of appropriate technologies leads directly to higher productivity and increased income (Hayami & Ruttan, 1984). Mechanized farming and the use of improved inputs enable farmers to cultivate larger areas efficiently, reduce post-harvest losses, and optimize resource use. For rice farmers, the introduction of tractors, improved seed varieties, fertilizers, and herbicides can significantly increase yield per hectare, translating into higher earnings. This increase in income enables farmers to meet household needs, invest in education, healthcare, and better living conditions, thereby improving their overall standard of living.

3.0 Methodology

This study adopted a quantitative research design in order to examine the impact of agricultural mechanization on rice production in North East Nigeria. The design was considered appropriate because quantitative approaches allow for objective measurement of relationships between variables using statistical models (Creswell & Creswell, 2018). The population of the study consisted of 4,500 rice farmers who benefited from the mechanization initiatives implemented by the North East Development Commission (NEDC) across Adamawa, Borno and Gombe States. These states were purposively selected because they represent the core rice-producing zones within the region and share similar agricultural, ecological and socio-economic characteristics with the remaining parts of the North East, making them suitable for drawing generalizable insights about mechanization outcomes in the zone.

Cluster sampling was employed to ensure fair representation across the three states. Each state constituted a cluster, after which simple random sampling was used to select respondents within each cluster. This approach enhances representativeness and reduces sampling bias when studying geographically dispersed populations (Etikan & Bala, 2017). The sample size was determined using Taro Yamane's formula for known populations, which yielded 400 respondents as follows:

$$n = \frac{\mathrm{N}}{\Sigma 1 + \mathrm{N}(\mathrm{e})^2}$$

Where,
n= desired sample size
N=total population
e= accepted sampling error (0.05) on the basis of confident level.
In this case:

$$n= \frac{4500}{1+ 4500(0.05)^2}$$

$$n= \frac{4500}{4501(0.05)^2}$$

$$n= \frac{4500}{4501(0.0025)}$$

$$n= \frac{4500}{11.2525}$$

$n = 399.911$

Therefore $n = 400$

To strengthen reliability and accommodate potential non-response, the sample was increased by 10%, consistent with the recommendation of Israel (2013) that social researchers may increase sample size to compensate for incomplete or invalid responses. This resulted in a final target sample of 440 respondents, out of which 396 valid questionnaires were retrieved and used for analysis.

Data were collected using a structured questionnaire measured on a 5-point Likert scale. Prior to the main data collection, the structured questionnaire was subjected to a pilot test to assess its clarity, relevance, and reliability. The pilot study was conducted among a small sample of rice farmers with characteristics similar to those of the target population but who were not included in the final survey. Feedback obtained from the pilot exercise was used to refine the wording, sequencing, and clarity of the questionnaire items. The reliability of the instrument was subsequently assessed using Cronbach's alpha, and the instrument demonstrated satisfactory internal consistency, confirming its suitability for the main survey. Following these refinements, the finalized questionnaire, measured on a 5-point Likert scale, was administered to the study respondents. The instrument captured farmers' access to mechanization inputs such as tractors, fertilizers, rice seeds, pesticides and herbicides, as well as indicators of productivity. The data collected were analyzed using descriptive statistics and simple linear regression to determine the extent to which mechanization inputs predicted rice production among beneficiaries. Statistical analysis was performed using SPSS version 26. The decision rule for testing the hypothesis was based on probability (p) value at the 5% level of significance. The null hypothesis was rejected where $p < 0.05$, indicating that agricultural mechanization policy had a statistically significant effect on rice production.

4.0 Results and Discussions

Table 1: Questionnaire Distribution and Response Rate

S/N	Details	Frequency	Percentage (%)
1	Distributed copies of questionnaires	440	100%
2.	Returned Copies of questionnaires	414	94%
3.	Unreturned copies of questionnaires	26	6%
4.	Invalid questionnaires	18	

	4%		
5.	Usable questionnaires	396	
	90%		

Source: Field Survey 2025

Table 1 above shows that, 440 questionnaires were distributed representing 100% as the percentage of total sample size for the study. The researcher was able to retrieved 414 questionnaires out of the 440 distributed. Among the 414 returned questionnaires, 396 were found to be usable, while 18 questionnaires were invalid. Therefore, the analysis was carried out using 396 valid questionnaires.

Table 2: Demographic Characteristics of Respondents

Variables	Frequencies	Percentages
Gender:		
Male	307	78%
Female	89	22%
Age:		
18-25	55	14%
26-35	74	19%
36-45	209	53%
46 and above	58	14%
Marital Status:		
Single	69	17%
Married	211	53%
Divorced	57	15%
Widow	59	15%
Educational Qualifications:		
No Formal Education	162	41%
Primary Education	135	34%
Secondary	50	13%
Tertiary Education	49	12%
State of Residence:		
Adamawa	128	32%
Borno	127	32%

Gombe	141	36%

Source: Field Survey 2025

As revealed by the data in table 2, Out of a total of 396 respondents, 307 (78%) were male and 89 (22%) were female. This indicates a significant gender imbalance, with males comprising the majority of the sample. The majority, 53%, fall within the 36–45 age group, indicating this is the most represented demographic. The 26–35 and 46 and above categories each account for 19% and 14%, respectively. Similarly, those aged 18–25 also make up 14% of the sample. This suggests that while there is some representation across all age groups, respondents are predominantly middle-aged. The total number of participants surveyed is 396, reflecting a fairly broad age range overall. As revealed by the data, majority, 53%, are married, making them the most represented group. Singles account for 17% of the total, while both divorced and widowed individuals each represent 15%. This indicates that over half of the participants are in a marital union, with the remaining portion fairly evenly split among the other categories. A significant portion of 41%, have no formal education, making this the largest group. Those with primary education follow closely at 34%, while only 13% have completed secondary education. The smallest group, 12%, holds tertiary qualifications. This suggests that the majority of respondents have low levels of formal education, with less than a quarter attaining secondary or higher education. Out of a total of 396 participants, the highest proportion, 36% (141 respondents), reside in Gombe State. Adamawa and Borno States have nearly equal representations, with 32% (128 respondents) and 32% (127 respondents) respectively. This indicates a fairly balanced sampling across the three states, with a slight predominance from Gombe.

Table 3: Impact of Agricultural Mechanization Policy on Rice Production

Key: SD = Strongly Disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree.

Statement	SD n (%)	D n (%)	N n (%)	A n (%)	SA n (%)	Mean	SD	Decision
Mechanization Policy significantly increase d output	24 (6.1)	9 (2.3)	139 (35.1)	193 (48.7)	31 (7.8)	3.50	0.904	Accepted
Mechanization Policy led to reduction in cost of production	3 (0.8)	25 (6.3)	148 (37.4)	179 (45.2)	41 (10.4)	3.58	0.790	Accepted
Mechanization Policy increased profitability of rice farming	2 (0.5)	11 (2.8)	139 (35.1)	170 (42.9)	74 (18.7)	3.77	0.801	Accepted
Mechanization Policy led to reduction in food loss	0 (0.0)	17 (4.3)	114 (28.8)	176 (44.4)	89 (22.5)	3.85	0.815	Accepted
Mechanization Policy led to increase in farm size	5 (1.3)	10 (2.5)	111 (28.0)	167 (42.2)	103 (26.0)	3.89	0.863	Accepted

Source: Field Survey, 2025 Decision Mean = 3.00 Average Mean = 3.72

Table 3 presents the impact of Mechanization Policy on various aspects of rice production. All the listed statements have mean values significantly above the decision threshold of 3.0, indicating overall positive perceptions among respondents. The policy is seen to have notably increased output (Mean = 3.50) and reduced the cost of production (Mean = 3.58), suggesting improved efficiency. Furthermore, there is a strong agreement that it enhanced the profitability of rice farming (Mean = 3.77) and reduced food loss (Mean = 3.85), pointing to better resource management and post-harvest outcomes. The highest mean score (3.89) corresponds to an increase in farm size, indicating that mechanization may have encouraged expansion in cultivation. The relatively low standard deviations (ranging from 0.790 to 0.904) suggest a strong consensus among respondents. With an overall average mean of 3.7, the data clearly supports the acceptance of the mechanization policy as beneficial to rice production, enhancing both productivity and economic viability.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.406a	0.164	0.156	0.46630

Source: SPSS version 26

Table 4 indicates that the independent variables use of tractors, improved variety seeds, fertilizer, and pesticides/herbicides have a moderate positive relationship (R = 0.406) with rice production. The R Square value of 0.164 shows that these inputs explain approximately 16.4% of the variation in rice output, meaning that while the model captures some effect of agricultural inputs, the majority (83.6%) of the variation is influenced by other factors not included in the model. The Adjusted R Square of 0.156 further confirms this limited explanatory power after adjusting for the number of predictors. Overall, the model demonstrates that technological and input-based interventions have a measurable impact on rice production.

Table 5: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	16.739	4	4.185	19.246	0.000b
Residual	85.018	391	0.217		
Total	**101.756**	**395**			

Source: SPSS version 26

The data in table 5 assesses whether the regression model significantly predicts rice production. The regression sum of squares (16.739) represents the variation explained by the model. With 4 degrees of freedom (df) for regression and 391 for residuals**,** the F-statistic is 19.246**,** and the associated p-value (Sig.) is 0.000**,** which is highly significant **(**$p < 0.001$). This indicates that the overall regression model is statistically significant and that, collectively, the independent variables (tractor use, improved seeds, fertilizer, and pesticides/herbicides) have a meaningful impact on rice production**.**

Table 6: Regression Coefficients Matrix

Predictors	Unstandardized B Coefficient	Error	Standardized Coefficients Beta	t	Sig.
Technology (Tractor)	0.168	0.052	0.167	3.251	0.001
Improved seeds	0.031	0.037	0.041	0.850	0.396
Fertilizer	0.109	0.044	0.127	2.464	.014
Pesticides/Herbicides	0.220	0.054	0.216	4.043	.000

Source: SPSS version 26

The coefficients in table 6 show that tractor technology, fertilizer, and pesticides/herbicides have a significant positive impact on rice production, with p-values of 0.001, 0.014, and 0.000 respectively. Among them, pesticides/herbicides have the strongest influence ($\beta = 0.216$), followed by tractor use ($\beta = 0.167$) and fertilizer ($\beta = 0.127$). In contrast, improved variety seeds have a weak and statistically insignificant effect on rice production ($\beta = 0.041$, $p = 0.396$), suggesting they do not contribute meaningfully within this model.

Hypothesis Testing

$H0_1$: Implementation of Agricultural Mechanization policy does not improve rice production.

The statistical evidence provided in tables 4.20, 4.21 and 4.22 does not support Hypothesis One, which states that the implementation of the Agricultural Mechanization Policy does not improve rice production. The model summary shows a moderate positive correlation (R = 0.406) between inputs (tractors, improved seeds, fertilizer, and pesticides/herbicides) and rice production, with an R Square of 0.164, indicating that 16.4% of the variation in rice output is explained by these variables. While this is a modest proportion, it is statistically significant. The ANOVA results confirm that the model is significant (F = 19.246, $p < 0.001$), meaning the collective influence of the inputs on rice production is meaningful. Additionally, individual regression coefficients reveal that tractor use ($p = 0.001$), fertilizer ($p = 0.014$), and pesticides/herbicides ($p = 0.000$) significantly contribute to rice output, though improved seeds do not ($p = 0.396$). Therefore, the hypothesis is invalidated, as technological and input-based interventions do improve rice production to a statistically significant extent.

Discussion of Findings

The findings of this study provide important empirical insights into how the Agricultural Mechanization Policy influences rice production in North East Nigeria. The descriptive analysis shows that all five productivity indicators increase output, reduction in cost of production, increase profitability, reduction in food lost and increase farm size recorded mean values above the 3.0 decision benchmark. The overall average mean score of 3.7 indicates that farmers perceive mechanization-related interventions as contributing positively to various aspects of rice production.

The regression analysis reveals that the mechanization-related inputs tractor use, improved variety seeds, fertilizer, and pesticides/herbicides collectively explain 16.4% ($R^2 = 0.164$) of the variation in rice output. Although this indicates a modest level of explanatory power, it is consistent with social science standards where R^2 values are often low yet meaningful (Ozili, 2022). The moderate positive correlation (R = 0.406) suggests that these inputs have a measurable influence on production outcomes. More importantly, the overall regression model is statistically significant (F = 19.246, $p < 0.001$), confirming that the mechanization variables jointly contribute to increased rice production among the beneficiaries. This aligns with the descriptive findings, which showed generally high levels of agreement that mechanization interventions were beneficial. This finding confirms earlier argument in literature that mechanization, when effectively implemented, can significantly raise productivity and reduce the burden of food insecurity in developing regions (Takeshima & Lawal, 2020; Daum & Birner, 2020).

5.0 Conclusion and Recommendations

This study concludes that the Agricultural Mechanization Policy implemented in North East Nigeria has had a positive and measurable effect on rice production. The descriptive data show strong acceptance that mechanization contributes to increase output. Furthermore, the regression analysis demonstrates that mechanization-related inputs significantly influence rice production. The findings therefore reinforce the relevance of mechanization as a pathway for agricultural recovery. Therefore, the recommendations for this study are:

i. Government should intensify efforts to ensure wider and more consistent access to tractors, improved seeds, fertilizers, and agrochemicals for smallholder farmers.
ii. NEDC should integrate complementary interventions such as extension services, irrigation, training, and post-harvest technologies to maximise productivity.
iii. Government should invest in operator training, machinery maintenance units, and local technicians are critical.
iv. Continuous assessment of mechanization outcomes should be institutionalised to ensure timely improvements and evidence-based decision-making.

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