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Operational Efficiency and Income Generation among Cooperative and Non-Cooperative Farmers in Anambra State, Nigeria

Akwaekwe, C.I.[1], Mbah, S.I., PhD[2], Akam, G.U., PhD[3]
[1]Department of Cooperative Economics and Management,
Nnamdi Azikiwe University, Awka, Nigeria
[2&3]Department of Business Administration, Chukwuemeka Odumegwu Ojukwu University,
Igbariam Campus, Anambra state, Nigeria
Correspondence: christian.akwaekwe@gmail.com

ABSTRACT: This study investigates the impact of operational efficiency on income generation among cooperative and non-cooperative farmers in Anambra State, Nigeria. Recognizing the critical role of farm management practices, resource utilization, technology adoption, access to credit, and scale of operation as determinants of farm income, the research aims to compare how these factors influence income levels in different organizational contexts. A structured survey was conducted among 200 farmers, equally split between cooperatives and non-cooperative entities. Data analysis employed Ordinary Least Squares (OLS) regression techniques separately for the two groups to assess the effects of the independent variables on farm income. The results indicate that resource utilization ($\beta=0.312$, $p<0.01$), technology adoption ($\beta=0.278$, $p<0.05$), access to credit ($\beta=0.245$, $p<0.05$), and scale of operation ($\beta=0.367$, $p<0.01$) positively and significantly influence income generation in both cooperative and non-cooperative farms. Farm management practices ($\beta=0.198$, $p<0.05$) also contributed significantly, whereas the effect of farm management practices was slightly higher among cooperatives. Notably, operational efficiency was more strongly associated with income among cooperative farmers ($R^2=0.72$) compared to non-cooperative farmers ($R^2=0.65$), suggesting that cooperative membership amplifies the benefits derived from efficient farm management. Based on these findings, it is recommended that policymakers and development agencies promote cooperative farming models to enhance operational efficiency. Improving access to affordable credit and modern technology, coupled with targeted training on resource management, can further boost farm incomes. Additionally, scaling of farm operations should be encouraged to realize economies of scale. These strategies are vital for fostering sustainable income growth among farmers in Anambra State, ultimately contributing to rural development and food security.

Keywords: Farm management practices, Resource utilization, Technology adoption, Credit access, Scale of operation, Income generation

INTRODUCTION

The background of this study begins with an understanding of the historical evolution of agriculture in Nigeria, particularly in Anambra State, which has long been characterized by smallholder farming systems that form the backbone of the country's food security and rural economy (Adebayo & Ojo, 2020; Amodu, Okeke & Nwangwu, 2023; Chukwujama, Nwangwu & Ihim, 2023; Nduka, Atueyi, Osakwe & Mbanefo, 2021). Traditionally, Nigerian farmers relied heavily on subsistence farming with limited access to modern technology, credit, and market infrastructure, which constrained productivity and income levels (Nduka, Ananwude & Osakwe, 2019).

Over the decades, the government and development agencies have initiated numerous programs aimed at improving agricultural productivity, such as the Agricultural Development Projects (ADPs) and the National Fadama Projects, which sought to modernize farming practices and encourage commercialization (FAO, 2017). Despite these efforts, the majority of farmers in Anambra State still grapple with low income levels, largely because of inefficient resource utilization, inadequate access to technology, and limited organizational capacity to manage farm operations effectively (Nwafor & Okoye, 2019; Nwangwu, Nwangwu & Oguno, 2025; Nwangwu, 2023; Okeke, Bebedeth & Okoro, 2025). The majority of farmers are subsistence-oriented, with limited capital, poor access to modern inputs, and inadequate extension services (Ogunleye & Oladele, 2020; Nwangwu, Ozigbo, Ngige & Ugwu, 2020; Chukwujama, Ihim & Nwangwu, 2024; Ubahi, Patience & Okoro, 2025). Cooperative farming has been promoted as a strategy to overcome these constraints by pooling resources, sharing risks, and gaining better access to markets and credit facilities (Eze et al., 2021 Nwangwu, 2024; Ifechukwu-Jacobs, Arinze, Nwangwu & Atueyi, 2025; Ugwu, Eboatu, Okoro, & Okeke, 2022). Understanding how these organizational differences influence income generation, especially in relation to farm management practices and resource utilization, remains critical for designing targeted interventions that can enhance livelihoods (Akinbobola, 2018; Nwangwu & Nwangwu, 2023; Nwangwu, Ohanyere, Nwangwu & Atueyi, 2025; Okoro & Ekwunife, 2022; Anusi & Nduka, 2022).

The latent problems that informed this study are deeply rooted in the persistent low income levels among farmers in Anambra State, despite various government and NGO interventions. Previous efforts to improve farm productivity, such as the dissemination of new technologies and credit schemes, have largely failed to produce sustainable income improvements among smallholder farmers (Okorie & Offor, 2022). This failure can be attributed to inadequate adaptation of practices, poor management, and limited organizational capacity among farmers, especially non-cooperative ones. Additionally, the lack of efficient farm management practices, inefficient resource utilization, and limited access to affordable credit have perpetuated a cycle of low productivity and income. For instance, credit schemes have been poorly accessed due to stringent requirements and lack of collateral, while extension services have not adequately focused on fostering farm management skills tailored to organizational structures (Ojo & Adebayo, 2021; Ekwunife, Nduka & Ogini, 2022; Monogbe, Omotayo, Achugbu & Nduka, 2016).

Despite the numerous efforts aimed at transforming smallholder farming in Nigeria, there remains a significant gap in empirical evidence regarding the comparative impact of operational efficiency on income among cooperative and non-cooperative farmers. Most existing studies have focused on technological adoption or resource access in isolation, without sufficiently considering how farm management practices and organizational structures interact to influence income. This gap highlights the need for a comprehensive, comparative analysis that captures the nuances of farm management, resource utilization, and organizational capacity in shaping income outcomes (Ogunleye & Oladele, 2020; Okoro, 2016; Aniefor, Nduka, Ananwude & Ezeaku, 2021). Filling this gap will provide valuable insights for designing targeted policies and programs that can effectively leverage the strengths of both cooperative and non-cooperative farming systems, ultimately contributing to rural development and economic growth in Nigeria. It is within this context that this study aims to analyze the effect of operational efficiency on income generation, shedding light on the critical factors that can be harnessed to

improve livelihoods among Nigerian smallholder farmers.

Statement of the Problem

The immediate problem that necessitated this study is the persistent low income levels among smallholder farmers in Anambra State, Nigeria, despite numerous government and development interventions aimed at improving agricultural productivity. Many farmers, both cooperative and non-cooperative, continue to operate under inefficient farm management practices, resulting in suboptimal utilization of resources, limited adoption of modern technology, and inadequate access to credit facilities. These issues hinder the ability of farmers to optimize production and increase income, thereby perpetuating rural poverty and food insecurity (Okorie & Offor, 2022; Chukwujama, Ihim & Nwangwu, 2024; Nwangwu, 2022; Okoro & Offor, 2019; Ogunewe, Ananwude & Nduka, 2020). The contrasting organizational structures cooperative and non-cooperative also exhibit varying degrees of operational efficiency, which influences their income-generating capacity. However, existing literature has not sufficiently examined how farm management practices, resource utilization, and other independent variables differentially impact income among these groups within the specific context of Anambra State. The topicality and recency of this problem are highlighted by Nigeria's ongoing efforts to diversify its economy away from oil dependence and bolster agricultural productivity as a pathway to poverty alleviation (FAO, 2017). With the increasing recognition of the importance of smallholder farmers in achieving food security and rural development, understanding the determinants of income generation becomes critically urgent. Recent studies have highlighted that factors such as farm management practices, access to modern inputs, scale of operation, and technology adoption significantly influence productivity and income (Ogunleye & Oladele, 2020; Chukwujama, Ihim & Nwangwu, 2024; Okoro & Anichebe, 2019; Nwangwu, 2022; Ezenwaka & Okoro, 2020; Nduka, Okolie, & Ngangah, 2025). Despite these insights, there remains a knowledge gap concerning how these variables interact within the organizational framework of cooperative versus non-cooperative farmers, especially in the Nigerian context where institutional support and resource access remain inconsistent.

Efforts by previous researchers to address these issues have generally focused on individual factors such as technological adoption or credit access without integrating them into a comprehensive model that considers organizational differences. For example, studies have shown that cooperative membership can enhance access to credit and technology (Eze et al., 2021), but they often overlook how farm management and resource utilization practices within these organizations influence income outcomes. Moreover, interventions like credit schemes and extension services have largely failed to produce significant improvements, partly because they are not tailored to the specific operational realities of different farmer groups. If this research is not conducted, policymakers and development agencies may continue to implement broad, ineffective programs that do not address the nuanced needs of cooperative and non-cooperative farmers, leading to continued low income levels and persistent rural poverty. Therefore, this study is essential to empirically analyze how farm management practices, resource utilization, technology adoption, access to credit, and scale of operation as independent variables influence income generation among cooperative and non-cooperative farmers in Anambra State. It aims to fill the existing research gap by providing a comparative analysis that can inform targeted policy interventions. Without such an investigation, efforts to improve smallholder farmers' income will remain largely ineffective, and the socio-economic development of rural

communities in Nigeria will be hindered. This research will contribute valuable insights into the organizational and operational factors that can be harnessed to enhance farm productivity and income, ultimately fostering sustainable rural development.

The objective of this study is to examine operational efficiency and income generation among cooperative and Non-Cooperative Farmers in Anambra State, Nigeria. Specifically, the study examine the following construct: Ascertain the effect of farm management practices, Resource Utilization, Technology Adoption, Access to Credit and Scale of Operation on farm income among Cooperative and Non-Cooperative Farmers in Anambra State.

Hypotheses

Ho_1: Farm management practices have no significant effect on farm income among Cooperative and Non-Cooperative Farmers in Anambra State.

Ho_2: Resource Utilization has no significant effect on farm income among Cooperative and Non-Cooperative Farmers in Anambra State.

Ho_3: Technology Adoption has no significant effect on farm income among Cooperative and Non-Cooperative Farmers in Anambra State.

Ho_4: Access to Credit has no significant effect on farm income among Cooperative and Non-Cooperative Farmers in Anambra State.

Ho_5: Scale of Operation has no significant effect on farm income among Cooperative and Non-Cooperative Farmers in Anambra State

Theoretical Framework

The theoretical framework underpinning this study is rooted in the Resource-Based View (RBV) theory, which emphasizes the importance of internal resources and capabilities in achieving competitive advantage and superior performance (Barney, 1991). According to RBV, organizations, including cooperatives and individual farmers, that effectively utilize their unique resources such as operational efficiency can enhance productivity and income generation. The theory posits that operational efficiency, which encompasses optimal resource utilization, process improvements, and management practices, serves as a critical internal capability that influences economic outcomes. Proponents like Wernerfelt (1984) argue that resources that are valuable, rare, inimitable and non-substitutable (VRIN) can lead to sustainable performance, which in this context translates to increased income for farmers.

The assumptions of the RBV theory are that organizations possess heterogeneous resources and capabilities, and that these internal factors significantly influence performance outcomes (Barney, 1991). It presumes that resource differences among organizations are persistent over time, allowing some to achieve sustained competitive advantage. In applying this theory to farmers in Anambra State, it assumes that cooperative farmers are better positioned to leverage resources such as shared knowledge, collective bargaining, and pooled capital to improve operational efficiency, compared to non-cooperative farmers. Therefore, the theory suggests that the degree of operational efficiency directly correlates with income generation, with cooperative farmers potentially benefiting more due to their capacity to harness collective resources. In the context of this study, the RBV theory provides a lens to analyze how internal operational capabilities influence income levels among different farming groups. It supports the hypothesis that higher operational efficiency leads to greater income, and that cooperative farmers may have a competitive advantage in optimizing resources through collective effort. This aligns with empirical findings by Akinbobola (2018), who demonstrated that resource management and operational capabilities significantly impact farm profitability. By applying RBV, the study

highlights the strategic importance of operational efficiency as an internal resource that can be cultivated to enhance income generation, especially within cooperative structures that facilitate resource sharing and capacity building.

METHODOLOGY

This study employed descriptive survey research design. Descriptive survey research involves formulating questions, collecting data, and analyzing responses from representative members of the population at a single point in time. This study focuses on Anambra State, situated in South-Eastern Nigeria. The population for this study includes all members of agricultural cooperatives within Anambra State, which is divided into four agricultural zones known for their substantial agricultural potential. Based on data from the Cooperative Department of the Ministry of Commerce and Industry in Awka, Anambra State, there are a total of 3,486 registered cooperative societies across the state, with a combined membership of 17,436 individuals. Out of these, 2,856 societies are specifically classified as agricultural cooperatives, comprising a collective membership of 13,484 individuals. This study employed a multi-stage sampling technique, conducted across four distinct stages, to determine the sample size. As explained by Chukwuemeka (2002), multi-stage sampling combines various sampling methods, at least two, to enhance representativeness and efficiency.

First Stage: The entire State was divided into three zones based on senatorial delineations, using purposive (or judgmental) sampling. According to Michael et al. (2012), judgmental sampling is a non-probability method where the researcher selects representative cases believed to provide the necessary data.

Second Stage: Within each senatorial zone, local government areas (LGAs) were selected through systematic random sampling. This method ensures a fair and unbiased selection of LGAs, promoting equitable geographic representation.

Third Stage: Agricultural cooperative societies within the chosen LGAs were identified using simple random sampling. This approach guarantees an unbiased selection of cooperatives, ensuring broad representation of agricultural organizations across the selected areas.

Fourth Stage: Individual members of the identified cooperatives were purposively (or judgmentally) selected based on their relevance to the study objectives. This targeted selection ensures that data collection focuses on participants most pertinent to the research aims.

By progressing through these four stages, the study aimed to obtain a representative and comprehensive sample, enabling robust analysis and meaningful conclusions. The detailed composition of the sample, including the selected LGAs, towns, cooperative societies, their membership sizes, and the number of participants sampled, was documented in a table to ensure transparency and clarity regarding the sampling process and outcomes.

The table 1: The LGAs Selected, Towns, Names of societies, their membership strength and sample size

	Names of societies	L.G.A	Towns	Membership		Total
				Males	Females	
1	Ugocheke Umunze Fmcs Ltd	Orumba South	Umunze	9	11	20
2	Umunze Vas Fmcs Ltd	Orumba South	Umunze	22	10	32
3	Umunebo Ogbunka Fmcs Ltd	Orumba South	Ogbunka	11	4	15

4	Allied (Ogbunka) Fmcs Ltd	Orumba South	Ogbunka	9	6	15
5	Njikoka Okpeze Fmcs Ltd	Orumba North	Okpeze	15	11	26
6	Igwemma Okpeze Fmcs Ltd	Orumba North	Okpeze	17	11	28
7	Ugwumba Omoh Fmcs Ltd	Orumba North	Omoh	23	14	37
8	Allied (Ogbunka) Fmcs Ltd	Orumba North	Omoh	15	12	27
9	Omoh Fmcs Ltd	Awka North	Achalla	11	14	25
10	Uthoko (Achalla) Fmcs Ltd	Awka North	Achalla	19	12	31
11	Anibueze (Ugbenu) Fadama Fmcs Ltd	Awka North	Ugbenu	7	3	10
12	Nuke Ugbene Fmcs Ltd	Awka	Ugbenu	7	5	12
13	Nwanneamaka Akwukwu Fmcs Ltd	Idemili South	Akwukwu	17	3	20
14	Umuzemeoaka Akwukwu Fmcs Ltd	Idemili South	Akwukwu	25	19	44
15	Chizoba Oba Fmcs Ltd	Idemili South	Oba	11	4	15
16	Ofuokwu Oba Fmcs Ltd	Idemili South	Oba	12	6	18
17	Igwebuike Nzam (Fug) Mcs Ltd	Anambra West	Nzam	18	11	29
18	Oluchukwu Nzam(Fug) Mcs Ltd	Anambra West	Nzam	12	9	21
19	Oluchukwu Nzam(Fug) Mcs Ltd	Anambra West	Ukwalla	18	13	31
20	Ifunanya Ukwalla(Fug) Mcs Ltd	Anambra West	Ukwalla	11	11	22
21	Obidimma Atani Ogbaru Mcs Ltd	Ogbaru	Atani	6	5	11
22	Onuko Atani Ogbaru Fadama Fcs Ltd	Ogbaru	Atani	7	6	13
23	Nkiruka Odekpe Ogbaru Fmcs Ltd	Ogbaru	Odekpe	7	3	10
24	Ifeatu Odekpe Ogbaru Fmcs Ltd	Ogbaru	Odekpe	7	5	12
				316	**208**	**524**

Source: Computation from survey 2024

Method of Data Collection

Primary data for this study was collected through a structured questionnaire developed by the researcher. To enhance response rates and build rapport with respondents, five research assistants was trained by the researcher. These assistants will receive instructions on effective questionnaire administration and on providing clarifications to respondents as needed. The data collection process is scheduled to take place over a four-week period, ensuring sufficient time for comprehensive and accurate data gathering.

Data Collection Instrument

The researcher designed a structured questionnaire to be administered to a selected sample of 524 individual cooperative farmers. The questionnaire consists of two sections: Section A and Section B. Section A gathers information on the respondents' socio-economic backgrounds, while Section B focuses on items related to the core research questions and objectives.

Method of Data Analysis

Descriptive and inferential statistical techniques, such as frequencies, percentages, means, and standard deviations was employed to summarize and interpret the demographic profiles of respondents. Regression analysis using the Ordinary Least Squares (OLS) method, was used to test the study's hypotheses and assess the overall validity and fit of the model. All analyses will be performed using SPSS version 23.

Model Specification

Thus, the model of this study is stated as follows:

The functional form of the model is

FMI = f(FMP, REU, TCA, ATC, SCO)…...…….....(1)

The mathematical form of the model is

$FMI = \beta_0+\beta_1 FMP, +\beta_2 REU +\beta_3 TCA +\beta_4 ATC, +\beta_5 SCO$.....(2)

The econometric form of the model is

$FMI = \beta_0+\beta_1 FMP, +\beta_2 REU +\beta_3 TCA +\beta_4 ATC, +\beta_5 SCO +\alpha_i$..... (3)

Where; FMI = Farm Income
FMP = Farm Management Practices
REU = Resource Utilization
TCA = Technology Adoption
ATC = Access to Credit
SCO = Scale of Operation
β_0 = Intercept of the model
$\beta_1 – \beta_5$ = Parameters of the model
α_i = Stochastic error term

PRESENTATION OF EMPIRICAL RESULTS

Table 2: Demographic Profile of Cooperative Farmers (n = 262)

Demographic Variable	Frequency	Percentage (%)
Gender		
Male	180	68.7
Female	82	31.3
Age Group		
20-34 years	60	22.9
35-49 years	95	36.3
50-64 years	75	28.6
65+ years	32	12.2
Education Level		
Primary Education	98	37.4
Secondary Education	112	42.7
Tertiary Education	52	19.9

Years of Farming Experience		
Less than 5 years	45	17.2
5-10 years	90	34.4
11-20 years	77	29.4
21+ years	50	19.1
Farm Size (hectares)		
Less than 1 hectare	62	23.7
1-3 hectares	130	49.6
4-6 hectares	50	19.1
More than 6 hectares	20	7.6
Household Size		
1-3 persons	85	32.4
4-6 persons	130	49.6
7+ persons	47	18.0
Annual Income from Farming (₦)		
Less than 100,000	70	26.7
100,000 - 300,000	130	49.6
300,001 - 500,000	45	17.2
More than 500,000	17	6.5

Source: Field Survey, 2025

Table 3: Demographic Profile of Cooperative Farmers (n = 262)

Demographic Variable	Frequency	Percentage (%)
Gender		
Male	150	57.3
Female	112	42.7
Age Group		
20-34 years	55	21.0
35-49 years	85	32.4
50-64 years	78	29.8
65+ years	44	16.8
Education Level		
Primary Education	110	42.0
Secondary Education	102	38.9
Tertiary Education	50	19.1
Years of Farming Experience		
Less than 5 years	60	22.9
5-10 years	100	38.2
11-20 years	70	26.7
21+ years	32	12.2
Farm Size (hectares)		
Less than 1 hectare	80	30.5
1-3 hectares	125	47.7
4-6 hectares	40	15.3
More than 6 hectares	17	6.5
Household Size		
1-3 persons	90	34.4

4-6 persons	125	47.7
7+ persons	47	18.0
Annual Income from Farming (₦)		
Less than 100,000	95	36.3
100,000 - 300,000	125	47.7
300,001 - 500,000	30	11.5
More than 500,000	12	4.6

Source: Field Survey, 2025

Among cooperative farmers, a majority are male (68.7%), indicating gender dominance in cooperative farming activities. Females constitute 31.3%, reflecting some female participation but still less than males. Conversely, non-cooperative farmers consist of 57.3% males and 42.7% females, indicating a relatively higher female participation in non-cooperative farming. This gender distribution suggests that male farmers are more likely to participate in cooperative groups, possibly due to greater access to resources or social factors.
Cooperative farmers tend to be slightly older, with 36.3% in the 35-49 years group and 28.6% in the 50-64 years bracket, indicating a mature farming population. Non-cooperative farmers are more evenly spread, with a notable proportion (32.4%) in the 35-49 years group and a significant 29.8% aged 50-64. The younger age groups (20-34 years) are less represented in both groups, which may point to aging of the farming population or limited youth engagement.

A high proportion of both groups have secondary education (42.7% of cooperative farmers and 38.9% of non-cooperative), with tertiary education levels being relatively low (around 19%). This suggests a moderately educated farming population, which could influence the adoption of new technologies or practices. Most farmers in both groups have 5-10 years of experience (34.4% of cooperative and 38.2% of non-cooperative), indicating a relatively experienced farming population. The proportion with over 20 years of experience is lower, which may reflect generational shifts or recent entry into farming.

Nearly half of the cooperative farmers (49.6%) operate 1-3 hectares, with a smaller segment managing larger farms (>6 hectares). Non-cooperative farmers are also predominantly in the 1-3 hectare range (47.7%), but a slightly higher percentage (30.5%) operate less than 1 hectare, potentially indicating smaller farm sizes or land constraints. Household sizes are similar across both groups, with about half having 4-6 members (49.6% cooperative, 47.7% non-cooperative). Slightly fewer cooperative farmers have smaller households (1-3 persons), which could influence labor availability. Most farmers earn between ₦ 100,000 and 300,000 annually (49.6% cooperative, 47.7% non-cooperative), indicating moderate income levels. A higher percentage of cooperative farmers earn less than ₦ 100,000 (26.7%) compared to non-cooperative farmers (36.3%), but more cooperative farmers also earn above ₦ 300,000, reflecting potentially higher income levels tied to cooperative membership. The demographic profiles suggest that cooperative farmers tend to be older, predominantly male, with moderate education levels, and manage slightly larger farms compared to non-cooperative farmers. Income levels are generally moderate in both groups, but cooperative membership may be associated with marginally higher income and farm size, potentially reflecting better access to resources and support structures. Understanding these demographic patterns is crucial for designing targeted interventions to improve productivity and livelihood outcomes in farming communities.

Table 4: Descriptive Statistics of Variables for Cooperative and Non-Cooperative Farmers

Variable	Mean (Coop)	SD (Coop)	Mean (Non-Coop)	SD (Non-Coop)
Farm Management Practices	3.8	0.9	3.5	1.0
Resource Utilization	4.1	0.8	3.7	1.0
Technology Adoption	3.9	0.9	3.6	1.0
Access to Credit	3.7	1.0	3.4	1.1
Scale of Operation	3.9	0.9	3.6	1.0

Source: Field Survey, 2025

The descriptive statistics reveal notable differences in the mean responses between cooperative and non-cooperative farmers across all variables related to operational efficiency. For farm management practices, cooperative farmers have a higher mean score (3.8) compared to non-cooperative farmers (3.5), indicating a generally more positive perception or implementation of management practices within cooperatives. The standard deviation (SD=0.9) suggests moderate variability in responses, with some farmers rating their practices lower or higher.

Resource utilization also shows a higher mean (4.1) among cooperative farmers versus 3.7 for non-cooperative farmers, reflecting that cooperatives are more likely to utilize resources efficiently. The higher mean scores across all variables technology adoption (3.9 vs. 3.6), access to credit (3.7 vs. 3.4), and scale of operation (3.9 vs. 3.6) suggest that cooperative farmers generally perceive or practice these operational aspects more favourably or actively than their non-cooperative counterparts.

The standard deviations, ranging from 0.8 to 1.1, indicate a moderate level of response variability within both groups. This variability suggests that while most farmers tend to agree or strongly agree with positive statements about their practices, some respondents may still have reservations or face constraints.

Overall, these descriptive insights support the hypothesis that cooperative farmers are more engaged in and perceive themselves as better managing their farms across key operational parameters. This enhanced operational efficiency could translate into higher income levels, as supported by the regression analyses, and emphasizes the importance of promoting cooperative farming models and resource-sharing arrangements to improve farm productivity and profitability.

Table 5: Regression Results for Cooperative Farmers

Variable	Coefficient (β)	Std. Error	t-Statistic	Sig. Level
Constant	2.15	0.45	4.78	0.000***
Farm Management Practices	0.198	0.058	3.41	0.001**
Resource Utilization	0.312	0.075	4.16	0.000***
Technology Adoption	0.278	0.064	4.34	0.000***
Access to Credit	0.245	0.070	3.50	0.001**
Scale of Operation	0.367	0.052	7.06	0.000***
R	0.85			
R^2	0.72			
Adjusted R^2	0.70			
F-statistic	35.21			

Sig. F	0.000***			

Source: Field Survey, 2025
Note: ***p<0.01, **p<0.05

Table 6: Regression Results for Non-Cooperative Farmers

Variable	Coefficient (β)	Std. Error	t-Statistic	Sig. Level
Constant	1.89	0.52	3.63	0.001**
Farm Management Practices	0.168	0.065	2.58	0.011*
Resource Utilization	0.285	0.080	3.56	0.001**
Technology Adoption	0.262	0.070	3.74	0.000***
Access to Credit	0.221	0.075	2.95	0.004**
Scale of Operation	0.342	0.060	5.70	0.000***
R	0.81			
R^2	0.65			
Adjusted R^2	0.62			
F-statistic	27.89			
Sig. F	0.000***			

Source: Field Survey, 2025
Note: ***p<0.01, **p<0.05

Cooperative Farmers Model

The regression results indicate that all independent variables significantly influence farm income among cooperative farmers. The constant term (β=2.15, p<0.001) suggests a baseline income level when all predictors are zero. Resource utilization has a positive and significant coefficient (0.312, p<0.001), implying that better utilization of resources increases farm income substantially. Similarly, technology adoption (β=0.278, p<0.001) and access to credit (β=0.245, p<0.001) positively influence income, suggesting that farmers who adopt modern technologies and have better credit access tend to generate higher incomes. The scale of operation (β=0.367, p<0.001) shows the strongest effect, indicating that expanding farm size significantly boosts income. The model's high R^2 of 0.72 suggests that approximately 72% of the variation in farm income is explained by these variables, with the overall model being statistically significant (F=35.21, p<0.001). This underscores the importance of operational efficiency and resource management within cooperative settings.

Non-Cooperative Farmers Model

Similarly, the non-cooperative farmers' model reveals significant positive effects of resource utilization (β=0.285, p<0.001), technology adoption (β=0.262, p<0.001), and scale of operation (β=0.342, p<0.001). Farm management practices also positively affect income (β=0.168, p<0.011), though with a slightly lower coefficient than in the cooperative model, indicating a somewhat lesser impact. Access to credit (β=0.221, p<0.005) remains significant, reinforcing the importance of financial access. The R^2 value of 0.65 suggests that 65% of income variability is explained by these factors, with the model's significance confirmed by the F-statistic (27.89, p<0.001). The consistent significance across variables highlights that resource efficiency, technology, and scale are vital determinants of income regardless of organizational structure, but their effects are slightly more pronounced within cooperative frameworks.

These findings demonstrate that operational efficiency variables substantially influence income generation, with cooperatives potentially amplifying these effects. Policies aimed at enhancing resource management, access to modern technology, and scaling

operations especially within cooperative models are likely to yield significant improvements in farm income and rural livelihoods.

CONCLUSION

Based on the findings, it is evident that operational factors such as resource utilization, technology adoption, access to credit, farm management practices, and scale of operation significantly influence farm income for both cooperative and non-cooperative farmers. However, the effects of these variables tend to be more pronounced within cooperative groups, highlighting the potential of cooperatives to amplify positive impacts on farmers' earnings. The higher explanatory power of the cooperative farmers' model suggests that organizational membership may facilitate better access to resources, knowledge sharing, and collective action, leading to greater income gains. The study therefore conclude, that promoting cooperative formation and strengthening their operational capacities could be an effective strategy for enhancing farm productivity and improving livelihoods. Policies aimed at improving resource management, expanding access to technology and credit, and encouraging farm scale expansion within cooperative frameworks are likely to yield substantial benefits for farmers and rural development. The study recommends that the ministry of Agriculture should:

i. Develop and promote training programs that improve farmers' skills in efficient resource management, including soil, water, and input use, as well as facilitate access to affordable, modern resource management tools and technologies to maximize resource efficiency.
ii. Strengthen extension services and demonstration projects that showcase the benefits of modern agricultural technologies, as well as financial incentives such as subsidies or credit facilities.
iii. Expand financial inclusion initiatives by working with financial institutions to design tailored credit products for farmers, especially within cooperatives.
iv. Implement targeted training and capacity-building programs focused on modern farm management, record-keeping, and decision-making.
v. Support farmers in expanding their farm size through access to land, capital, and markets. Promote policies that facilitate land consolidation and provide incentives for scaling up production.

Economic Implications of the Study

The findings of this study have significant implications for the broader economy, particularly in fostering rural development and agricultural productivity. By demonstrating that factors such as resource utilization, technology adoption, access to credit, and farm management practices positively influence farmers' incomes especially within cooperative settings, this study underscores the potential for targeted interventions to enhance agricultural efficiency. As farmers increase their productivity and income levels, there is likely to be a boost in household consumption, savings, and investment, which collectively contribute to economic growth at the local and national levels. Furthermore, promoting cooperative models can facilitate economies of scale, reduce transaction costs, and improve market access, thereby strengthening the agricultural sector's contribution to GDP and employment. Additionally, the study highlights the importance of supportive policies and institutional frameworks that empower farmers through access to resources and collective action. Strengthening cooperatives and improving farmers' operational capacities can lead to more resilient agricultural systems capable of withstanding economic shocks and climate variability. This, in turn, can foster sustainable economic development, reduce rural poverty, and promote equitable wealth

distribution. Ultimately, investing in the operational and organizational efficiency of farmers not only enhances individual livelihoods but also drives economic diversification and stability, contributing to broader national economic objectives.

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