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# ANALYSIS OF ECONOMIC EFFICIENCY AND ITS DETERMINANTS AMONG MAIZE FARMERS IN KOGI STATE, NIGERIA

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***Abstract***
*This study analyzed maize farmers' economic efficiency in Kogi State, Nigeria. The specific objectives were to: describe the socio-economic characteristics of maize farmers, measure the economic efficiency of maize farmers and determine factors influencing economic efficiency of maize farmers in the study area. Primary data were collected from 240 respondents using a well-structured questionnaire. Data collected were analyzed using descriptive and inferential statistics. The results of the socio-economic characteristics of the maize farmers revealed that the respondents were predominantly within the economically active age group, with a mean age of 42 years. The majority (62.50%) of the respondents were male, 69.17%, were married and 30.00% had secondary education, with a mean household size of 9 persons, average farming experience of 10 years, and farm size of 2.17 hectare on average. Also, the mean economic efficiency index of 0.95 indicates that, maize farmers in the study area operated at 95% of the optimal economic efficiency level on average. Factors influencing economic efficiency of maize farmers revealed that the explanatory variables; seed quantity (0.1605), fertilizer quantity (0.0908), herbicide application (0.1842), age (0.0385), formal education (-0.0642) and credit access (1.0496) jointly exerted a significant influence on the economic efficiency of maize farmers in the study area.*

***Keywords**: Analysis, economic, efficiency, determinants, maize farmers*

## 1.0 Introduction

Maize is one of the popular crops predominantly grown by farmers and it is a staple food crop that is grown in many parts of the Sub-Saharan countries of Africa including Nigeria, with per capita consumption of 40 kg/year. In Nigeria, maize is arguably the most important cereal crop in terms of production volume, cultivated area, and consumption diversity. It is grown across all the country's agro-ecological zones, from the humid south to the drier northern savannas, reflecting its adaptability. National maize production reached an estimated 12.7 million metric tons in 2022, harvested from approximately 6.8 million hectares, making Nigeria the largest maize producer in Africa (FAO, 2023).

Resource utilization is central to agricultural production and it is refers to the process and manner in which farmers combine and employ the factors of production. These resources are inherently scarce, necessitating efficient allocation and management to maximize output and achieve desired economic returns. The efficiency with which these diverse resources are combined determines the overall productivity of the farming enterprise. It is typically expressed as a ratio of the total output to one or more inputs used in its production. Efficiency, in the context of production economics, refers to the degree to which a farm, or any production unit, is able to produce the maximum possible output from a given set of resources (Adenuga et al., 2023). As such, an inefficient farm has the potential to increase its output without needing to acquire more resources;

it simply needs to improve how it utilizes the resources it already possesses (Ogunnaike et al., 2024).

Despite the economic importance of maize production in ensuring the availability and sustainability of food across various households, Nigeria's maize sector is grappling with a significant and persistent gap between domestic demand and supply. The root of this supply deficit lies in the widespread inefficiency that characterizes smallholder maize production across Nigeria. Studies have consistently shown that many maize farmers operate well below the production frontier, indicating significant levels of inefficiency. This inefficiency translates directly into lower incomes for millions of farming households, trapping them in a cycle of poverty and hindering the agricultural sector's potential to drive economic growth (Onyenweaku et al., 2023). It is against this ground that this study seeks to anaylize the efficiency of maize farms in Kogi State, Nigeria.

## 2.0 Objectives of the Study

The broad objective of this study was to analyse farmers' economic efficiency in Kogi State, Nigeria. The specific objectives were to:

i. describe the socio-economic characteristics of maize farmers in the study area;
ii. determine economic efficiency of maize farmers in the study area;
iii. identify factors influencing economic efficiency of maize farmers in the study area

## 3.0 Methodology

This study was conducted in Kogi State, located in the North Central geopolitical zone of Nigeria. Geographically, the State lies approximately between latitudes 6°30'N and 8°48'N, and longitudes 5°23'E and 7°48'E. Kogi State is popularly known as the "Confluence State" because its capital, Lokoja, is situated at the confluence of Nigeria's two major rivers, the Niger and the Benue (Yusuf et al., 2024). The state shares boundaries with ten other states, including the Federal Capital Territory (FCT), Nasarawa, Benue, Enugu, Anambra, Delta, Ondo, Ekiti, Kwara, and Niger, making it a central connecting point within the country.

The target population for this study consists of all maize farming households in Kogi State. The sampling frame for this research is the comprehensive list of registered maize farmers maintained by the Kogi State Agricultural Development Project (KADP). A multi-stage sampling procedure was adopted to select respondents for this study. In stage one, a purposive selection of Kogi States. This is because of the intensity of maize farming in the States and most individuals in the state are predominantly farmers. In stage two, four agricultural zones A, B, C and D) were purposively selected from Kogi state. In stage three, a random selection of one block (LGA) was made from each agricultural zone. This makes a total of 4 blocks selection in Kogi state. In stage four, a random selection of 4 cells from each block was made and this will give a total of 16 cells from states.. In stage five, a proportionate selection of respondents form each of the cell making a total of 240 respondents in general representing 60, 62, 60 and 57 respondents from zones A, B, C and D respectively. This selection follows Krejcie and Morgan table which was used to determine the sample size of 240 for the study

A well-structured questionnaire were used to collect the primary data from the respondents for the study. Data collected were analyzed using both descriptive and inferential statistical tools. Objectives 1 was achieved using descriptive statistics, objectives 2 was realized using economic efficiency index from Stochastic Frontier Production Function (SFPF) and objectives 3 was obtained using OLS regression.

## 4.0 Results and Discussion

### 4.1 Socioeconomic Characteristics of Maize Farmers

The socioeconomic characteristic of the respondents are presented in Table 1.

**Table 1: Distribution of respondents according to their socio-economic characteristics of the maize farmers (n = 240)**

| Variables | Frequency | Percentage | Mean/Mode |
|---|---|---|---|
| **Age (years)** | | | |
| ≤30 | 42 | 17.50 | |
| 31-40 | 68 | 28.33 | 42 |
| 41-50 | 66 | 27.50 | |
| 51-60 | 53 | 22.08 | |
| >60 | 11 | 4.58 | |
| **Sex** | | | |
| Female | 90 | 37.5 | Male |
| Male | 150 | 62.50 | |
| **Marital status** | | | |
| Divorce | 19 | 7.92 | |
| Married | 166 | 69.17 | Married |
| Single | 37 | 15.42 | |
| Widow | 18 | 7.50 | |
| **Level of education** | | | |
| Non formal education | 48 | 20.00 | |
| Primary education | 48 | 20.00 | |
| Secondary education | 72 | 30.00 | |
| Tertiary education | 72 | 30.00 | |
| **Household Size** | | | |
| 1-5 | 32 | 13.32 | |
| 6-10 | 140 | 58.33 | 9 persons |
| >10 | 68 | 28.33 | |
| **Farming Experience (years)** | | | |
| 1-10 | 141 | 58.75 | 10 years |
| 11-20 | 85 | 35.42 | |
| >20 | 14 | 5.83 | |
| **Farm size (ha)** | | | |
| ≤ 1.0 | 80 | 33.33 | |
| 1.1-2.0 | 80 | 33.33 | |
| 2.1-3.0 | 50 | 20.83 | 2.17Ha |
| 3.1-4.0 | 20 | 8.33 | |
| 4.1-5.0 | 10 | 4.17 | |
| **Source of labour** | | | |
| Both | 47 | 19.58 | |
| Family | 144 | 60.00 | |
| Hired | 49 | 20.42 | |
| **Access to credit** | | | |
| No | 159 | 66.25 | No |
| Yes | 81 | 33.75 | |
| **Extension access** | | | |
| Contact | 18 | 7.50 | |
| No contact | 222 | 92.50 | |
| **Annual farm income (naira)** | | | |

| | | |
|---|---|---|
| 1-500,000 | 112 | |
| 500,001-1,000,000 | 128 | 644,833.3 |

Source: Field Survey (2026).

Table 1 reveals that the mean age of the maize farmers was 42 years, indicating that maize production in the study area is predominantly undertaken by individuals within their economically active and productive years. Specifically, 17.50% of the respondents were aged 30 years and below, 28.33% were between 31 and 40 years, 27.50% were between 41 and 50 years, 22.08% were between 51 and 60 years, while only 4.58% were above 60 years. The age distribution demonstrates that more than half (55.83%) of the respondents were between 31 and 50 years, suggesting that maize farming in Kogi State is largely practiced by middle-aged farmers who possess the physical strength, farming experience, and managerial capability required for efficient agricultural production. This finding agrees with Aboki *et al.* (2021) reported that the average age of maize farmers in Kaduna State was approximately 43 years, indicating that maize production was dominated by economically active farmers.

Table 1 also shows majority (62.50%) of the maize farmers were males, while 37.50% were females, with males constituting the dominant gender involved in maize production within the study area. This finding suggests that maize farming in Kogi State remains largely male-dominated despite the increasing participation of women in agricultural production. The higher representation of male farmers may be attributed to the labour-intensive nature of maize cultivation, particularly during land preparation and ridging which often require considerable physical strength. The present finding corroborates several studies conducted in Nigeria. Akinbode *et al.* (2021) found that male farmers constituted about 64% of maize producers in Oyo State, attributing the dominance to greater access to land and agricultural resources.

The findings on the marital status of maize farmers revealed that the majority (69.17%) of the respondents were married, while 15.42% were single, 7.92% were divorced, and 7.50% were widowed. Marriage is often associated with increased access to household labour, enhanced decision-making capacity, and greater motivation to engage in agricultural production to meet family food requirements and generate income. The finding corroborates the study of Akinwale *et al.* (2024), who reported that married farmers constituted over two-thirds of maize producers in Benue State and argued that marriage contributed significantly to farm labour availability and efficient resource utilization.

The educational profile of the respondents indicated that 20.00% had non formal education, 20.00% attained primary education, while 30.00% each possessed secondary and tertiary education, respectively. This distribution implies that approximately 80.00% of the maize farmers had acquired one form of formal education, suggesting a relatively high literacy level among maize producers in Kogi State. Education is widely regarded as one of the most important determinants of agricultural productivity and efficiency because it enhances farmers' cognitive abilities, managerial competence, and willingness to adopt improved technologies. The findings are in line with Adewale Ojo *et al.* (2022), who reported that educational attainment significantly enhanced the technical efficiency of maize farmers in Osun State through improved adoption of recommended production practices.

Table 1 indicates that majority (58.33%) of the maize farmers had household sizes ranging from 6 - 10 persons, while 28.33% had household sizes greater than 10 persons. Only 13.32% of the respondents had relatively small households comprising between 1 and 5 persons. The average household size was approximately 9 persons, suggesting that maize farming households in the study area are relatively large. This finding reflects the prevailing family structure in many rural communities of Kogi State where extended family systems are common and agriculture remains the primary livelihood activity. Similarly, Ibrahim *et al.* (2023) reported that household size

positively affected farm productivity among maize farmers in Niger State because larger families provided sufficient labour during peak production seasons.

Table 1 further reveals that majority (58.75%) of the maize farmers had between 1 - 10 years of farming experience, while 35.42% had between 11 - 20 years of farming experience, and only 5.83% had more than 20 years of farming experience. The mean farming experience was 10 years, indicating that maize production in the study area is predominantly undertaken by farmers with moderate farming experience. Farming experience is a critical determinant of agricultural productivity and technical efficiency because it enhances farmers' capacity to make informed production decisions, identify appropriate planting periods, and manage pests and diseases effectively.

Table 1 also shows that 33.33% cultivated one hectare or less, another 33.33% cultivated between 1.1 - 2.0 hectares, while 20.83% cultivated between 2.1 - 3.0 hectares. Only 8.33% operated farms between 3.1 - 4.0 hectares, whereas 4.17% cultivated between 4.1 - 5.0 hectares. The average farm size was 2.17 hectares, indicating that maize production in the study area is predominantly characterized by smallholder farming systems. This result agrees with the findings of Abdulrahman *et al.* (2023), who reported that maize farmers in North Central Nigeria cultivated an average farm size of approximately two hectares, reflecting the predominance of smallholder farming systems.

Table 1 shows that majority (60.00%) of the maize farmers relied primarily on family labour for their farming operations, while 20.42% employed hired labour and 19.58% combined both family and hired labour. This distribution demonstrates that maize production in Kogi State is predominantly dependent on household labour rather than commercial wage labour. The finding reflects the smallholder nature of maize farming in the study area, where farming activities are mainly carried out by family members to reduce production costs and maximize household income. The findings reveal that 66.25% of the respondents had no access to agricultural credit, while only 33.75% reported having access to credit facilities. This indicates that the majority of maize farmers in Kogi State continue to finance their production activities primarily through personal savings, family support, informal borrowing, or proceeds from previous harvests. The limited access to institutional credit remains one of the major constraints facing smallholder agriculture in Nigeria and has significant implications for production efficiency, technology adoption, and farm expansion.

The findings revealed that only 7.50% of the maize farmers had contact with extension agents, whereas an overwhelming majority (92.50%) reported having no contact with extension services. This result indicates a very low level of interaction between maize farmers and agricultural extension personnel in the study area. Agricultural extension services constitute one of the most important institutional mechanisms for disseminating improved farming technologies, providing technical guidance, facilitating access to agricultural inputs, and linking farmers to markets and other support services.

Table 1 further reveal most 46.67% of the maize farmers earned between ₦1 - ₦500,000 annually from farming, while a slightly higher proportion (53.33%) earned between ₦500,001 and ₦1,000,000, with an average annual farm income of ₦644,833.30. The distribution indicates that although income levels among maize farmers remain modest, more than half of the respondents generated relatively higher farm earnings, suggesting that maize production constitutes an important source of livelihood and household income in the study area. The mean annual income of ₦644,833.30 suggests that maize farming contributes substantially to rural household livelihoods in Kogi State, although the income may still be insufficient to finance large-scale mechanization, improved irrigation facilities, or substantial investment in modern production technologies.

### 4.2 Economic efficiency of maize farmers in the study area

Table 2 represents the Economic efficiency of the respondents. The results presented in Table 2 indicate that the economic efficiency indices of the sampled maize farmers ranged from 0.88 to 1.00, with a mean economic efficiency score of 0.95.

**Table 2: The Distribution of Economic Efficiency Index for the Respondents (n=240)**

| Economic efficiency | Frequency | Percentage |
|---|---|---|
| **0.80 – 0.89** | 110 | 45.83 |
| **0.90 – 0.99** | 95 | 39.58 |
| **1.00** | 35 | 14.59 |
| **Total** | **240** | |
| **Minimum** | **0.88** | |
| **Maximum** | **1.00** | |
| **Mean** | **0.95** | |

Source: Field Survey (2026)

Table 2 further reveals that most (45.83%) of the farmers recorded economic efficiency scores between 0.80 - 0.89, while 39.58% achieved scores ranging from 0.90 - 0.99. Only 14.59% of the sampled farmers attained the frontier level of 1.00, indicating full economic efficiency. The implication of these findings is that although the majority of maize farmers operated at relatively high levels of economic efficiency, only a limited proportion succeeded in combining available production resources in a manner that minimized production costs while maximizing output and profitability. The mean economic efficiency score of 0.95 suggests that, on average, maize farmers in Kogi State could still improve their economic performance by approximately 5% through better allocation of production resources and more cost-effective management practices without necessarily introducing new technologies.

The relatively high average economic efficiency obtained in this study reflects an encouraging level of managerial competence among maize farmers in the study area. Economic efficiency combines both technical and allocative efficiency; therefore, the result implies that farmers were generally effective not only in converting inputs into output but also in selecting the least-cost combination of production resources given prevailing input and output prices. However, the finding that only 14.59% of the respondents achieved perfect economic efficiency indicates the continued existence of resource misallocation among the majority of farmers. Approximately 85% of the sampled farmers still operated below the economic frontier, suggesting that some production inputs were either over-utilized or under-utilized relative to their optimal economic levels. Such inefficiencies may arise from imperfect information regarding input prices, limited access to production credit, high transportation costs, poor rural infrastructure, and unstable market prices among others.

The present finding also agrees with Obianefo *et al.* (2024), who investigated maize production efficiency under climate-smart agricultural practices in Southeast Nigeria. They observed that while many maize farmers achieved relatively high efficiency scores, only a small proportion attained full efficiency because of persistent challenges associated with production costs, limited financial capital, and variations in managerial capacity.

### 4.3 Factors Influencing Economic Efficiency of Maize Output in the Study

The diagnostic statistics demonstrate that the estimated economic efficiency model provides a satisfactory explanation of the factors influencing economic efficiency among maize farmers in Kogi State. The Wald Chi-square value of 69.65 with a corresponding probability value of 0.0000 indicates that the explanatory variables jointly exert a statistically significant influence on economic

efficiency. The log-likelihood value of 35.493176 further suggests that the maximum likelihood estimation procedure achieved satisfactory convergence, indicating a good fit between the specified stochastic frontier model and the observed data.

**Table 3: Factor influencing economic efficiency**

| Variables | Coefficient | Std. error | P\|z\| |
|---|---|---|---|
| Seed quantity | 0.1605 | 0.0679 | 0.018** |
| Fertilizer quantity | 0.0908 | 0.0436 | 0.037** |
| Labour | -0.1791 | 0.0760 | 0.019** |
| Herbicides | 0.1842 | 0.0363 | 0.000*** |
| Pesticides | 0.0394 | 0.0245 | 0.107 |
| Age | 0.0385 | 0.0138 | 0.005*** |
| Household size | -0.0703 | 0.0605 | 0.245 |
| Years of formal education | -0.0642 | 0.0261 | 0.014** |
| Credit access | 1.0496 | 0.3601 | 0.004*** |
| Membership of association | -0.2024 | 0.3662 | 0.580 |
| Farm size | 0.0105 | 0.0342 | 0.760 |
| Extension contact | 0.2420 | 0.1618 | 0.135 |
| Constant | -5.0594 | 1.0846 | 0.000*** |
| Number of obs | = 240 | | |
| Wald chi2(12) | = 69.65 | | |
| Prob > chi2 | = 0.0000 | | |
| Log likelihood | = 35.493176 | | |

Source: Field Survey (2026).

NB ***, **, * represent significance @ 1%, 5% and 10% respectively

**Seed Quantity**

The estimated coefficient of seed quantity was positive (0.1605) and statistically significant at the 5% probability level (z = 2.37; p = 0.018). This result indicates that seed quantity exerts a significant positive influence on the economic efficiency of maize farmers in the study area. Specifically, an increase in the quantity of seed used increases the likelihood of attaining higher economic efficiency, holding other explanatory variables constant. Similarly, Ayinde *et al.* (2023) established that farmers using certified hybrid maize seed achieved significantly higher economic returns than those relying on recycled local seed.

**Fertilizer Quantity**

The coefficient of fertilizer quantity was positive (0.0908) and statistically significant at the 5% level (z = 2.08; p = 0.037). This indicates that fertilizer application significantly improves the economic efficiency of maize farmers in the study area. The positive coefficient implies that an increase in fertilizer use enhances maize productivity sufficiently to outweigh the associated increase in production costs, thereby improving overall economic efficiency. The finding corroborates the work of Olagunju *et al.* (2023), who found fertilizer use to be a significant determinant of production efficiency among maize farmers in Kwara State.

**Labour**

Labour recorded a negative coefficient (-0.1791) that was statistically significant at the 5% level (z = -2.36; p = 0.019). The negative sign indicates that increased labour utilization significantly reduces the economic efficiency of maize farmers in the study area. This finding suggests that many farmers are employing labour beyond the economically optimal level, resulting in higher production costs that are not matched by proportional increases in maize output. Consequently, excessive labour use lowers profitability and overall economic efficiency. The present finding agrees with

Abdulrahman *et al.* (2023), who found that excessive labour utilization significantly reduced profit efficiency among maize farmers in northern Nigeria because labour costs constituted a substantial proportion of total production costs.

**Herbicides**

The coefficient of herbicide use was positive (0.1842) and highly significant at the 1% level ($z = 5.08$; $p < 0.001$), making it one of the strongest determinants of economic efficiency among maize farmers in the study area. This finding indicates that increased and appropriate herbicide utilization significantly improves farmers' economic efficiency by reducing weed competition, lowering labour requirements for manual weeding, and increasing maize yield. Bello *et al.* (2023) found that herbicide adoption significantly increased production efficiency among cereal farmers in northern Nigeria because of improved weed control and lower production costs.

**Age**

The coefficient of age was 0.0385, which was positive and highly significant at the 1% probability level ($z = 2.79$; $p = 0.005$). This result indicates that older maize farmers were significantly more economically efficient than their younger counterparts. Specifically, an increase in the age of the household head increased the likelihood of attaining higher economic efficiency in maize production. The result corroborates the findings of Obianefo *et al.* (2024), who reported that age significantly influenced allocative efficiency among maize farmers in Southwest Nigeria because experienced farmers demonstrated superior resource allocation and managerial competence.

**Years of Formal Education**

The coefficient of years of formal education was -0.0642 and statistically significant at the 5% level ($z = -2.46$; $p = 0.014$). Contrary to conventional expectations, the negative coefficient indicates that additional years of formal education significantly reduced the economic efficiency of maize farmers in the study area. This finding appears counterintuitive because education is generally expected to improve managerial ability, enhance technology adoption, and strengthen farmers' decision-making capacity.

**Credit Access**

The estimated coefficient for credit access was 1.0496 and statistically significant at the 1% level ($p = 0.004$), indicating that access to credit exerts a strong positive influence on the economic efficiency of maize farmers in Kogi State. The positive coefficient implies that farmers who had access to formal or informal credit facilities were more economically efficient than those without access to credit. This finding suggests that credit availability enables farmers to acquire productive inputs at the appropriate time, adopt improved production technologies, and undertake farm operations without financial constraints.

## 5.0 Conclusion and Recommendations

### 5.1 Conclusion

The study analysed economic efficiency of maize farmers in Kogi State, Nigeria. The findings revealed that the farmers operated at relatively high levels of economic efficiency, with mean efficiency scores of 0.95. The regression analysis established that seed quantity, fertilizer quantity, herbicide use, age, and access to credit significantly enhanced economic efficiency, whereas labour use and years of formal education had significant negative effects.

### 5.2 Recommendations

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

i. Government and financial institutions should strengthen farmers' access to affordable agricultural credit. Since access to credit had a positive and significant influence on economic efficiency.
ii. The provision and timely distribution of improved production inputs should be enhanced.
iii. Labour-saving technologies and farm mechanization should be promoted to reduce production costs.
iv. Extension service delivery and farmers' capacity-building programmes should be strengthened.

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