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# EFFICIENCY OF LABOUR USE AMONG MAIZE FARMING HOUSEHOLDS IN SHENDAM LGA., PLATEAU STATE, NIGERIA

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**ABSTRACT**

Increasing the production of crops such as maize requires increased labour productivity, expanded use of native technologies, and enhanced land utilisation are all necessary for increasing the production of crops like maize. The study focused on Efficiency of Labour Use among Maize Farming Households in Shendam Local Government Area of Plateau state, Nigeria. This study adopted Multistage sampling technique to randomly select 126 farming households. Primary data was obtained through structured questionnaire administration. Descriptive statistics and Stochastic Labour-use Requirement Frontier model was used for the analysis. The result revealed that 93% of the respondents were married, with a mean age of 44 years, 99% were literate and with mean farming experience of 19 years and with a mean farm size of 2 hectares. Of the 160.046 man-hours of labour utilized for maize production; 86.50% was contributed by family labour.. Labour-use stochastic frontier estimates indicate that maize output, agrochemical and farm size significantly affected labour usage while socio-economic determinants of labour use efficiency were labour wage, age, education, gender and farming experience. Furthermore, estimated efficiency mean value was 0.69, while 61% were in 0.61-0.80 efficiency range. It can be concluded that out of a total of 160.046 man-hours of labour utilized for maize production; 86.50% was contributed by family labour. Therefore, the study recommends: women be given more prominent role in maize production given their contribution to farm labour supply, Inputs such as agrochemicals be subsidized while barriers to farm land acquisition be removed through legislation and Technologies need be introduced to reduce human labour use, therefore increasing maize production and labour use efficiency.

**Key words:** *Labour-use efficiency, Maize farming households, Shendam LGA.*

## INTRODUCTION

In every economy, labour plays significant economic and social roles. It is one of the primary producers and provides livelihoods for billions of people globally. One of the production variables that incorporates both family and non-family members is labour. The term "labour" refers to people who are paid on a daily or hourly basis. The group of productive services rendered by human physical effort, skill, and mental strength is referred to as labour (Akintobi, 2021). Akintobi further asserts that People's labour, not the people themselves, is what makes things happen. Labour input, which is typically measured in man-days or occasionally man-hours and represents the input of work of an average man in a working day, is the instrument with which capital and managerial abilities are employed to extract value from the land. Labour as an important production factor plays critical economic and social roles in any economy. It is one of the most important factors of production as well as a source of livelihood to billions of people globally (Schneider, 2005). The degree of labour productivity, which measures the technical effectiveness of human activity used in the manufacture of usable things, is used to represent the efficiency of using labour as a production factor. Nigeria's agricultural production requires a lot of labour. Human labour is required for over 90% of tasks in non-mechanized production systems, and for between 50% and 60% of tasks in mechanised production systems. In addition, family labour makes up more than 76% of farm labour, human labour is essentially about the only type of farm labour available to farmers, and farmers produce more than 80% of all domestic agricultural production (Olayide, 2002; Shaib *et al*., 1997). This means that domestic food supplies in Nigeria are produced by human labour. However, the future of meeting the ever-increasing population's requirement for food depends very favourably on the productivity and availability of human labour (Akintobi, 2021). According to Anyiro *et al.,* 2013; & Bervidová, (2001), the total labour supply is influenced by factors like population size, age mix, and specific institutional characteristics.

The amount of family labour that can be relied upon is constrained by the seasonal relationship between the irregular changes in labour usage patterns and the many labour tasks that must be completed on time (Oluyole *et al.*, 2007). King (1992) in their study found that in general, men performed heavy activities on the farm such as land preparation while women and children performed lighter operations such as planting, fertilizer application and weeding. The study also confirmed that separate wage rates are obtained for these labour categories. Several problems are associated with agriculture and over the years agricultural production has drastically reduced (Ogundari & Ojo, 2006). The labour supply is therefore the glaringly scarce production element. Long-term usage of manpower in agricultural output is hampered in farming communities by the labour supply's responsiveness to potential profitable alternative work options among small-holder farmers (Oluyole *et al.*, 2007: As cited in Nmadu & Akinola, 2015).

Nigeria's food shortage problem has gotten worse as a result of decreased farm productivity brought on by ineffective production methods, a lack of enough resources, and a shortage of farm workers, among other factors (Akintobi, 2021). Akintobi further stated that labour makes up a significant portion of the cost of producing food crops in Nigeria, and that labour productivity has fallen precipitously as a result of the prevalence of farm households with elderly and young children and the use of primitive tools, both of which limit farmers' ability to increase crop yield and income with subsequent increase in poverty level. The sharp decline in labour supply for agricultural production in the country is attributed to a host of factors such as rural-urban migration, increased enrolment in school, increased employment opportunities accompanying analysis of the challenges of small-scale farmers' access to labour in North Central Nigeria (Akintobi, 2021). At present, there is no indication that farming will be mechanized in Northern Nigeria in the nearest future. In Nigeria, labour is a significant barrier to the production of food crops (Gocowski & Oduwole, 2003). According to Gocowski & Oduwole, (2003), the attempts were reportedly hampered by a number of variables, including migration, wage rates, farm revenue, age distribution, barriers to technology adoption, and the impact of illnesses on agricultural labour providers. Studies are typically necessary to provide information that could advise prospective food crop producers on those impacts and elements that are likely to affect the supply of labour used on farms given the importance of farm labour supply in the production of food crops and agricultural production.

The use of maize as a source of foreign exchange in Nigeria further increases its strategic significance. Maize has a variety of other applications besides providing sustenance for people and animals and functioning as a means of exchange. Included in this is the maize seed edible oil, which is a general-purpose cooking oil (Oladejo & Adetunji 2012: As cited in Amaza, *et al.*,2021). Oladejo & Adetunji further asserted that Levulinc acid, a molecule generated from maize, can take the place of hazardous petroleum-based components in anti-freeze products. As a biomass fuel, maize-derived ethanol is employed. A cheap energy source for furnaces used for domestic heating is maize straw. Maize can be used as a raw material for manufacturing and in pharmaceuticals. There is a need to enhance the availability of maize because cattle and people use it in conflict. Studies on the production of maize in several regions of Nigeria have demonstrated the crop's expanding significance in light of its growing use in food processing and livestock feed mills

(Abdulrahman & Kolawole 2008; Ogunsumi & Adebiyi 2005: As cited in Amaza, *et al.*, 2021). Thus, maize has developed into a "cash crop," of Western region of Nigeria, where at least 30% of cropland has been adopted for Maize production. A household's hunger can be eliminated by planting 1-2 hectares of maize, and the whole result might triple food production in Africa (Oladejo & Adetunji 2012: As cited in Amaza, *et al.*, 2021).

Increasing the production of crops such as maize requires increased labour productivity, expanded use of native technologies, and enhanced land utilisation are all necessary for increasing the production of crops like maize. To do this, it is necessary to develop suitable policies and programmes that are geared to reduce the obstacles to farmers and other stakeholders' usage of these crucial inputs. This study is notable because there hasn't been much study done on the subject in the study area, which is its primary motivation. The specific objectives were to: (i) describe the socioeconomic characteristics of maize farming households in the study area; (ii) describe the pattern of labour usage among maize farming households; (iii) estimate the efficiency of labour use among maize farming households; and (iv) estimate the determinants of labor-use efficiency among Maize farming households in the study area.

## METHODOLOGY

### Study Area

The study was carried out in Shendam Local Government Area (LGA) of Plateau State, Nigeria. The LGA is located at 170km from Jos, the Plateau State capital. The estimated population of Shendam LGA was put at 293,814(NPC., 2006) with a land area of 2,477 square kilometers. The Local Government with headquarters in Shendam shares boundaries with Ibi, Taraba State to the South, Qua'anpan Local Government to the East, Pankshin Local Government to the North and Mikang Local Government to the West. Shendam town is the second most populous town in Plateau State after Jos town. It has a latitude of $8^0$ 53' North and longitude $9^0$ 32' East in the tropical Savanna ecological zone. The hot season in Shendam is between January and April, and with average daily high temperature above $96^0$ F. The month of March is the hottest month of the year. The cool season last between June and October. The rainy period of the year last between April and November. The month with the most rain is August, with an average rainfall of 131.75cm. The major spoken language in Shendam Local Government is Ga̲mai. A number of mineral resources such as gypsum and salt are found in Shendam Local Government Area. Trade also flourishes in Shendam Local Government Area with the area hosting several markets such as the Shendam main market which attracts several buyers and sellers of diverse Agricultural commodities. Other important economic activities that take place in Shendam Local Government Area includes: farming, animal rearing and hunting. The common Agricultural crops grown in Shendam Local Government area are Rice, Yam Guinea corn, Millet and Maize while the common livestock found in Shendam Local Government Area are Sheep, Coats, cattle, Local chickens and Duck. Shendam Local Government Area is made up of four (4) districts which includes: Dorok district, Derteng district, Dokan Tofa district and Shendam district.

### Sampling Procedures and Sample Size

A multistage sampling technique was used for this study. In the first stage, a purposive sampling technique was used to select two districts from the list of districts (Shendam & Derteng) in the LGA based on the intensity of Maize production. The second stage involved random selection of 4 villages in each of the selected districts, thereby making a total of 8 villages sampled for the study. The third stage involved random selection of 20% of the total farming households to give the total sample size of 160 maize farmers from the sampled frame of 800 maize farmers obtained from Plateau Agricultural Development Programme (PADP). The reason

### Method of Data Collection

Primary data was obtained through the use of well-structured questionnaire which was complimented with oral interview to elicit responses from the Maize farmers based on the objectives of the study.

**Analytical Techniques**

1. Descriptive statistics, and 2. Stochastic – Labour-use requirement frontier function

**Descriptive Statistics**

Descriptive statistics such as mean, median, frequency distribution in tables and percentages was used to analyze objective 1 and 2 of the study.

**Stochastic – Labour use Requirement Frontier Function**

*Model specification*

Following Masso & Heshmati (2003), Akanni & Dada (2012), Anyiro *et al*. (2014) and Kadurumba *et al.* (2020), the imposed Cobb-Douglas Stochastic Labour-use frontier function approach is given in equation [1].

$$L_i = f(X_{ij}, Y_{ij}; \beta) + (V_i - U_i)\ (i = 1,2 \ldots n) \qquad [1]$$

Where $L$ = Labour use of the $i^{th}$ farmer; $X$ = Vector of the actual $j^{th}$ inputs used by

the $i^{th}$ farmer; $Y$ = Vector of the actual $j^{th}$ output of the $i^{th}$ farmer; β = parameter to

be estimated; $V$ = Uncertainty which is beyond the control

of the $i^{th}$ farmer; and, $U$ = Risk which is attributable to the error of the $i^{th}$ farmer;

Given the technology level at the disposal of a technical unit, the labour-use efficiency is expressed as the ratio of the observed labour-use ($L^b$) to the corresponding optimum labour requirement (, and it is given in equation [2].

$$L_i = \frac{L^b}{L^{op}} = \frac{f(X_{ij}; V_{ij}\ \beta) + (V_i + U_i)}{f\ (X_{ij}; V_{ij}\ ; \beta) + V_i} = \exp(U_i) \qquad [2]$$

Where $L_e$ is the efficiency of labour , and it takes the value of 1 defining labour-use efficient technical unit. The observed labour-use ($L^b$) represents the actual labour-use while the potential labour requirement $L^{opt}$ represents the frontier labour requirement level.

The explicit form of the Cob-Douglas functional form of the LCF function is as given in equation [3].

$$I_n = I_n\beta_0 + \sum\beta_K I_n X_{ij} + \beta_i I_n I_n Y_{ij} + (V_i + U_i) \qquad [3]$$

Where $L_i$ = Total human labour-use of $i^{th}$ farmer (man-day); $X$ = Vector of farm inputs used: $X_1$ = inorganic fertilizer (kg), $X_2$ = seeds (kg), $X_3$ = herbicides (litre), $X_4$ = pesticides (kg), $X_5$ = depreciation on capital items (₦), and $X$ = farm size (hectare); $Y$ = Farm output (kg) from $i^{th}$ farmer; $V$ = random variability in the pro-duction that cannot be influenced by the $i^{th}$ farmer also known as uncertainty; $U$ = deviation from potential labour requirement attributable to labour-use inefficiency and also known risk. $B_0$ =*intercept,* $B_k$ =vector of input parameters to be estimated; $B_l$ = vector of output parameter to be estimated; $i$ = *1,2,3…n farmers*; *j = 1,2,3…n inputs.*

The inefficiency model is given in equation [4].

$$U_i = \delta_0 + \delta_1 Z_1 + \delta_2 \delta_2 \ldots + \delta_n Z_n \qquad [4]$$

Where $Z_1$ = Labour wage (year); $Z_2$ = Age (Years), $Z_3$=Gender (male = 1, female = 0); $Z_4$ = Household size (Number of persons); $Z_5$= Educational level (year); $Z_6$ = Farming Experience (Years); $Z_7$ = Primary Occupation (farming = 1, civil service =2, business=3, artisanship=4, others=5); $Z_8$ = Cooperative membership (year); $Z_9$ = $Z_9$ = Farm Distance from home (kilometer); $Z_{10}$ = Farm income (Naira); $\delta_1$ = intercept; and, $\delta_{1-n}$ = parameters to be estimated. Using the generalized likelihood function, the test for the presence of labour-use inefficiency is defined
by equation [5]:

$$\lambda = -2\ln\left(\frac{H_0}{H_a}\right) \qquad [5]$$

Where, $H_0$ is the value of the likelihood function for the unrestricted frontier (OLS) while $H_a$ is the value of the likelihood function for the restricted Cobb-Douglas frontier model. Thus, if the calculated $Chi^2$ is greater than the tabulated $Chi^2$ at 5 % degree of freedom, then the null hypothesis is rejected in favour of alternative hypothesis. The alternative hypothesis has approximately a mixed $Chi^2$ distribution with a degree of freedom equal to the number of parameters omitted in the unrestricted model, if the null hypothesis is true (Sadiq & Singh, 2016).

**Determinants of Labour-use Efficiency:**

To determine factors contributing to the observed labour-use efficiency, the following model was formulated and estimated jointly with the stochastic frontier model in a single stage Maximum likelihood estimation procedure using the computer software frontier version 4.1 (Coelli, 1996) as follows;

$$LE = a_0 + a_1Z_1 + a_2Z_2 + a_3Z_3 + a_4Z_4 \ldots. a_{11}Z_{11} \quad [6]$$

Where

LE= Labour-use efficiency of the ith farmer

$Z_1$ = Labour wage (Naira)

$Z_2$ = Age of farmers (Years)

$Z_3$ = Level of education (Years)

$Z_4$ = Membership of cooperative (1=yes;0=No)

$Z_5$ = Farm size (Hectare)

$Z_6$ = Gender of the farmer (1=Male;0=female)

$Z_7$ = Farm distance (Km)

$Z_8$ = Farming experience (Years)

$Z_9$ = Primary occupation (Framing =1; otherwisw=0)

$Z_{10}$ = Household size (Number)

$Z_{11}$= Farm income (Naira)

## RESULTS AND DISCUSSION

With a mean age of 44, Table 1 shows that farmers between the ages of 40 and 49 (44.44%) were the highest percentage of maize farmers, while those between the ages of 30-39 (24.84%), 50 to 59 (22.22%), less than 30 (4.58%), and 60 years and older (3.92%) have the lowest percentage. This result is consistent with a number of research (Oluyele & Ojo, 2013 for example), which revealed that persons involved in the supply of farm labour are in the prime of their strength and vitality, which is needed to carry out many of the farm tasks. As a result, they are less susceptible to food shortages and have access to money, demonstrating that they used their youthful energies in worthwhile endeavours. This suggests that the majority of the respondents were young and their age plays a significant role in agricultural activities. Table 1 indicate that the majority of respondents (75.82%) were men. Maize production is gender sensitive and necessitates the use of physical power. This result is consistent with research by Olanrewaju *et al.*, (2022) who examined the economics of cassava production in the Akoko District of Ondo State, Nigeria. Their findings showed that most of the cassava growers were men (72.7%), while women made up 27.3% of the population. This clarifies that the male preponderance in farming operations may be ascribed to the laborious and difficult nature of the varied farm.

Table 1 revealed that married people make up 93.46% of respondents who work in maize farming, whereas widowed people and single farmers contributed just 5.23% and 1.31%, respectively. This means that married people performed the majority of farming operations since they are accountable for the household's many duties, including providing for their families' needs (such as food, shelter, and welfare). This outcome is consistent with Egwuowu & Ozor (2020) findings, which discovered that most sweet potato farmers are married people. The result in Table 1 further indicates the maize farmers' educational backgrounds and revealed that the majority of them were literate and held degrees. Primary education (38.56%), secondary education (32.68%), and higher education (27.45%), with only 1.31% of the farmers holding non-formal education. This conclusion is consistent with Egwuowu & Ozor (2020) findings, which reported that more farmers (51.6%) had a secondary education. This indicate that the majority of farmers were literate. The high percentage of literate individuals in the farmers population suggests that the majority of them were in a better position to receive knowledge about advanced maize production technologies. Table 1 shows that the household size ranged from 1 to 10 people, with 30%, 60.78%, and 9.15%, respectively and with a mean of 12 persons. This indicate that the largest household sizes were between 11 and 20 people. This suggests that although the farmers relied on other forms of farm labour, they utilised family labour to a significant extent in maize production. This finding is consistent with that of Olanrewaju *et al.,* (2022), who found that majority of cassava farmers (55.3%) belonged to households with 4 to 6 members, thus indicating that respondents had access to family labour that helped to increase cassava production. They also found that large households acted as a significant source of farm labour, which helped to increase productivity.

Table 1 of the results also revealed that 16.99% of respondents had farming experience, whereas 36.6% of farmers in the study area had farming experience spanning 11–20 years. This indicate that they are knowledgeable enough about farm management and experienced enough to make day-to-day decisions about the farm. This conclusion was corroborated by study conducted by Oladimeji (2017), who found that 53.5% of sorghum farmers in his study area had between 11 and 30 years of experience in farming, with a minimum of 2 years and a maximum of 40 years of experience. The farmers had an average of 19 years of farming experience, but this does not necessarily indicate their decision-making abilities.

The methods through which the farmers' acquired land is also shown in Table 1 in which 13.07% of the respondents acquired land by inheritance, 36.60% through lease or rent, 1.31% through family land, 1.31% through purchase, 1.31% through borrowed land, and 1.31% through family land. The method through which the farmers acquired their land is also shown in Table 1; 13.07% of the respondents got land by inheritance, 36.60% through lease or rent, 1.31% through family land, 1.31% through purchase, 1.31% through borrowing and 38.56% through government acquisition. This suggests that the majority of respondents obtained government land for maize growing through leases or rent, whereas very few of them did so through inheritance. This implies that they must pay taxes to the government as well as land rent. This conclusion contrasts with that of Moudjahid *et al.* (2022), who discovered that inheritance accounted for 88.2% of respondents' access to land and that the primary means of access in the study area were purchase (13.9%), land rent (4%), and purchase (4%). According to Table 1, 20.3% of maize farmers had farms between 1 and 2 hectares, 74.5% had farms between 3 and 4 hectares, and 5.20% had farms between 6 and 8 hectares. This suggests that small-scale farming accounts for the majority of the maize production in the Shendam Local Government Area. This outcome is consistent with Onuwa (2022).

Table 1: Socio-economics characteristics of maize farmers.

| Variables | Frequency | Percentage | Mean | Std dev. |
|---|---|---|---|---|
| | | | | |
| than 30 | 7 | 4.58 | | |
| 39 | 38 | 24.84 | | |
| 49 | 68 | 44.44 | 44 | 8.651 |
| 59 | 34 | 22.22 | | |
| 60 and above | 6 | 3.92 | | |
| **Gender** | | | | |
| Male | 116 | 75.82 | | |
| Female | 37 | 24.18 | | |
| **Marital status** | | | | |
| Single | 2 | 1.31 | | |
| Married | 143 | 93.46 | | |
| Widowed | 8 | 5.23 | | |
| **Education level** | | | | |
| Non-Formal | 2 | 1.31 | | |
| Primary | 59 | 38.56 | | |
| Secondary | 50 | 32.68 | | |
| Tertiary | 42 | 27.45 | | |
| **Household size** | | | | |
| 1-10 | 46 | 30.07 | | |
| 11-20 | 93 | 60.78 | 12 | 4.320 |
| 21-30 | 14 | 9.15 | | |
| **Farming experience** | | | | |
| 1-10 | 37 | 24.18 | | |
| 11-20 | 56 | 36.6 | | |
| 21-30 | 26 | 16.99 | 19 | 11.777 |
| 31-40 | 34 | 22.22 | | |
| **Mode of land acquisition** | | | | |
| Inheritance | 20 | 13.07 | | |
| Least/Rent | 56 | 36.60 | | |
| Family Land | 14 | 9.15 | | |
| Purchase | 2 | 1.31 | | |
| Borrowed | 2 | 1.31 | | |
| Government | 59 | 38.56 | | |
| **Farm size** | | | | |
| 1-2 | 31 | 20.30 | | |
| 3-4 | 114 | 74.50 | 2 | 1.106 |
| 5-6 | 8 | 5.20 | | |
| **Total** | **153** | **100** | | |

## Labour Use Pattern in Maize Production

Table 2 revealed labour use in maize production among farming households in the study area. For an hectare of maize farm, a total of 160.046 man-hours of labour was utilized. The result indicates that, adult males provided 44.57% man-hours of labour, while the adult females and children accounted for 31.29% and 24.14% of man-hours of labour respectively. The males were the highest contributor, followed by the females while the children were the least contributor of labour to maize production.

The result in table 2 further revealed that 15.42% of the total man-hour labour was spent on pre-planting operations, 13.88% of man-hour was expended on maize planting, 14.50% of the man-hour was spent on 1st and 2nd fertilizer application. Furthermore, 31.71% of man-hour on maize production was spent on 1st and 2nd weeding while 18.3% of the man-hour was expended on harvesting and post-harvesting operation in the study area. This means that weeding was the operation with the highest demand for labour, followed by harvesting and post-harvesting operations, pre-plating operations, while the least operation with demand for labour was planting and replating in the study area. Also, the result on table 2 revealed that of the total (160.046) man-day labour requirement for maize production, family labour contributed 138.438 man-days representing 86.50% while hired labour contributed 21.608 man-days representing 13.50%. It is also noteworthy that child labour was not practiced in the study area as the column for children hired labour was zero (0) man-days. This result implies that most of the farmers depend on family labour and farm families spent most of their time on farm the during farming season due to the poor capital position of the farming households. This result agrees to the findings of Mohammed, et *al.,* (2022) Who found out that 93.64% of labour was sourced from household members which is cheap and almost free while hired labour contributed a marginal 6.36% to labour use.

Table 2: Labour-use distribution pattern per hectare (man-day per hectare) in the study area.

| Operations | Family labour (FLAB) | | | Hired labour (HLAB) | | | FLAB | HLAB | AM | AF | Children | Total labour |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AM | AF | Children | AM | AF | Children | | | | | | |
| Land clearing | 6.157 | 5.242 | 4.876 | 0.980 | 0.131 | 0 | 16.275 | 1.111 | 7.137 | 5.373 | 4.876 | 17.386 (10.86) |
| Ridging | 2.804 | 2.105 | 1.673 | 0.719 | 0 | 0 | 6.582 | 0.719 | 3.523 | 2.105 | 1.673 | 7.301 (4.56) |
| Planting | 4.869 | 4.222 | 3.209 | 0.412 | 0 | 0 | 12.301 | 0.412 | 5.281 | 4.222 | 3.209 | 12.712 (7.94) |
| Replanting | 3.647 | 3.379 | 2.425 | 0 | 0.052 | 0 | 9.451 | 0.052 | 3.647 | 3.431 | 2.425 | 9.503 (5.94) |
| 1st fertilizer application | 4.078 | 3.830 | 3.052 | 0.229 | 0.098 | 0 | 10.961 | 0.327 | 4.307 | 3.928 | 3.052 | 11.288 (7.05) |
| 2nd fertilizer application | 3.882 | 3.431 | 3.124 | 1.111 | 0.373 | 0 | 10.438 | 1.484 | 4.993 | 3.804 | 3.124 | 11.922 (7.45) |
| 1st weeding | 7.405 | 7.013 | 5.484 | 6.608 | 0.353 | 0 | 19.902 | 6.961 | 14.013 | 7.366 | 5.484 | 26.863 (16.78) |
| 2nd weeding | 7.294 | 6.830 | 5.373 | 4.320 | 0.078 | 0 | 19.497 | 4.399 | 11.614 | 6.908 | 5.373 | 23.895 (14.93) |
| Pesticides application | 3.503 | 3.085 | 2.542 | 0.693 | 0.065 | 0 | 9.131 | 0.758 | 4.196 | 3.150 | 2.542 | 9.889 (6.18) |
| Harvesting | 4.654 | 4.242 | 3.575 | 2.922 | 2.190 | 0 | 12.471 | 5.111 | 7.575 | 6.431 | 3.575 | 17.582 (10.99) |
| Threshing | 4.895 | 3.235 | 3.301 | 0.157 | 0.118 | 0 | 11.431 | 0.275 | 5.052 | 3.353 | 3.301 | 11.706 (7.31) |
| Total | 53.190 | 46.614 | 38.634 | 18.150 | 3.458 | 0.000 | 138.438 (86.50) | 21.608 (13.50) | 71.340 (44.57) | 50.072 (31.29) | 38.634 (24.14) | 160.046 |

AM = Adult male; AF= Adult female, Values in parentheses are percentage

### Labour-use Efficiency of Maize Farmers

The result in table 3 of the MLE of the labour-use requirement stochastic frontier function showed the variance parameters; sigma square and gamma are within the plausible margin of 1 % level of probability. Thus, it indicated that the sigma squared distribution assumed for the composite error term is correct and fit while the gamma indicate that the dominant sources of random error are systematic influences that are unexplained by the labour-use function as shown in table 3. In addition, inefficiency effect present in labour is due to differences in farmers peculiar attributes. The gamma coefficient of 0.867 depicts that 86.7% of the variation in the total labour-use among the maize farmers in the study area was due to the significant difference in their labour efficiencies. The generalized Log likelihood function was45.851 and implies inefficiency presence in the data set. The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. Thus, the Cobb-Douglas approach used in this estimation is an adequate representation of the data.

The table reveals that the estimated coefficient (0.260) for the quantity of maize seed was positive and significant at 1% level of probability, which means that for every one percent increase in the quantity of maize seed will result in an increase of 0.260% in the amount of labour-use in Maize production. Also, the result revealed that the agrochemicals used for the maize production had a positive coefficient (0.432) and is significant at 1 level of probability. This implies that for everyone 1% increase in agrochemicals, there will be an increase of 0.432% in the amount of labour used on the Maize farms in the study area. This is similar to the findings of Akanni & Dada (2013) where they obtained similar result among smallholder cocoa farmers in South Western Nigeria. Furthermore, the result reveals that farm size cultivated to maize production also had a positive coefficient (0.241) and was significant at 10% level of probability. This means that for every 1% increase in the in-farm size in Maize farm, labour use requirement will increase by 0.241%.

The outcome of the stochastic frontier function for the labour use requirement inefficiency model in Table 3 shows that the factors that affected the use of labour by households engaged in maize farming in the study area included labour wage, age, gender, household size, education level, and primary occupation. The aforementioned variables' coefficients were all significant. At 5% and 10% levels. The coefficient of labour wage (0.019*) was positive and significant at 10% level. This implies that holding other factors constant, a unit increase in the labour wage of Maize farmers will decrease labour use efficiency by magnitude of 0.019%. This means that the higher the labour wage, the less the quantity of labour per hectare that can be engaged by the farmers and hence, the less the efficiency of labour use. At a 5% level of probability, the age coefficient (-0.038**) is negative. This suggests that, when controlling for other variables, a unit increase in the age of maize farmers will result in an increase in labour use efficiency of 0.038% Smaller farming households with fewer years of education may be prevented from pursuing options outside of farming, such as formal employment, according to Idowu *et al.,* (2018) who found that smaller farming households with low year of schooling could prevent them from getting opportunities other than farm such as formal employment etc.). This indicate that majority of the respondents in the study area are in their youthful age. The outcome is consistent with the findings of Adebayo & Ojogu 2019 that farmers between the ages of 21 and 40 are at the prime of their agricultural production careers. This implies that the majority of respondents were in their prime earning years and would raise their output to ensure food security. However, it is typically believed that younger people are more productive than their older counterparts (Sennuga & Fadiji, 2020). At 10% level of probability, the predicted coefficient for gender (0.745**) is positive and significant at 5% level. This suggests that the labour usage efficiency of maize farmers responds to the gender of the respondents and will decline by 0.745%. The gender coefficient's positive significance showed that gender stereotypes owing to cultural barriers did not prevent women's access to and control over production resources in the study area, which will favourably affect labour use efficiency. The coefficient of education (0.098*) is positive and significant at 10% level. Farmers are more likely to embrace labour-saving methods for growing maize the better educated they are. Given that men made up the majority of those working in the study area's maize production, gender clearly plays an important role in labour usage. The coefficient of Household size (0.104**) is positive and significant at 5% level of probability. The efficiency of labour usage of maize farmers will therefore decrease by a factor of 0.104% for every unit gain in Household-size, other parameters being held constant. Inefficiency will set in especially with large households. On the other hand, the farmers' household size in Maize production may help them choose a labour-use combination that will be less expensive and optimise maize yield.

The coefficient of primary occupation was (0.404*) is positive and significant at 10% level of probability. The efficiency of labour usage of maize farmers will therefore decrease by a factor of 0.404% for every change in primary occupation, other parameters being held constant.

Table 3: Maximum likelihood estimates of stochastic frontier function labour-use of maize farmers

| Variables | Parameter | Coefficient | Standard error | T-ratio |
|---|---|---|---|---|
| **Deterministic Model** | | | | |
| **Constant** | $\beta_0$ | 1.116*** | 0.158 | 7.075 |
| Seed | $\beta_1$ | 0.260*** | 0.052 | 4.967 |
| Fertilizer | $\beta_2$ | 0.020 | 0.065 | 0.302 |
| Agrochemical | $\beta_3$ | 0.432*** | 0.104 | 4.166 |
| Farm size | $\beta_4$ | 0.241* | 0.143 | 1.689 |
| **Inefficiency model** | | | | |
| Constant | $Z_0$ | 1.775* | 1.060 | 1.674 |
| Labour wage | $Z_1$ | 0.019* | 0.011 | 1.680 |
| Age | $Z_2$ | -0.038** | 0.019 | -2.001 |
| Gender | $Z_3$ | 0.745** | 0.314 | 2.373 |
| Household size | $Z_4$ | 0.104** | 0.043 | 2.405 |
| Education | $Z_5$ | 0.098* | 0.053 | 1.854 |
| Farming experience | $Z_6$ | -0.010 | 0.013 | -0.780 |
| Primary occupation | $Z_7$ | 0.404* | 0.236 | 1.714 |
| Cooperative membership | $Z_8$ | 0.221 | 1.001 | 0.221 |
| Farm distance | $Z_9$ | 0.646 | 0.513 | 1.258 |
| Farm income | $Z_{10}$ | 0.018 | 0.088 | 0.209 |
| **Diagnostic statistics** | | | | |
| Sigma squared | $\sigma^2$ | 0.489*** | 0.093 | 5.245 |
| Gamma | $\Upsilon$ | 0.867*** | 0.291 | 2.979 |
| LR test | | 32.821 | | |
| Log likelihood function | | 45.851 | | |

*Note: *** Significant at 1%; ** Significant at 5% * Significant at 10%*

**Farm Level Distribution of labour-use Efficiency**

The frequency distribution of labour use efficiency estimates of Maize farming households in the study area as obtained from the labour use requirement stochastic frontier analysis is presented in Table 4. The result indicates that the minimum and the maximum labour use efficiency of the Maize farmers were 0.48 and 1.00 respectively, which means that the minimum Maize farmers had 48% labour use efficiency and had a maximum of 100% labour use efficiency. This result is however at variance that of Sadiq, *et al*., (2022) who reported a higher mean and minimum labour use efficiency. The wide variation in labour use efficiency estimates is an indication that most of the Maize farmers are still using their labour inefficiently in the production process and there still exists wide opportunities for improving on their current level of labour use efficiency. The distribution table further indicate that 61.44% of the maize farmers in the study area were in the labour use efficiency range of 0.61 – 0.80, followed by farmers with labour use efficiency range of 0.41 – 0.60 were 24.84%, and the lowest is 13.73% who were within labour use efficiency range of 0.81 – 1.00. The implication of the result is that for the farmers with the best labour use efficiency, labour use requirement will rise by 39% [1-(0.61/1.0)] *100] from the maximum possible level of 100% due to labour use inefficiencies while for the Maize farmers with the least labour use practices, the labour use requirement will rise by 77% [1-(0.14/1.0)] *100] from the maximum 100% due to labour use inefficiencies. Also, the result indicated that 61.44 % of the Maize farmers operated within the 0.61 – 0.80 labour use efficiency range, which means that majority of the Maize farmers operated far from their production frontier. This result is inconsistent with the findings of Sadiq, *et al.,* (2022) who reported that 83% of the respondents were between 0.80 – 0.99 labour use efficiency range. In the short-run therefore, there is scope for reducing labour use requirement by adopting the labour use combination employed by the most labour use efficient Maize farmers in the study area.

Table 4: Distribution of labour use efficiency in maize production.

| **Labour use Efficiency Range** | **Frequency** | **Percentage** |
|---|---|---|
| 0.41-0.60 | 38 | 24.84 |
| 0.61-0.80 | 94 | 61.44 |
| 0.81-1.00 | 21 | 13.73 |
| Total | 153 | 100 |
| Maximum Labour-use Efficiency | 1.00 | |
| Minimum Labour-use Efficiency | 0.48 | |
| Mean Labour-use Efficiency | 0.69 | |

## CONCLUSION AND RECOMMENDATIONS

From the findings of this study, it can be concluded that out of a total of 160.046 man-hours of labour utilized for maize production; 86.50% was contributed by family labour; adult male, adult female and children were the sources of labour supply in the study area. The result also revealed that the Cobb-Douglas functional form of labour-use frontier estimates indicate that maize output (10%), agrochemical (1%) and farm size (10%) significantly affected labour usage. The socio-economic drivers of labour use efficiency in the study area were labour wage, age, education, gender, and farming experience. The result further shows that the estimated mean labour-use efficiency value was 0.69, which is an indication of the presence of labour use inefficiency in the study area. Therefore, the study recommends: i. women be given more prominent role in maize production given their contribution to farm labour supply, ii. Inputs such as agrochemicals be subsidized while barriers to farm land acquisition be removed in order to increase the scale of maize production and iii. Technologies need be introduced to reduce human labour use, therefore increasing maize production and labour use efficiency.

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