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# Comparative Gender Analysis of Allocative Efficiency of Fadama III Crop Farmers in Adamawa State, Nigeria

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***Abstract:***
*Efficient allocation of resources has been a problem among farming households in Nigeria. This study compares the allocative efficiency of male and female beneficiaries of Fadama III support in Adamawa State who are into crop production. Primary data was used for the study and collected from a random sample of 183 male and 95 female Fadama III beneficiaries from ten participating Local Government Areas of the state that were purposively selected for the study. The analytical tools employed were simple descriptive statistics involving the use of frequency distribution tables and percentages, stochastic frontier cost function and difference of mean statistics. The socio-economic characteristics of the respondents reveal that male and female beneficiaries had a mean age 40 years and 41 years respectively, with majority (above 75%) of them attaining up to secondary level of education. Their average farm sizes were 1.89 hectares and 1.39 hectares respectively, an indication that crop production among them is undertaken on a small scale. The Maximum Likelihood Estimates of the parameters of stochastic frontier cost function for male and female beneficiaries shows that all the parameter estimates are positive, indicating a direct relationship with the total cost of production. For the male beneficiaries, the coefficients of agrochemicals, inorganic fertilizers, seed and crop output were all significant at varying levels. Similarly, for female beneficiaries the coefficient of hired labour was also significant in addition to those of the male beneficiaries. The estimated gamma values were 0.85 and 0.82 for the male and female respondents respectively and were both significant at 1% level. For the inefficiency model of the male beneficiaries, the coefficients of age, farming experience, education and marital status were all significant at 1% level. Similarly, for female beneficiaries, the coefficient of household size was also significant in the addition to those of the male beneficiaries except marital status. The mean allocative efficiency for the male respondents was 0.86 while that of the female respondents was 0.83. This means that an average male farmer in the study area has the scope of increasing allocative efficiency by 14% as compared with 17% for the female farmer under the existing technology. The t-test result shows a no significant difference between the mean allocative efficiency of the male and female beneficiaries. The study recommends among others the use of model farmers with high allocative efficiency estimate identified in the study to be used to transfer knowledge to other farmers in order to increase their allocative efficiency.*

***Keywords:*** *Gender, allocative efficiency, Fadama III, Adamawa state*

## 1. Introduction

Gender relates to socially assigned roles and behaviours attributable to men and women; it refers to the social meaning of biological sex differences. Gender roles are roles that are played by both women and men and which are not determined by biological factors but by the socio-economic and cultural environment or situation (Mollel and Mtenga, 2000). These roles involve looking beyond differences in activities between men and women to also looking at differences in activities between different women and between different men, as mediated by factors such as age, wealth and marital status (Jo, 2004). Gender affects the distribution of resources, wealth, work, decision-making, political power as well as the enjoyment of rights and entitlements within the family and in public life (Welch et al., 2000). Understanding the roles that women and men play in the different stages of agriculture as well as other production and income-generating activities is important in determining access to, and control over livelihood opportunities and the extent to which programmes may impact on women and men differently (Jo, 2004). A better understanding would assist programme targeting and could be used not only in programme design but also in monitoring and evaluation.

One of the deliberate efforts by the government to reduce poverty among rural farmers was the establishment of National Fadama Development Project which was implemented in phases. 'Fadama' is a Hausa name for irrigable land or lowlying areas and flood plains underlain by shallow aquifers found along Nigeria's major river systems. Food crops are grown in both rainy and dry seasons within the fadama lands.

Fadama I was implemented from 1992-1999 and focused mainly on crop production and largely ignored support of post production activities such as commodity processing, storage and marketing (downstream agricultural sector). Fadama II was designed to correct the shortcomings of Fadama I and paid attention to downstream activities like marketing, processing and infrastructure development, ensuring the participation of all stakeholders at the Federal, State and Local Governments as well as of the ultimate participating Fadama users. The Fadama III project was more of an agricultural diversification programme that provided financing for the diverse livelihood activities identified by the beneficiaries. It included other resource users that the first project had not captured with a wider geographical coverage and was implemented in all the 36 States of the Federation including the FCT. It had the objective of increasing the income of users of rural land and water resources on a sustainable basis.

Fadama III project activities are centered on Fadama User Groups (FUGs) defined as fadama users with a common economic interest, and Fadama Community Associations (FCAs) defined as associations of FUGs operating in a given area. Since the project uses the Community-Driven Development (CDD) approach, beneficiaries were given the chance to choose the kind of activities they want to pursue. This strategy has gained acceptance because of its capacity to develop programs and projects that are capable of empowering the local communities to manage their development agenda, to conform to local demand, and focus on poor and vulnerable groups (Dongier et al., 2001; Gillespie, 2004). Some of the FUGs are gender-based and are given assistance by Fadama III along their operational mandates and plans. Therefore, there is the need to describe the socio-economic characteristics of Fadama III beneficiaries and to determine how efficient they are in the allocation of their resources in crop production.

## 2. Conceptual Framework and Empirical Reviews

Allocative efficiency relates to the degree to which a farmer utilizes inputs in optimal proportions, given the observed input prices (Coelli *et al*., 2002; Ogundari *et al*., 2006). According to Farrell (1957), allocative efficiency refers to the ability of a firm to produce at a given level of output using cost-minimizing input prices. The analysis usually assumes that the firm-farm seeks to optimize a profit-maximization objective function subject to resource constraints. Allocative (or price) efficiency as reported by Liverpool-Tasie *et al*. (2011), refers to the ability of the firm to choose its inputs in a cost-minimizing manner. For allocative efficiency to hold, farmers must equalize their marginal returns with true factor market prices. Thus, technical inefficiency is related to deviations from the frontier isoquant, while allocative inefficiency reflects deviations from the minimum cost input ratios (Bravo-Ureta and Pinheiro, 1997).

Ogunsumi (2005) stated that resources are efficiently allocated when the value of marginal product of each resource input equals its price. Thus, a profit-maximizing entrepreneur will not use a resource beyond the point where the resource adds just as much to his revenue as it adds to his cost. On the other hand, allocative inefficiency arises when factors are used in proportions which do not lead to profit maximization (Russell and Young, 1983; Asogwa *et al*. 2011). A production process may be allocative inefficient when the marginal revenue product (MRP) is not equal to the marginal cost of that input. This results in utilization of inputs in the wrong proportions, given input prices.

An empirical assessment of smallholder cost efficiency and its determinants in maize production were carried out by Ogunniyi and Ajao (2010) using stochastic cost frontier function. The study investigated whether the issue of gender was really important in estimating the cost efficiency of farmers and concluded that there was need for renewed efforts in addressing the problem of gender imbalance in smallholder agriculture in Nigeria. Findings from the study indicated that estimates of the stochastic frontier cost function revealed that the coefficient of seed was found to be significant and negative in female respondents, while it was insignificant in male. This further confirmed the fact that female farmers do not have continuous access to farm inputs (seed) and tend to use the seed from the previous harvest.

Mallam *et al*. (2014) compared the resource use efficiency among beneficiary and non-beneficiary rice farmers of Fadama Project in Niger State, Nigeria. Data were collected from 120 randomly selected rice farmers from both the beneficiary (60) and non-beneficiary (60) groups of Fadama Rice Project in the state using structured questionnaires. Technical and allocative efficiency estimates were obtained using stochastic frontier production function and marginal product approach, respectively. The study found that the mean technical efficiency of the Fadama group was 0.79, while that of the non-Fadama group was 0.81. The result of t-test showed that the difference between the mean scores of the two groups was not statistically significant. Allocative efficiency analysis also showed that the two groups under-utilized available resource inputs. The study recommends among others the intensification of advisory services/training to rice farmers so as to increase their efficiencies in rice production.

Adegbite *et al*. (2015) compared the production efficiencies of Fadama II catfish farmers with non-beneficiaries in Ogun State, Nigeria from two hundred and seventy (270) respondents from the 10 the Fadama participating Local Government Areas of the State. The Maximum Likelihood Estimates (MLE) of the cost function revealed that lime and fingerlings significantly decreased the production cost, while quantity of feed significantly increased the cost among the beneficiaries. Consequently, quantity of feed, labour and pond size significantly increased the production cost among the non-beneficiaries. The cost inefficiency analysis revealed that farming experience decreased the cost efficiency but increased the economic efficiency. The beneficiaries were more efficient in terms of their technical, allocative and economic efficiencies than the non-beneficiaries. The study recommends among others the expansion of the project scope to all the non-benefitting communities.

## 3. Methodology

### *3.1. Study Area*

Adamawa State is located in the North East part of Nigeria between latitude 7.0°N and 11.0°N of the equator and longitude 11.0°E and 14.0°E of the Greenwich meridian (Adebayo, 1999). The State shares common boundary with Taraba State in the South and West, Gombe State in its Northwest and Borno State to the North. It has an international boundary with the Cameroun Republic along its eastern border. The State covers a land area of about 38,741km$^2$ and is divided into 21 Local Government areas. The State has population of 3,161,374 people comprising of 1,580,333 males and 1,581,041 females (NPC, 2006). As opposed to a national annual population growth rate of 3.2%, the population of Adamawa State is growing at 2.8% per annum (Adamawa State MDG Report, 2006).

The State has a tropical climate marked by dry and rainy seasons. The rainy season commences in April and ends in late October. The wettest months are August and September. The mean annual rainfall pattern shows that the amounts range from 700mm in the north-west part to 1600mm in the southern part (Adebayo, 1999). The temperature characteristic in the State is typical of the West African Savannah climate characterized by high temperature almost throughout the year due to high solar radiation which is relatively evenly distributed throughout the year. Maximum temperature in the State can reach 40°C particularly April, while minimum temperature can be as low as 18°C between December and January. Mean monthly temperature in the State ranges from 26.7°C in the south to 27.8°C in the north-eastern part of the State.

The dominant soil groups in the State are luvisols, regosols, cambisols, vertisols and lithosols derived from basement complex, while few other places are on sandstones, shales and alluvium (Ray, 1999). The major economic activity of the inhabitants is agriculture (farming, fishing and cattle rearing). Some of the agricultural crops of importance are cereals, roots and legumes supplemented by few planted trees. The main food crops grown are maize, sorghum, millet, rice, cowpea/beans, groundnut, sweet potatoes and cassava. The farming system employed is either monocropping or mixed cropping. Non-farm economic activities include trading, blacksmithing, fishing and animal husbandry among others.

### *3.2. Sampling Technique*

Purposive and multi-stage random sampling techniques were employed in the selection of respondents. First stage sampling involved the purposive selection of 10 out of 20 Local Government Areas (LGAs) based on the activities of Fadama III in the state. In the 10 LGAs selected, there are a total of 192 male FUGs and 84 female FUGs. In the second stage, a random selection of 49 male FUGs and 26 female FUGs who are into crop production was done based on proportionality factor, to give a total number of selected FUGs to 75. Finally, 183 males and 95 females farmers were randomly selected from the 75 FUGs to give a total number of 278 sampled farmers.

### *3.3. Analytical Techniques*

Both descriptive statistics and inferential statistics were employed in the analysis of the data collected. Descriptive statistics involved the use of means, percentages and frequency distributions to describe the socio-economic characteristics of the farmers; while inferential statistics involved the use of stochastic frontier cost model to determine the allocative efficiency of male and female Fadama III crop farmers. The t-statistics was used in testing for significant difference between the mean allocative efficiencies between the male and female beneficiaries.

The empirical model used in determining the allocative efficiency of the male and female Fadama III crop farmers in explicit form is given as:

$$\ln C_i = \beta_0 + \beta_1 \ln P_1 + \beta_2 \ln P_2 + \beta_3 \ln P_3 + \beta_4 \ln P_4 + \beta_5 \ln P_5 + \beta_6 \ln y + V_i + U_i \quad \text{.......................} (1)$$

Where:

In=Logarithm to base e

$C_i$=Total production cost (₦/ha) by the i$^{th}$ farmer

$P_1$=Rent on land (₦)

$P_2$=Cost of hired labour (₦/ha)

$P_3$=Cost of agrochemicals (₦/ha)

$P_4$=Cost of inorganic fertilizer (₦/ha)

$P_5$=Cost of seeds (₦/ha)

y =Crop output (grain equivalent weight)

$\beta_0$ - $\beta_6$ =Parameters to be estimated

$V_i$ =Systematic component which represents random disturbance term due to factors outside the control of the farmers,

$Ui$ =Allocative efficiency of the i$^{th}$ farmer

It is assumed that the cost inefficiency effects are independently distributed and $U_i$ arises by truncation (at zero) of the normal distribution with mean $\mu_i$ and variance $\delta^2$, where $\mu_i$ is defined as:

$$\mu_i = \delta_1 Z_1 + \delta_2 Z_2 + \delta_3 Z_3 + \delta_4 Z_4 + \delta_5 Z_5 + \delta_6 Z_6 + \delta_7 Z_7 + \delta_8 Z_8 \quad \ldots\ldots\ldots\ldots(2)$$

Where:
$\mu_i$ = Cost inefficiency of the $i^{th}$ farmer
$Z_1$ = Age of farmers (years)
$Z_2$ = Farming experience (years)
$Z_3$ = Education (measured by years of formal education)
$Z_4$ = Household size (number)
$Z_5$ = Extension contact (number of meetings)
$Z_6$ = Marital Status (dummy, where 1 = married and 0 = otherwise)
$Z_7$ = Primary occupation (dummy, where 1 = married and 0 = otherwise)
$Z_8$ = Access to credit (dummy, where 1 = married and 0 = otherwise)
$\delta_1$ - $\delta_8$ = Inefficiency parameters to be estimated

### *3.4. Research Hypothesis*

$H_0$: There is no significant difference between the allocative efficiency of Fadama III male and female farmers.

## 4. Results and Discussions

### *4.1. Socio-Economic Characteristics of Fadama III Crop Farmers in Adamawa State*

Analysis of the socio-economic characteristics of the respondents is presented in Table 1. The age distribution shows that Fadama III crop farmers comprises of both young and older people. The mean age of the male farmers was 40 years with majority (86.80%) of them under 50 years of age, while the mean age of the female farmers was 41 years with majority (80%) of them under 50 years of age. This implies that most of the farmers participating in Fadama crop production in the State are within the economically active age group.

The distribution of their educational levels (as measured by years spent in formal education) reveals that the mean years of formal education for the male farmers was 9 years while that of female farmers was 10 years, an indication that majority of them are literate and possessed up to a secondary school education. About 11% of the female respondents had no formal education as opposed to 25% of the male respondents. This indicates that literacy level is high among the respondents and this could have implication on the adoption of improved crop production technologies, better choice of inputs and efficient utilization of production inputs to boost crop production. This agrees with the findings by Quisumbing and McClafferty (2006) who reported that investment in education has positive effect on farmers.

Their farm size distribution shows a mean farm size of 1.89 hectares and 1.39 hectares for Fadama III male and female farmers respectively. This indicates that male farmers cultivate relatively larger farms than the female farmers. This implies that fadama crop farmers are small scale farmers, a characteristic of subsistence agriculture where resource poor farmers cultivate between 0.05 – 3.00 hectares of farmlands and usually scattered over a wide expanse of land area (Amojoyegbe and Elemo, 2011).

The distribution of respondents by access to extension contact reveals that majority (88%) of the male farmers and most (83%) of the female farmers had contacts with extension agents who are called facilitators under the project. The facilitators train and provide technical assistance to beneficiaries through access to a diversified menu of farm advisory services, including knowledge, technology, information and guidance on technical and economic management of specific crop enterprises leading to increase in crop productivity. This agrees with the findings of Ambali *et al.* (2012) that extension service to farmers is an important incentive in farm production as it aids information dissemination and adoption of innovation thereby increasing food crop production.

| Variables | Male (n = 183) | | Female (n = 95) | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| Age (years) | | | | |
| ≤ 30 | 24 | 13.10 | 17 | 17.90 |
| 31-40 | 82 | 44.80 | 32 | 33.70 |
| 41-50 | 53 | 28.9 | 27 | 28.40 |
| 51-60 | 18 | 9.80 | 14 | 14.70 |
| > 60 | 6 | 3.40 | 5 | 5.30 |
| Mean | 40 yrs. | | 41 yrs. | |
| Educational level | | | | |
| No formal education (0) | 46 | 25.1 | 10 | 10.5 |
| Primary education (6) | 60 | 32.8 | 43 | 45.3 |
| Secondary education (12) | 61 | 33.3 | 31 | 32.6 |

| Variables | Male (n = 183) | | Female (n = 95) | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| Tertiary education (15) | 16 | 8.70 | 11 | 11.6 |
| Farm size (ha) | | | | |
| ≤ 1.0 | 55 | 30.0 | 36 | 37.8 |
| 1.1 – 2.0 | 61 | 33.3 | 40 | 42.1 |
| 2.1 – 3.0 | 28 | 15.4 | 14 | 14.8 |
| 3.1 – 4.0 | 24 | 13.1 | 3 | 3.2 |
| > 4.0 | 15 | 8.2 | 2 | 2.1 |
| Mean | 1.89 ha | | 1.39 ha | |
| Extension contact | | | | |
| Yes | 161 | 87.9 | 79 | 83.2 |
| No | 22 | 12.1 | 16 | 16.8 |

Table 1: Socio-economic Characteristics of the Fadama III Crop Farmers
Source: Field Survey, 2016

*4.2. Maximum Likelihood Estimates of Parameters of Stochastic Cost Function*

The Maximum Likelihood Estimates (MLE) of the parameters of stochastic frontier cost function for male and female farmers is presented in Table 2. All the parameter estimates are positive, indicating a direct relationship with the total cost of production. For male farmers, the coefficients of agrochemicals ($\beta_3$), inorganic fertilizers ($\beta_4$), seed ($\beta_5$) and crop output ($\beta_6$) were all significant at 1% except for crop output which is significant at 5% level. Similarly, for female farmers the coefficient of hired labour ($\beta_2$) is significant at 1% level in addition to the significant ones under male farmers except for cost of inorganic fertilizers which is significant at 5% level. This means that these factors are important determinants of total cost associated with food crop production among Fadama III crop farmers in the State. Since the parameter estimates are the direct cost elasticities, a 1% increase in the cost of agrochemicals, cost of inorganic fertilizers, cost of seed and crop output will increase total production cost by approximately 0.03%, 0.29%, 0.36% and 0.62% respectively for the male farmers. Similarly, for the female farmers, a 1% increase in the cost of hired labour, cost of agrochemicals, cost of inorganic fertilizers and crop output will increase total production cost by approximately 0.05%, 0.41%, 0.03% and 0.24% respectively. A similar result was obtained by Mallam *et al.* (2014) in their study on resource use efficiency among Fadama beneficiary rice farmers in Niger State, Nigeria who identified farm size, seed, labour and herbicides as important determinants of allocative efficiency but were underutilized.

The estimated gamma ($\gamma$) values for male and female farmers were 0.85 and 0.82 respectively and statistically significant at 1% level, indicating that 85% and 82% of the variation in the total cost of production among the male and female farmers respectively were due to differences in their cost efficiencies. Sigma squared ($\sigma^2$) on the other hand were 0.47 and 0.93 for the male and female farmers respectively and statistically significant at 1% level indicating correctness of fit of the model as assumed for the composite error term.

The estimated coefficients of the parameters in the inefficiency cost model for the farmers reveals that all the coefficients have a negative sign except for credit access in the female farmers. A negative coefficient implies inverse relationship with cost inefficiency, that is, it has a direct positive effect on cost efficiency and vice-versa *apriori*. The analysis for the male farmers reveals that the coefficients of age ($\delta_1$), farming experience ($\delta_2$), education ($\delta_3$) and marital status ($\delta_6$) are all significant at 1% level. Therefore, increase in age, farming experience, education and marital status will significantly decrease cost inefficiency among the male farmers and vice versa. Similarly, for the female farmers, the coefficients of age ($\delta_1$), farming experience ($\delta_2$), education ($\delta_3$) and household size ($\delta_4$) are all significant at 1% level. This implies that an increase in age, farming experience, education and household size will significantly decrease cost inefficiency among the female farmers and vice versa.

| Variables | Parameters | Coefficients | | Standard error | | t- ratio | |
|---|---|---|---|---|---|---|---|
| | | Male | Female | Male | Female | Male | Female |
| Constant | $B_0$ | 1.8860* | 3.5737* | 0.0729 | 0.0568 | 25.873 | 6.287 |
| Rent on land ($P_1$) | $B_1$ | 0.0028 | 0.0138 | 0.0036 | 0.0084 | 0.779 | 1.638 |
| Cost of hired labour ($P_2$) | $\beta_2$ | 0.0092 | 0.0464* | 0.0075 | 0.0097 | 1.224 | 4.774 |
| Cost of agrochemicals ($P_3$) | $\beta_3$ | 0.0344* | 0.4069* | 0.0110 | 0.0297 | 3.108 | 13.713 |
| Cost of fertilizer ($P_4$) | $\beta_4$ | 0.2888* | 0.0339** | 0.0209 | 0.0139 | 13.772 | 2.424 |
| Cost of seed ($P_5$) | $\beta_5$ | 0.3605* | 0.1354 | 0.0219 | 0.0890 | 16.476 | 1.521 |
| Crop output (y) | $\beta_6$ | 0.6249** | 0.2382* | 0.27851 | 0.0912 | 2.2440 | 2.612 |

| Variables | Parameters | Coefficients | | Standard error | | t- ratio | |
|---|---|---|---|---|---|---|---|
| | | Male | Female | Male | Female | Male | Female |
| Inefficiency effects | | | | | | | |
| Age ($Z_1$) | $\delta_1$ | -0.2217* | -0.6144* | 0.0333 | 0.4708 | -6.65 | -13.052 |
| Farming experience ($Z_2$) | $\delta_2$ | -0.1709* | -0.5081* | 0.0351 | 0.2432 | -4.86 | -20.883 |
| Education ($Z_3$) | $\delta_3$ | -0.1329* | -0.4212* | 0.0322 | 0.0721 | -4.12 | -5.8402 |
| Household size ($Z_4$) | $\delta_4$ | -0.2130 | -0.1260* | 0.1871 | 0.0368 | -1.138 | -3.432 |
| Extension contact ($Z_5$) | $\delta_5$ | -0.0523 | -0.109 | 0.0610 | 0.0625 | -0.857 | -1.750 |
| Marital status ($Z_6$) | $\delta_6$ | -0.5731* | -0.1338 | 0.1007 | 0.0875 | -5.69 | -1.528 |
| Access to credit ($Z_7$) | $\delta_7$ | -0.0302 | 0.2228 | 0.0289 | 0.1723 | -1.045 | 1.293 |
| Diagnostic statistics | | | | | | | |
| Log likelihood function | | 122.46 | 43.11 | | | | |
| Sigma squared | ($\sigma^2$) | 0.4699* | 0.9336* | 0.0251 | 0.1730 | 18.72 | 5.396 |
| Gamma | ($\gamma$) | 0.8520* | 0.8228* | 0.0692 | 0.0243 | 12.31 | 33.905 |

*Table 2: Maximum Likelihood Estimates of Parameters of Stochastic Frontier Cost Functions for Male and Female Fadama III Crop Farmers in Adamawa State*
*Source: Computer Output From Frontier 4.1 * Significant At 1%; ** Significant At 5%*

### *4.3. Allocative Efficiency Estimates for Male and Female Fadama III Crop Farmers*

The distribution of allocative efficiency estimates for male and female Fadama III crop farmers is presented in Table 3. The minimum allocative efficiency indices for the male and female farmers were estimated at 0.28 and 0.33 respectively; signifying the most allocative inefficient farmers in both cases. On the other hand, the maximum allocative efficiency value for the male and female farmers were the same (0.97). By extension, the least allocative inefficient male and female farmers have the potential of increasing their allocative efficiency by 69% and 64% respectively in the short run to attain the level of the allocative efficiency of the average farmers. The mean allocative efficiency for the male respondents was 0.86 while that of the female respondents was 0.83. This means that an average male farmer in the study area has scope for increasing allocative efficiency by 14% as compared with 17% for the female farmer in the short run under the existing technology.

The distribution of the allocative efficiency estimates revealed that only 3.3% of the male farmers were operating below 50% allocative efficiency as against 4.2% for the female farmers. Also, about 84% of the male farmers had allocative efficiency score of above 80% as against 73.7% for the female farmers. It can be concluded that Fadama III crop farmers in the State are efficient in the allocation of resources in crop production.

| Efficiency level | Male (n = 183) | | Female (n = 95) | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| ≤ 0.49 | 6 | 3.28 | 4 | 4.21 |
| 0.50 – 0.59 | 2 | 1.09 | 1 | 1.05 |
| 0.60 – 0.69 | 3 | 1.64 | 6 | 6.32 |
| 0.70 – 0.79 | 19 | 10.38 | 14 | 14.74 |
| 0.80 – 0.89 | 60 | 32.79 | 39 | 41.05 |
| 0.90 – 0.99 | 93 | 50.81 | 31 | 32.63 |
| Minimum | 0.28 | | 0.33 | |
| Maximum | 0.97 | | 0.98 | |
| Mean | 0.86 | | 0.83 | |

*Table 3: Distribution of Allocative Efficiency Indices of Male and Female Fadama III Crop Farmers in Adamawa State*
*Source: Field Survey, 2016*

### *4.4. Test of Mean Allocative Efficiency Difference between the Male and Female Fadama III Crop Farmers in Adamawa State*

The result of the t-test as shown in Table 4 revealed that there is no significant difference between the allocative efficiency ratings of the two categories of farmers. This signifies that Fadama III crop farmers in the State allocate production inputs in similar proportion such that there is no significant difference in their respective average total production cost per hectare. This may not be unconnected with the technical support the beneficiaries receive from Fadama III facilitators who are specially trained for that purpose. Therefore, the null hypothesis is accepted that there is no significant difference in the mean allocative efficiency indices of the male and female farmers.

| Category | Mean Efficiency | Standard Deviation | Sample Size (n) | Degree of Freedom | T-Value | Decision |
|---|---|---|---|---|---|---|
| Male beneficiaries | 0.86 | 0.5639 | 183 | | | |
| Female beneficiaries | 0.83 | 0.4211 | 95 | 275 | 1.3218 | Accept $H_0$ |

*Table 4: Test of Mean Allocative Efficiency Difference between the Male and Female Fadama III Crop Farmers in Adamawa State*
*Source: Field Survey, 2016*

## 5. Conclusion and Recommendations

The study is on comparative gender analyses of Fadama III crop farmers in Adamawa State, Nigeria. The mean age of the male farmers was 41 years as against 40 years for the female farmers. The study identified the presence of cost inefficiency effects in both the male and female stochastic cost analyses. The allocative efficiency range of the male farmers was 0.28 – 0.97, with mean of 0.86, while that of female farmers was 0.33 – 0.97, with mean of 0.83. The least allocative inefficient male and female farmers have the potential of increasing their allocative efficiency by 69% and 64% respectively in the short run to attain the level of the allocative efficiency of the average farmers. Also, an average beneficiary male farmer in the state has the scope for increasing allocative efficiency by 14%, while that of the female beneficiary is 17% in the short run under the existing technology. The result of the t-test however revealed a no significant difference between the mean allocative efficiency of the two categories of beneficiaries, hence the null hypothesis is accepted.

Base on the findings of the study, the following recommendations are made;

(i) Model farmers that were identified in the study with high allocative efficiency estimates should be used to transfer knowledge to other farmers in order to increase their allocative efficiency.

(ii) The standards already in place where facilitators work with farmers in their communities should be sustained as it will increase the extension knowledge of farmers towards improving their productivity.

(iii). More Fadama III support should be extended to non-beneficiaries so that they can be efficient in the allocation of resources.

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