APPRAISAL OF URBAN AGRICULTURE IN ABUJA, NIGERIA

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ABSTRACT

Urban agriculture is a food production strategy that has been employed since Roman times to secure supplementary food supplies. Importance of urban and Peri – urban agriculture cannot be down played. It is regarded as a practice that is growing out of its ability to assist, resolve or cope with diverse development challenges. Urban agriculture and peri-urban agriculture has been employed since Roman times. Despite the importance of urban agriculture it has not been given its rightful place. This is because it has not been officially recognized; rather it is merely tolerated as response to the socio-economic conditions faced by many poor-individuals (Olofin et al., 2010).

Keywords: Appraisal, Urban, Agriculture, Abuja

INTRODUCTION

The rapid rate of urban growth in Third World countries is a cause for concern. Whereas in 1960, only 22% of the population of Third World countries lived in urban areas, the figure is projected to increase to 44% by the new millennium (Anderson 1994). The situation is particularly alarming in Sub-Saharan Africa where, although about 70% of the population still live and work in rural areas, the average annual urban growth rate of 4.8% between 1980 and 1993 was more rapid (World Bank, 1995). Past experience of cities in developed countries suggest that the future sustainable development and political stability of the Third World cities will depend upon food supplies for burgeoning populations (Peddison et al 1990; Walton and Seddon, 1994). There has been a growing interest in recent years in the considerable potential of agriculture in and around the large cities of Sub-Saharan African (SSA), as one possible element in solving the problem of future food supply.

The International Food Policy Research Institute opined that "One way to help ward off hunger among low-income households of the future may be through 'Urban Agriculture', the farming of small plot of land available in urban environments or on the perimeter of the city" (IFPRI, 1996). Eqziabler et al (1994), stress the importance of urban agriculture for many reasons, including provision of employment, food supply, supplementing income and producing important nutrition not normally available to low-income households. Urban Agriculture, defined as production in the home or plots in urban or Peri-urban areas, is more widespread and important than generally thought. Some believe that it is not only potentially significant source of income, food, energy and micro nutrients for family members but that it can also benefit the environment by providing a way to use solid waste and water.

The United Nation Development Programme (UNDP) defined Urban Agriculture as "an industry that processes and markets food fuel, largely in response to the daily demand of customers within a town, city or metropolis, on land and water dispersed throughout the urban and peri-urban areas, applying intensive production methods, using natural resources and urban wastes, to yield a diversity of crops and livestock. According to the World Bank (2002), Urban Agriculture is a significant economic activity central to the lives of hundreds of millions of people throughout the world. There is evidence here and abroad that the potential of Urban Agriculture for food security is real. The United Nations Development Programme estimates that 15% of food worldwide is grown in cities; the opportunities exist to significantly increase this percentage.

The study on urban agriculture has not been exploited in Nigeria, only Etim (2001), had considered the technical inefficiency of the urban farmers in one of the eastern part of the country (Akwa Ibom State). But this study focused on economics of urban agriculture and identifies the constraints in production using stochastic production frontier in Abuja.

MATERIALS AND METHODS

Abuja, Nigeria's new capital city is located in the middle of the country. The Federal Capital Territory has a land area of 8,000 square kilometers, which is two and halftimes the size of Lagos, the former capital of Nigeria. The FCT is bounded on the north by Kaduna State, on the west by Niger State, on the east and south-east by Nasarawa State, and on the south-west by Kogi State. It falls within latitude 7° 25' N and 9° 20° North of the Equator and longitude 5° 45' and 7° 39'.

The FCT has two distinct seasons, namely the rainy season that begins around March and runs through October and the dry season which begins from October and ends in March. However, within these seasons is a brief harmattan season that is occasioned by the north east trade wind and the attendant dust haze, increased cold and dryness.

Weather conditions in Abuja are influenced by its location within the Niger-Benue trough on the windward side of the Jos Plateau and at the climate transition zone between the essentially 'humid' south and the 'sub-humid' north of the country. The climatic dictates of the FCT are essentially from the south West to the North West due to the rising elevation from the Gurara valley in the south west, to the Bwari-Aso hills and the Agwa -Karu hills to the north east.The high temperatures and the relative humidity in the Niger-Benue trough give the Federal Capital Territory a heating effect but the increasing elevation towards the north east reduces the heat in areas like on the Gwagwa plains where the Federal Capital City (FCC) is sited than on the Iku-Gurara plains to the west.

Rainfall in the FCT reflects the territory's location on the windward side of the Jos Plateau while the monthly rainfall distribution intensifies during the months of July, August and September. It is endowed with fertile land for agriculture and at the same time a yearly climate that is neither too hot nor too cold. The FCT is divided into six area councils namely, Abuja Municipal, Gwagwalada, Abaji, Kuje, Bwari and Kwali.

SAMPLING TECHNIQUES

The study makes use of Multistage Simple Random Sampling Techniques. A list of farmers practicing urban agriculture was be prepared with the help of officials of the agricultural department. The listed farmers were further categorized based on farm holdings. Twenty five respondents were selected randomly from the six area councils in Abuja, namely, Abuja Municipal, Gwagwalada, Abaji, Kuje, Bwari and Kwali. Totaled to One Hundred and Twenty in number.

METHOD OF DATA COLLECTION

The research work will be based on primary data. Structured questionnaire, interviews, and observation will be employed to gather the data related to economic analysis of Urban Agriculture in Abuja. The target populations are people are engaging in urban farming activities in Abuja.

Model Specification

The probit model postulates that the probability (Pi) that an individual (i) adopts or does not adopt Urban Agriculture is a function of an index Zi.

Zi is also the inverse of the logistics cumulative function of Pi.

Pi (Y = 1) = f (zi) - - - -- --------------- (1)

Zi = F^{-1} (pi)------------------------------(2)

The probability of adoption is given by

$$Pi\ (Y = 1) = \frac{1}{1 + e\text{-}zi} \quad \text{- - - -- --------------- (3)}$$

The probability of non-adoption is given by

Qi (y = 0) = 1 – Pi (y = 1)

$$\text{But } 1 - Pi\ (y = 1) = \frac{1}{1 + e\text{-}zi} \quad \text{- - - -- --------------- (4)}$$

Therefore, we can rewrite as

$$\frac{pi}{1 - pi} = \frac{1 + e^{zi}}{1 + e^{-zi}} = e^{zi} \quad \text{------------- (5)}$$

The equation (5) gives the ratio of the probability of adoption to the probability of non-adoption.

Dependent Variable

The dependent variable (y) is a dummy

Y = 1, if the individual adopts urban agriculture.

Y = 0, if otherwise

Since the dependent variable is binary, the ordinary least squares (OLS) technique is inappropriate to estimate the model (Scott, et al 1997). The cumulative distribution function (CDF) is used to model such as regression.

The value of p goes from 0 to 1 i.e (as Z varies from -∞ to +∞). The probit (L) goes from -∞ to +∞

$$Li = \ln \frac{pi}{1 - pi} = zi$$

Using the probit function, the probability of adoption by individual is calculated from his or her Zi values.

$Zi = b_0 + b_1x_1 + b_2x_2 + \text{---------------------} + b_nx_n$

The probability of non-adoption by individual is estimated from the average value of Zi

$Zi = b_0 + b_1x_1 + b_2x_2 + \text{---------------------} + b_nx_n$

X_1 = Cost of family labour input used in production (in Naira).

X_2 = Cost of hired labour inputs used in production (in Naira).

X_3 =other cost representing expenses on maintenance of equipment used in production (in Naira)

X_4 = Cost of other variable materials used (in Naira)

e = error term.

The Technical Efficiency Production Model is expressed as:

$\text{In } Yij = \beta_0 + \beta_1 \text{ In } Xij + \beta_2 \text{ In } Xij + \beta_3 \text{ In } Xij + \beta_4 \text{ In } Xij + ei.$

Where; subscripts ij refer to be production level of urban farmers.

In – denote logarithm to base e.

Y = represents the farm gross margin (in Naira)

X_1 = Cost of family labor input used in production (in Naira).

X_2 = Cost of hired labor inputs used in production (in Naira).

X_3 = other cost representing expenses on maintenance of equipment used in production (in Naira)

X_4 = Cost of other variable materials used (in Naira)

e = error term.

RESULTS AND DISCUSSIONS

The log likelihood value and it is -3.3544 and this shows that natural logarithms of all the probability of the joint variable and it is negative relationship that exit between them. Monthly income has a positive effect on the welfare of farmers. This is consistent with the Keynesian consumption function and the permanent income hypothesis of Friedman. These posit a positive relationship between welfare and income. According to the permanent income hypothesis, which distinguishes between permanent and transitory components of incomes, households will spend mainly the permanent income while the transitory income is channeled into saving with marginal propensity to save from the income approaching unit. This positive relationship has been confirmed by empirical studies (Avery and Kamichkel, 1991). Household size also has a negative effect on welfare of the farmers. This suggests those household that have larger household sizes are more likely to have reduced welfare, which is economic in theory. The larger the household size, the more difficult it may be for the household to meet the basic requirement such as education for children, proper nutrition and adequate housing, all of which tend to reinforce poverty. This also means that consumption synergies expected from lager household size may be absent. Sex of the respondents also has a positive co-efficient. It is psychologically deducted that both male and female members high level of commitments to urban farming practice.

Table 2

The log-likelihood function is estimated to be 55.86 which maximize the joint densities in the estimated model. Sigma-squared (σ^2) has the value of 0.0186 that is variation that occurs in the farms is caused by1.86% of the error term (Measurement error). Gamma (γ) is not statistically/significantly different from zero which implies that technical inefficiency plays a minimal role in the variation of observed urban farms output. The estimated value of Gamma in the model, which is 0.1282, implies that 12.8% of the total variation in urban s due to technical inefficiency. The negative sign of the parameters in the inefficiency function means that the associated variables have a positive effect on the technical efficiency and a positive sign indicate the reverse. Coefficient Values indicate elasticity.

Farmland: The coefficient (0.5959) is statistically significant at 1% meaning that land is an important factor explaining changes in production. If the land size is increased by 10 percent, output level would rise by 5.959 percent, all things being equal (ceteris paribus). This implies that the magnitude of the coefficient shows inelastic nature of output with respect to land.

Family Labour: The coefficient (0.0899) is statistically significant at 10 percent showing that family labour appears to be an important factor that explains changes in output of crop. But the magnitude of the coefficient shows inelastic nature of output with respect to the family labour. If family labour is increased by 10 percent, output level would improve less than proportionate by a margin of 0.899 percent in a ceteris paribus case. Therefore, there is still some scope for increasing output by increasing number of family labour.

Plantlings: The production elasticity of output with respect to cost of plantings is 0.1979 showing an inelastic situation. If plantings are increased by 10 percent, output level would improve by a margin of 1.979 percent in a ceteris paribus case. The coefficient is statistically significant at 5 percent. This shows that there is still some scope for increasing output of crop production per plot by increasing cost of plantings especially when the land area can be increased.

Inefficiency Factors

1. AGE: The coefficient (0.0095) is statistically significant at 1 percent showing that as age increases, inefficiency in resource use in urban farms increases and technical

efficiency decreases. 10 % increases in age will lead to 0.09% increases in inefficiency in a ceteris paribus case.

2. EDUCATION: The Coefficient (-0.19926) is statistically significant at 1 percent showing that as educational level of the urban farmers increases, inefficiency in resource use decreases and technical efficiency increases that is the more education, the less is technical inefficiency. The years of former education of the farmer is increased by 105 inefficiency is decreased by 1.9926% in case of ceteris paribus
3. EXPERIENCE: The coefficient (-0.1926) is not statistically significant.
4. GENDER: The coefficient (0.0234) is not statistically significant.
5. CROPPING SYSTEM: The coefficient (0.1362) is statistically significant at 10 percent.This shows that the mixed cropping system practiced affects the technical efficiency of the farmers negatively. (i.e. farmers practicing sole –cropping are more efficient than mixed cropping). And the majority of the urban farmers practiced mixed cropping which reduces the technical efficiency.
6. OCCUPATION: The coefficient (-0.1403) is statistically significant at 10 percent showing that the secondary nature of occupation in urban farming affects the technical efficiency negatively. That is, farmers that take urban farming as primary occupation are more efficient than farmers that take urban farming as secondary occupation.

Table 3. Technical Efficiency

Table 3 shows frequency distribution of individual technical efficiency estimate. It is shown from the table that the highest percentage of technical efficiency falls between 0.9 and < 1 while the least percentage of technical efficiency fall between the class interval of 0.7 and 0.8. Also from Table 3, technical efficiency clustered around the upper end of the technical distribution, indicating that most of the urban farms in Abuja are near or operating close to full technical efficiency. However, no farm is one hundred percent efficient

Table 4

The empirical estimation of the probit analysis result as presented in table 4.16 reveals a log likelihood of -3.3544, pseudo R^2 of 0.7653 and LR statistic of 21.88, all significant at 5 percent probability level; this shows that the model has a good fit. Considering P>/Z/ values for all the variables included in the model, only X^2, X^4 and X^5 are significant and they are all significant at 5 percent level of significance, having confidence interval of 95 percent each. The implication of the findings is that increase in the level of any explanatory variable with coefficient positive sign, X^5 for example, will have a positive effect on Urban Agricultural practice, whereas the variables with negative sign will exert a negative relationship on urban Agricultural practice.

However, Monthly Income (X^5) being positive and significant at 5 percent indicates that it is a strong factor in Urban in Agricultural production practice; although its coefficient is positive and in line with prior expectation because it is expected to contribute positively to urban agriculture. Also, households size (X^3) is negative and not significant at any level of probability. The negative coefficient of X^3 is line with (Damise et al 2007) finding because household size X^3 measure number of working members; generally, an increase in farm size is likely to increase the probability of urban farming in agricultural production, all things being equal; this probability means that, younger members of the household are not involved in urban agriculture because the youths of modern days prefer white-collar jobs. Age X^1 is not statistically significant but have positive.

Table 1. Marginal Effects After Probit

Variables	dy/dx	Standard Error	Z	P>/Z/
Age	0.5433	0.7265	-0.75	0.455
Sex	0.0724	0.1518	0.48	0.633
Household Sizes	0.4379	0.5723	0.77	0.444
Years of Experience	0.3554	0.6514	0.55	0.585
Monthly Income	0.5639	0.7590	0.74	0.457

Table 2. The Maximim Likelihood Etimates (Mle) And Inefficiency Function

Variables	Coefficient	t-Ratio
Constant term (β_o)	2.5938	8.6916 ***
Land (ha) (β_1)	0.5959	7.9476 ***
Fertilizer (KG) (β_2)	-0.0054	- 0.3904
Hired labour (mandays) (β_3)	0.0148	1.3776
Family labour (mandays) (β_4)	0.0899	1.6763
Plantings (₦) (β_5)	0.1979	2.4027 **
Inefficiency Model		
Intercept (δ_0)	-0.6715	–7.6526 ***
Age (year) (δ_1)	0.0095	3.5853 ***
Education (δ_2)	-0.1926	-2.9191 ***
Experience (Year) (δ_3)	-0.0037	-0.9259
Gender (δ_4)	0.0234	0.3339
Primary purpose (δ_5)	0.0497	0.8152
Land ownership (δ_6)	0.0543	0.8769
Household size (δ_7)	0.0054	0.7804
Cropping System (δ_8)	0.1362	1.8821*
Occupation (δ_9)	-0.1403	-1.9680 *
Diagnostic Statistics		
Sigma-squared (σ^2)	0.0186	5.2659 ***
Gamma (γ)	0.1282	0.4515
Log likelihood Function	55.8605	
LR test	29.3172	
Number of observation	120	

Source: computed from MLE results.

Note: From the tables above,

Asterisks: *** indicates 1% significant level, ** indicates 5% significant level

* indicates 10% significant level

Table 3. Frequency Distribution Of Individual Technical Efficiency Estimate

Technical efficiency	Frequency	Percentage
$0.7<TE\leq 0.8$	16	7
$0.8<TE\leq 0.9$	36	19
$0.9<TE< 1$	68	74
Total	120	100.0

Source: MLE Result.

Table 4. Probit Estimates of the selected explanatory variables on dependent

Variables	Coefficient	Standard Error	Z Statistics	P – Values
Constant	17.9871	22.6652	0.79	0.427
Age (X_1)	0.2526	0.2304	-1.10	0.273
Sex (X_2)	1.7375	2.8294	0.61	0.539**
Household Size (X_3)	-2.1566	1.8601	1.16	0.246
Year of Experience (X_4)	0.9731	1.3739	0.71	0.479**
Monthly Income (X_5)	0.005	0.004	0.79	0.248**

Source: Field Survey, 2010

Log likelihood=-3.3544, LR Statistic= 21.88, Pseudo R^2=0.7653, Prob>chi^2=0.0612

Note: From the tables above,

Asterisks: *** indicates 1% significant level, ** indicates 5% significant level

* indicates 10% significant level

SUMMARY AND RECOMMENDATIONS

This study was based on data collected from 120 urban crop farmers in Abuja metropolis, in order to determine the economic appraisal of urban farming in the study area. The stochastic frontier production approach using the maximum likelihood procedure was used to estimate the model and predict the individual farmer's technical efficiency.The results of the analysis showed that 81.2 percent of the farmers were male while 18.8 percent were female, and majority of them were married (82.3 percent) with the equal mean efficiencies (0.95). The majority of the farmers (71.8 percent) were within the age range of 30-59 and their mean efficiencies decrease as their age increase. Majority of the farmers (64.75 percent) have farm size within 0.1hectare and 1.0 hectare with decreases in mean efficiency as farm size increases are most of farm land owned by the government which have equal mean efficiencies with the individual farm land. (70.6 percent) majority of the farmers has formal education and the mean efficiencies of the farmers increase as their level of education increase. Also most of the urban crop farmers practiced mixed cropping system (80 percent), and their mean efficiency of the farmers' decreases with mixed cropping system.

The stochastic production frontier model results showed that the mean technical efficiency is 0.93. The results also indicate that farmland, family labour, and plantings have decreasing returns to scale since their coefficients (0.5959, 0.0899 and 0.1979 respectively) are positive and statistically significant in urban crop production. The results of the inefficiency model reveals that occupation variable has negative Coefficient (-0.1403), which means farmers that take urban farming as primary occupation are more efficient than farmers who take urban farming as secondary occupation. Also, age variable is statistically significant, with coefficient of 0.0095, showing that as age of the farmer increases the technical inefficiency increases. Level of education Coefficient is negative which means that the more education, the less is the level of technical inefficiency. Also cropping system has positive coefficient (0.1362) which means the mixed cropping system decreases the technical efficiency. Finally, from the result it was shown that most of the urban crop farms in Abuja metropolis are near or operating close to full technical efficiency and it was also revealed that no farm is one hundred percent efficient in the stochastic production frontier model

The resource productivity of the physical input (i.e. farmland, family labour and plantings) show that there is still some scope for increasing output by increasing the physical inputs (that is, there are still opportunities to raise the present level of urban crop production in the study area).In view of the above findings, it was clearly established that urban crop farmers, though cultivate on small plot of land can still improve their productivity with the resources available, and reduce technical inefficiency by considering the factors stated above which will enhance food security by households and food sufficiency in the country.

Based on the result of the findings, the following are hereby recommended to ensure continuous availability of food to urban households and efficient use of resources in urban crop farms.

1. Land is a limiting factor in the urban areas; therefore government policy should concentrate on addressing this issue by allocating some portion of urban lands for permanent framing purposes.
2. It was shown from the study that as age of the farmers increase the technical efficiencies also decrease, therefore people should enter into urban farming early because they will benefit more and it will enhance food security.
3. Since formal education has positive effect on productivity of farmers therefore farmers should be encouraged to have formal education.
4. From the study it was shown that farmers that practice sole cropping are more efficient than farmers that practice mixed cropping, therefore farmers should be encouraged to practice sole cropping.
5. There is need to carry out further research on urban farming as related to food security and food sufficiency.

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