ASSESSING THE IMPACT OF TECHNOLOGY ADOPTION ON PRODUCTIVITY OF PLANTAIN FARMERS IN NIGERIA

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Abstract: Sub-Saharan Africa has been plagued with food insecurity due to lack of adoption of modern technology to improve their productivity. Technology is the systematic application of scientific or other organized body of knowledge to practical purposes. This includes new ideas, inventions, innovations, techniques, methods and materials. Since increasing agricultural productivity is critical to meeting the continuous rise in demand for food, agricultural technologies will play an immense role in increasing the production of food. As a result, it is useful to examine the adoption of technologies among farmers. A multistage sampling technique was used for the selection of five hundred and fifty-six plantain farmers. The data were collected through the administration of a well-structured questionnaire on a cross-section surveyed of plantain farmers. The result of the study shows that educating the plantain farmers in Nigeria will enable them adopt new technologies which will enhance their productivity.

Keywords: *Adoption; Multistage; Plantain; Productivity; Technology*

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INTRODUCTION

Economic policies depend heavily on the agricultural sector in the Sub-Saharan Africa (SSA). According to the report of World Bank (2014), agricultural growth has led to food security and income growth which creates spill over effects to the remaining sectors. The declining rate of African population living in poverty has dropped drastically from 50% in 1981 to 45% in 2012, African Development Bank/AfDB, (2014), but in Sub-Saharan country's 48% of the populations were found to be food insecure.

Abraham, et al; (2014) suggested that boosting the agricultural sector can be a solution for reducing the abject food insecurity in the Sub-Saharan Africa. Some studies show that production and productivity of the agricultural sector in SSA is low due to low technological adoption and techniques among others (Abraham et al., 2014; Berihun et al., 2014; Gashaw et al., 2014; Tsegaye and Bekele, 2012; Lulit et al., 2012; MoFED, 2012).

Akubuilu et al., (2007) defines adoption as a decision made by an individual or group to use an innovation in a continuous manner. They also went further to define technology as the systematic application of scientific or other organized body of knowledge to practical purposes.

Meeting the demand and supply gap of food in the SSA is depended on increase in agricultural productivity which can be achieved through the adoption of agricultural productivity. Agricultural technologies have been found to include all forms of improved techniques and practices which increases the growth of agricultural output (Jain, et al; 2009).

The finding of Loevinsohn, et al; (2013) shows that there are common areas of technology development and promotion for crops which include new varieties and management regimes; soil as well as soil fertility management; weed and pest management; irrigation and water management.

Food and Agricultural Organisation (FAO, 2011) reported that Nigeria is one of the largest plantain producers in West Africa with an annual output of about 2.74 million metric tons. In Nigeria, plantain is one of the major foods containing about 35 – 40% of carbohydrate. Plantain has been found to be left in the hands of subsistence farmers who account for about 80 percent of Nigerian agricultural output.

Plantain (*Musa paradisiaca*) belong to the family Musaceae which is a common horticultural crop cultivated in Nigeria, and its production requires an optimum temperature of 30°C, mean

monthly rainfall of 100mm, soil pH of 4.5-7.5 and a partly drained sandy-loam soil (Ajiboye, 2016)

The report of IITA (2009) shows that plantain is among the primary sources of carbohydrates in humid tropical Africa as it contains about 35% carbohydrate, 0.2 to 0.5% fats, 1.2% protein, and 0.8% ash. This report implies that plantain can serve as source of food for the plantain farming households. According to the study of Adejoro et al., (2010) noted that plantains if properly cultivated have the potential to contribute to reduce food insecurity and also minimized rural poverty. In the world ranking of crops, plantain has been ranked fourth after rice, wheat, and maize, as the most important food crop in the world (IITA, 2014). plantain is an important staple food crop for both rural and urban areas and occupies a strategic position for rapid food production in Nigeria.

This study thereby assessed how the impact of technology adoption by plantain farmers can improve their productivity and profitability thereby reducing the food insecurity of the farmers.

MATERIALS AND METHODS

This study was conducted out in the southwest region of Nigeria which consists of Lagos, Ogun, Oyo, Osun, Ondo and Ekiti States. The area lies between longitudes 20 311 and 60 001East and latitudes 60 211 and 80 371N, with a total land area of about 77,818 km². It is bounded in the east by Edo and Delta State in the north by Kwara and Kogi States, in the west by the Republic of Benin and in the south by the Gulf of Guinea. The climate of Southwest Nigeria is tropical in nature and is characterized by wet and dry seasons. The mean temperature ranges between 210 C and 340 C, it has an annual rainfall range between 150mm and 3000mm. The wet season is associated with the southwest monsoon wind from the Atlantic Ocean while the dry season is associated with the northeast trade wind from the Sahara-desert, Ojo, et al; (2019). Multistage sampling technique was used for the selection of the plantain farmers. The first stage involves purposive selection of three states (Ogun, Oyo and Osun), the second stage involves a purposive selection of two Agricultural Development Programme (ADP) zones from each of the state. The third stage was the purposive selection of two blocks per zone based on the concentration of plantain farmers. The fourth stage consist the random selection of five farming cells from each of the block making a total of sixty (60) farming cells. Lastly, ten plantain farmers were randomly selected from each farming cell giving a total sample size of 600 plantain farmers. The data were collected through the administration of a well-structured questionnaire on a cross-section surveyed of plantain farmers in the study area.

METHOD OF DATA ANALYSIS

Descriptive, adoption index and inferential statistics were adopted for analysing the data for the study. The descriptive statistical tools used were frequency and percentages. Adoption index was computed for technologies adopted, while Logit regression models was used to analysed the impact of technology adoption on the farmers' productivity.

Estimation of the Adoption index

Adoption index was used in capturing the various technologies adopted by the farmers in the study area, and it is specified in equation 1 following Mihiretu (2008), Ayalew (2011) and Obayelu et al., (2016), was used to measure the extent of technology adoption at the time of the survey for multiple practices, which shows to what extent the respondent has adopted the most set of technology.

$$AI_i = \sum \frac{\left[\frac{AH_i}{AT_i} + \frac{SRA_i}{SRR} + \frac{FA_i}{FR} + \dots - N \right]}{NP} \quad (1)$$

Where:

AI_i = Adoption index i of respondents (which ranges between 0 and 1)

AH = area under improved variety of plantain of the i th farmer.

AT_i = Total area allocated for plantain production (improved variety+ local, if any) of the i th farmer.

SRA_i = Suckers rate applied per unit of area in the production of improved variety of plantain of i th farmer.

SRR = Suckers rate recommended for application per unit of area.

FA_i = amount of fertilizer applied per unit of area in the cultivation of improved variety of plantain by i th farmer,

FR_i = Amount of fertilizer recommended for application per unit of area in the cultivation of improved variety of plantain

NP = Number of practices.

Logit regression was adopted to analyse the impact of technology adoption on the farmers productivity.

The model is specified as

$$Y_i = \gamma_0 + \sum \gamma_j x_j + \epsilon_j \dots \dots \dots 2$$

$$Y = \gamma_0 + \gamma_1 \text{age} + \gamma_2 \text{sex} + \gamma_3 \text{hhs} + \gamma_4 \text{edu} + \gamma_5 \text{farsize} + \gamma_6 \text{coopmem} + \gamma_7 \text{accesstocre} + \gamma_8 \text{marital} + \gamma_9 \text{ext.visit} + \epsilon_i$$

Where:

Y_i = Output (in tons)

Age = Farmers age [in years]

Sex = [Male = 1, Female = 0]

Hhs = Household Size [Number]

Numyrsedu = Educational Status [in years]

Farsize = farm size [hectare]

Coop Mem = Cooperative Membership [yes = 1, no = 0]

Accredit = Farmers' Access to credit [Accessed = 1, otherwise = 0]

Marstatus = Marital status [Married = 1, single = 0]

Extvisit = Extension visit [Number of visit per year]

ε_i = Random term

RESULTS AND DISCUSSIONS

Table 1 shows the demographic characteristics of the respondents. The farmers from table 1 age of shows that most of the plantain farmers are vibrant and still in their active age, which is within the age range of 30 – 39 years had the highest (33.9) percent. This suggest that most of the respondents are likely to adopt most technologies used in plantain production this will translate to increase in their productivity. The study of Tang (2005) found that older workers are on average, less productive than younger workers and that labor force aging has a modest negative direct impact on productivity growth in Canada.

It was observed that the population of the respondents in the area of study were more of male with about 86.5 percent. This could be due to fact

that agriculture has been viewed to be labor intensive and the female folks are mostly involving in the processing aspect of the venture rather than in the production aspect.

Table 1 shows that a large (52.9) percent of the farming households were between the ranges of 5 – 8 persons. This implies that there is likely to be enough man power to implement the available technologies.

Majority (40.5%) of the respondents were found to be literate with a minimum of secondary school certification. It has been noticed in literature that education is succent in technology adoption.

A larger number (46.6%) of the plantain farmers had plot size ranging from 4 – 6 hectares of farm land. This implies that the farmers had enough space to adopt or try new technologies.

Being a member of farming cooperative has been linked to a higher rate of technology adoption. 73 percent of the plantain farmers in the study were found to belong at least a farming cooperative

Table 1 also shows that 52.9% Of the farmers had access to credit facilities. The credit facilities will enable the farmers have access to new technologies in plantain production and hence increase their productivity.

Table 1

Variable	Frequency	Percent
Age		
20 – 29	38	6.8
30 – 39	189	33.9
40 -49	146	26.3
50 – 59	144	25.9
60 and above	39	7.1
Total	556	100.0
Sex		
Male	481	86.5
Female	75	13.5
Total	556	100.0
Household Size (in Persons)		
1 - 4	113	20.3
5 – 8	294	52.9
9 and above	146	26.8
Total	556	100.0
Education		
Non – Formal Education	183	32.9
Primary	112	20.1
Secondary	225	40.5
Tertiary	36	6.5
Total	556	100.5
Farm Size		
1 – 3	184	33.1
4 – 6	256	46.5
7 and above	116	20.4
Total	556	100.0
Cooperative		
YES	406	73.0
NO	150	27.0
Total	556	100.0

Access to Credit		
YES	294	52.9
NO	262	47.1
Total	556	100.0

Source: Field survey, 2020

The age of the had significant coefficient but with negative signs for some of the technologies such as land clearing, land preparation, improved sucker, organic fertilizer and harvester adopted by the farmers except for the herbicides which had a positive sign. This result shows that age has an indirect relationship to the technologies with negative coefficients. This also implies that age can affect the productivity of farmers, owing that young farmers may tend to be more productive. This result is inline findings of Afodu et al; (2019) who observed that the older household heads were, less diversified in the sources of livelihood they pursue. This shows that the younger farmers the more chances of adopting modern technologies on plantain production thereby increases their productivity. Ugwoke et al. (2005) also found that age is a good index to improved productivity because farmers' productivity is deemed to decrease as they age.

The regression shows that the household size had a positive coefficient for land clearing, land preparation, herbicide, inorganic fertilizer and harvester. This shows that a larger household size may lead to more adoption of the modern technologies in plantain production which could translate into increased productivity of the plantain farmers. The finding is in line with the findings of Olumba, (2014) who found that the household size influences farming decision on management practices. Fasina (2005) and Nwachukwu (2008) also noticed that the larger household size had a direct relationship with the productivity of the farmers.

Education of the respondents was found to be significant with positive coefficient for all the technologies adopted by the farmers. This could be due to the importance of education that has been found by different researchers to be an important tool in improving the productivity of the farmers. According to the findings of Oduro-Ofori, et al; (2014), education has a positive effect on agricultural productivity. This finding is also in accordance with the result of John et, al; (2020) who found that an increase farmers level of education, will lead to increase in the adoption of production technologies and this will further better the farmers productivity.

The farm size of the farmers was found to be significant for all the available production technologies expect for pest scaring devices and sprayer technologies, and also organic fertilizer technology was found to be negatively significant. The implication of farm size being positive and significant on other production technology is that as the farm size increases there is tendency for the farmers to adopt those technologies.

The coefficient of cooperative was observed to be for land clearing, organic fertilizer and inorganic fertilizer. This implied that farmers in cooperative are likely to adopt these technologies.

Access to credit facilities was found to be significant in all the available plantain production technologies adopted by farmers. This is in line with the a priori expectation, because if the farmers can have access to credit facilities, there is a high level of probability that those farmers will adopt the latest technologies to improve their productivity and subsequently improve their income and livelihood. This result is in accordance with the result of Afodu et al; (2019), they found that access to credit facilities may lead to increase in livelihood diversification thereby increasing the sources of the farmers' income.

Farmer size was found to be significant in only the land clearing technology

Extension agent visit to farms was found to increase the adoption of all the technologies adopted by the farmers in the study area.

Table: 2 Factors affecting the rate of adoption of some production technology

	land clearing	land preparation	improved sucker	herbicide	organic fertilizer	inorganic fertilizer	pesticides	sprayer	harvester
Age	-.018*	-.065**	-.029**	.042**	-.033**	.361	.019	-.004	-.051**
Sex	.02	.026	-.003	-.301	.009	.018	.022	.063	.092
Hhs	.011***	.014**	-.052	.026**	-.094	.115*	.061	-.185	.031**
Edu	.031**	.035**	.029**	.062**	.0045***	.002*	.017***	.025*	.110*
Farm Size	.040*	.012	.036***	.041*	-.076***	.044**	.080**	.019	.069**
Coop	.033***	.013	.018	.083	.013**	.072**	.051	-.023	.070
Accestocre	.049**	.080*	.056**	.055**	.010*	.033**	.066**	.024*	.043**
Farmex	.005*	.062	.030	.035	-.038	-.009	.011	-	-.020
Ext. Visit	.044**	.071***	.003**	.059*	.009**	.008**	.039*	.017	.098
Const.	.757***	.193**	.514**	.110*	.333*	.307**	.552**	.701*	.612**

$R^2 = 0.71$ Adj. $R^2 = 0.47$. df = 10 Source: Field survey (2020). *** significant at 1%, **significant at 5%, *significant at 10%. Number of observations = 556.

CONCLUSION

Plantain is one the major food crops with a high level of vitamin K and highly productive in Nigeria. Technology adoption in plantain production is critical to productivity, food security, poverty reduction and improved vitamins in the country. This study examined assessing the impact of technology adoption on productivity of plantain farmers in Nigeria. Educational status of the respondents was found to be a very important variable as it was significant with positive coefficient in all the technologies adopted by plantain farmers in Nigeria. It was also deduced from the study that access to credit will enable plantain farmers in Nigeria to acquire technologies that will enhance their productivity. Farm size was also a notable factor to the adoption of technologies by the plantain farmers in Nigeria.

Recommendations

The following are the recommendations from this study:

1. The government should enforce the Land Use Act to enable plantain farmers in Nigeria get access to land, so as to encourage more commercial plantain production.
2. Educating the plantain farmers on modern technologies in the production of the crop should be encouraged.
3. The plantain farming households should be encouraged and assisted by providing the necessary technologies needed for plantain production.

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