IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 9, Issue 3 Ver. I (Mar. 2015), PP 39-45
www.iosrjournals.org

Socio Economic Factors affecting Adoption of Farm Mechanization by Cassava Farmers in OndoState, Nigeria

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Abstract: *Farm mechanization has been seen as the pivot to agricultural revolution in many parts of the world and has contributed greatly to increased output of food crops and other agricultural products to meet the demands of the ever increasing world population. Moreover, due to the fact that farmers prepare their farms at the same time of the year as a result raising the rental fees for tools and machines. The sharing of these tools could even lead to their mismanagement and breakdown which discourage farmers from using it. The objectives of this research is to;(1) identify the socio economic characteristics of farmers in Ondo state, (2) identify the constraints to adoption of farm mechanization in Ondo state (3) identify factors affecting the adoption of farm mechanization by cassava farmers in Ondo state. The study area is Ondo State; a random selection was used to select two local governments (Ifedore and Idanre). Data were analyzed using descriptive and inferential statistics. The major determinants of adoption of farm mechanization were access to extension workers which had a positive relationship with adoption and access to farm machines which also had a positive relationship with adoption. Problems faced include access to spare parts, access to skilled man power, maintenance of farm machines, availability of machines in time required. There is a difference between tonnage before adoption of farm mechanization and tonnage after adoption of farm mechanization. Therefore more work should be devoted to increasing the level of access to extension agents in other to increase farmers' awareness and benefits of mechanization. Also access to credit by farmers increases the adoption attitude to mechanization.*

Key words:*Farm mechanization, adoption, awareness, Ondo state*

I. Introduction

The introduction of mechanization which entails the use of machines to perform several activities on the farm, there is reduction in money spent on hiring of labour and time of operation, and increase in productivity to meet the growing population. The term mechanization is generally used as an overall description of the application of these inputs (Clarke, 2000). Farm mechanization covers the use of tools, implements and powered machineries as they are the major inputs in agriculture.

Mechanization is one of the factors responsible for urbanization and industrial economics. It also improves production efficiency, encourages large scale production and improves the quality of farm produce.Other key factors that influence successful mechanization include Socio-economic factors, supporting infrastructure, land and agro-ecological conditions, and technical skills and service (Olaoye, 2007).Farm mechanization has been seen as the pivot to agricultural revolution in many parts of the world and has contributed greatly to increased output of food crops and other agricultural products to meet the demands of the ever increasing world population (Akande, 2009).

The importance of agriculture in the Nigerian economy cannot be overemphasized. It is a major occupation providing employment for about 70 percent of the people (Idrissa et al, 2008). Despite this, Nigeria is unable to produce enough food and fiber to meet her demand. This could be attributed among others, to the fact that majority of Nigerian farmers are subsistence smallholder farmers who cultivate between 1-2 hectares, which is usually scattered over a wide area.In Nigeria, cassava production is well-developed as an organized agricultural crop. It has well-established multiplication and processing techniques for food products and cattle feed. There are more than 40 cassava varieties in use. Cassava is processed in many processing centers and fabricating enterprises set up in the country. FAO (2004) posted that Nigeria is the largest cassava production, a third more than the production in Brazil and almost double the production of Indonesia and Thailand (38845000 tones). Cassava production in other African countries like Ghana, Madagascar, Democratic Republic of Congo and Uganda appears small in comparison to Nigeria's substantial output.

Nigeria produces over 41 million metric tons of cassava per annum making her the highest producer in the world. She does not earn the highest income from cassava because 70 percent of her output is consumed as food, leaving only 30 percent to be used as industrial raw materials. The only way to increase quantity produced for exportation is by increasing output substantially through mechanized farming. According to Food and Agricultural Organization (FAO), the estimated industrial cassava use was approximately 16 percent of cassava root production and was utilized as an industrial raw material in 2001 in Nigeria.

Moreover, smallholder farm operations in Nigeria are accomplished through the use of hand tools which sometimes are rented or shared among users. Due to the fact that they prepare their farms at the same time of the year as a result raising the rental fees for tools and machines. The sharing of these tools could even lead to their mismanagement and breakdown. The type of crops grown also affect adoption of farm mechanization as not all crops has been mechanized, e.g. crops such as yam and cassava has not been fully mechanized and these two crops serve as important source of carbohydrates in the diets of millions of people, particularly in the tropics and the production of these crops is labour intensive. Planting, harvesting, peeling, and storage of yam and cassava has not been mechanized very successfully and these are areas where real breakthroughs are urgently required as regard farm mechanization.

The main objective of study is to examine the socio economic factors affecting the adoption of farm mechanization by cassava farmers in Ondostate.The specific objectives of this research is to;(1) identify the socio economic characteristics of farmers in Ondo state, (2) identifythe constraints to adoption of farm mechanization in Ondo state (3)identify factors affecting the adoption of farm mechanization by cassava farmers in Ondostate.Hypothesistested are Ho 1:there is no significant relationship between cassava farmers constraints and adoption of farm mechanization in Ondo State, and Ho 2: there is no significant difference between tonnage before the adoption of machines and tonnage after the adoption of machines by farmers in Ondo State

II. Methodology

OndoStateis located on the south western part of Nigeria on longitude 7^0 10`N $5^0$05`E with an area of 15,500km^2 and population of 3,440,000. It has eighteen (18) Local Government Areas (LGAs) and three (3) Administrative Zones, namely North (six LGAs), central (six LGAs), and south (six LGAs). Themajor ethnic composition is largely from Yoruba subgroups of Akoko, Akuee, Ikare, Ilaje, Ondo, Owo, Arogbos and Akpois.The major occupation is farming with the major crops plantedinclude maize (*Zea mays*), yam (*Dioscorea*spp.), cassava (*Manihotesculenta*), cocoyam (*Colocasia*spp.), rice (*Oryzasativa*) and vegetable (*Amaranthus*spp.). The permanent crops include cocoa (*Theobroma cacao*), kolanut (*Cola nitida*) and oil palm (*Elaeisguinensis*).Also fishing in the riverine areas.The study was carried out in Idanre and Ifedore local government areas of Ondo state.

Idanre is a Local Government Area in ondo state with its head quarters in the town of Owena. It has an area of 1914km^2 and a population of 129,024at the 2006 census. Ifedore is a Local Government Area in Ondo State its head quarters in the town of Igbara-Oke. It has an area of 295km^2 and a population of 176,327 at 2006 census.

Fig1. Map of Ondo State showing the Local Government Areas

Primary data was drawn from a sample of 93 farmers in the study area using a multi stage sampling technique will be employed, and astructuredquestionnaire to include social economic characteristics of the farmers, age, gender, marital status, educational level, farm size, type of crops grown will be used in obtaining information from farmers in the study area. Descriptive like tables, percentages, and frequency were used. Inferentially, the logistic regression analysis is adopted to measure the degree of association between two or more variables. i.e constraints, budgetary technique to measure profitability, and the paired t-test to identify if there is significant difference between tonnage before and tonnage after adoption.

Inseveral adoption studies, the dependent variable takes value between 0 and 1 and the models used were exponential functions while univariate and multivariate logit and probit models including their modified forms have been used extensively to study the adoption behavior of respondents. The logistic model, which is based on cumulative logistic probability functions, was developed to analyze the adoption characteristics of farmers to farm mechanization because the responses recorded were discrete.

The study adopted a logistic regression analysis model to examine the adoption of farm mechanization, since the dependent variable "i.e adoption" is a 1 or 0 variable "i.e 1 for adopters and 0 for non-adopters". It measures the relationship between two or more variables. It is denoted by r square (R^2) which shows the percentage of the total variation of dependent variable (adoption of farm mechanization) explained by the independent variable (constraints toadoption of farm mechanization), the two log likelihood function and chi-squared.

The regression model is given as:

$Y=b_{0+}b_1x+e$

Where:

Y=adoption of farm mechanization measured as dummy (1=adopters, 0=non adopters)

b_0=regression intercept

b_1=regression slope

x=independent variable

The model specification for the analysis is given as:

Y=f(X1, X2, X3, X4, X5, X6, X7,X8,)……

Where:

Y is adoption of farm mechanizationmeasured as dummy (1=adopters, 2=non adopters)

X1 is age (number of years of farmers)

X2 is level of education of respondent

X3 is farming experience

X4 is farm size

X5 is sex of respondent

X6 is extension agent visitation (yes=1, otherwise=0)

X7is membership of cooperative (yes=1, otherwise=0)

X8 isaccess to farm machines

E is the error term

III. Results and Discussion

Malewere65.59% while 34.41% werefemale; this shows that more men are involved inthe production of cassava in the areas. This is consistent with the fact that the cassava production activity was carried out by male as it is labour intensive. Able manpower is needed in the operations of planting, harvesting and therefore left in the hands of men.Age 60 and above accounted for 60.22% making it higher than those in the productive ages of 41-50 accounting for 22.58% of the sample. This implies the cassava production was undertaken more by older people with little or no strength to see most of the operations through. People within this age bracket prefer to stick to what they know rather than accepting new innovation or adopt late except with right incentive or they are given a substantial reason to.Majority (76.34%) of the respondents were married while 12.90% were single. Married farmers have greater advantage as they can involve their family in production activities as planting and harvesting, this will also help them to reduce cost of Production. Also the thought of providing for a family, a farmer may adopt the use of farm mechanization just to meet his family needs.Result revealed that farmers between 5-10 years of experience account for 21.51% of the sample, while 11-15 years of experience account 20.43%, 16-20 years of experience 18.28%. Years of experience could affect adoption of farm mechanization positively or negatively. A farmer who has been planting cassava using indigenous method and mastered his technique so well for a long time and has come to believe that no other methods could be as effective and efficient as that which he knows will find it difficult to change and adapt farm mechanization or, in his usual operation has come to discover that he can perform better. Most of the respondents did not advance beyond primary school education and this make up 41.94% of the sample followed by those that didn't attend school at all accounting for 26.88%, those that didn't go beyond secondary and tertiary are 15.05% and 16.13% respectively. Illiteracy is a big barrier to adoption as it limits the level of thinking, understanding, and dormant to adopting new technologies capable of improving their current state of living. They see no reason to change from their present state which they could have termed to be the best. Introduction of efficient informal extension education through well trained extension agents could serve as the turning point in changing their mind set and therefore yielding a positive impact on adoption program.

Table 1: Socio-Economic Characteristics of Cassava Farmers

Sex	Frequency	Percentage
Male	61	65.59
Female	32	34.41
Total	93	100
Age group	Frequency	Percentage
Below 21	3	3.23
21-30	6	6.45
31-30	7	7.53
41-50	21	22.58
Above 60	56	60.22
Total	93	100
Marital status	Frequency	Percentage
Single	12	12.90
Married	71	76.34
Divorced	1	1.08
Widowed	9	9.68
Total	93	100
Highest education level	Frequency	Percentage
Non Formal Education	25	26.88
Primary	39	41.94
Secondary	14	15.05
Tertiary	15	16.13
Total	93	100

Source: field survey data,2014

Access to extension agents who gives farmers information on the latest technology in terms of new varieties, new advancements etc.Table 2 shows that 79.57% of the farmers have access to farmers with 20.43% said they have no access. Extension agents stand between innovation and adoption of new technology (i.efarm mechanization). They play a major role as farmers over time have developed to trust them and are most likely to yield to offers brought by them. From the research the impact of the extension worker favors the adoption of farm mechanization.Access to machines such as tractor for use is another factor limiting the adoption of mechanization. 34.42% reported that machines were very accessible to them, while 51.61% and 13.98% have moderate accessibility and not accessible respectively. Since machine is moderately available to farmers it can boost its adoption. Availability and affordability go hand in hand. If machines were available but not affordable (i.e. within the amount a farmer is willing to pay for its use) it will as well not be adopted.

Also table 2 revealed that 27.96% had access to credit while 72.04% did not have access to credit. Credit accessibility is a reasonable determinant as to whether to increase scale of production which most likely will involve the use of farm machines. Most of the respondents do not have access to these credit facilities which may be attributed to various reasons. Mechanization itself is capital intensive and without sufficient access to such capital adoption may be limited. Most importantly farmers are denied credit because of the risk and uncertainty around agricultural production.The use of machines can also be limited by the size of farm or even scale of production. Small scale farmers would not want to use machines because it will be unprofitable. 8.60% of the famers were on the small scale, 63.44% were practicing medium scale while 27.96% were practicing large scale. The scale of production distribution is between the medium and large scale cassava farmers as they account for the largest percentage of the sample. Machine need large fields to operate and therefore limited to be used by medium and large scale farmers. It is not advisable neither is it profitable nor feasible to be used by a small scale farmer who farms on subsistence level and maybe sells his surplus in the local market. Small and medium scale farmers enjoy economics of gain when they adopt farm mechanization as they are able to increase their level of output.

Cooperative society plays a role in making available machines for members. Table 2 shows that 77.42%of the respondents belong to cooperative societies, therefore,Farmers should be encouraged to join cooperative societies to make extension agent's work easier and adoption faster since rural people are collectively driven and can be persuaded into trying the use of farm machines especially, when their leaders were carried along. Government can also easily access farmers to offer support when farmers are members of cooperatives society.

Table2: Distributions of Respondents Based on Other Characteristics

Access to extension	Frequency	Percentage
Yes	74	79.57
No	19	20.43
Total	93	100
Machine accessibility	Frequency	Percentage
Very accessible	32	34.41

Moderately accessible	48	51.61
Not accessible	14	13.98
Total	93	100
Access to credit	Frequency	Percentage
Yes	26	27.96
No	67	72.04
Total	93	100
Scale of production	Frequency	Percentage
Small	8	8.60
Medium	59	63.44
Large	26	27.96
Total	93	100
Member of a cooperative	Frequency	Percentage
Yes	72	77.42
No	21	22.58
Total	93	100

Source: field survey data,2014

Constraints to the adoption of farm machine differ with their degree of seriousness depending on individual disposition. Skilled manpower and Electricity were the most serious constraints to adoption while Spare part,maintenance and repairs of farm machines were indicated as serious problem. Also, most damaged tractors are left to rust instead of putting them in order for use because most of the spare parts arenot available locally which is a great limitation to its availability. Even if machines are available the right personnel with the technical knowhow of operating them are unavailable. People who handle these machines know little or nothing about its proper use. So also the technicality in the repair is beyond the scope of farmers.

Table 3. Constraints To Adoption Of Mechanization By Cassava Production

Problems	Serious	More serious	Most serious
Spare parts	67 (72.04%)	24 (25.81%)	2 (2.15%)
Skilled manpower	16 (17.20%)	48 (51.61%)	29(31.18%)
Maintenance	63 (67.74%)	25 (26.88%)	5 (5.38%)
Electricity	48 (51.61%)	22 (23.66%)	23 (24.73%)
Availability of machine on time for use	42(45.16%)	40 (43.01%)	11 (11.83%)

Source: field survey data,2014

Access to extension agents and access to machines are the only two factor variables that have significant effect on the adoption of farm mechanization in Ondo state. This reveals that access to extension was significant at 5% and a positive relationship with the dependent variable (i.eadoption of farm mechanization). Also access to farm machines was significant at 5% with a positive relationship with the dependent variable.

An increase in the access to extension agent will lead to increase in adoption of farm mechanization in that the farmers are aware of the innovation going on the importance of the use of farm machines in improving productivity and generally bettering the lives of the farmers. Extension agents serve as intermediaries to dissemination of information to farmers and statement of problems and feedback to researchers. Also increase in access to farm machines will also lead to an increase in likelihood for adoption of farm mechanization. If machines are made available at affordable prices and right time it will increase the possibility of adopting these farm machines for use.

It implies that for 1 unit increase in the access to extension worker there will be 0.27 unit increases in likelihood of adoption of farm mechanization and for 1 unit increase in access to farm machines there will be 0.002 unit increases in adoption of farm mechanization.

The effect of all independent variables age (number of years of farmers), level of education of respondent, farming experience, farm size, sex of respondent, access to extension agent, membership of cooperative, access to farm machines on the dependent variable (adoption of farm mechanization) tested were significant at 5% level of probability with the Cox & SnellR^2=0.307, Nagelkerke R^2=0.4

Table 4: Result of Logistic Regression Analysis

Variables	Coefficients	S.E	Sig
Constant	-5.206	2.939	.077
Age	-009	.027	.757
Year of experience	..061	.041	.149
Access to farm machines	1.800	.591	.002***
Sex	-.800	.706	.257
Highest educational level	-.403	.376	.284
Access to extension	1.892	.856	.027***
Access to credit facilities	-.528	.785	.501

Member of a cooperative	.537	.694	.439
Land size	-.020	.017	.233
Diagnostic test for the model			
-2 log likelihood	69.963		
Chi-squared	34.079		
Significance level	.00000		

Cox & SnellR^2=0.307, Nagelkerke R^2=0.456

The paired T-test statistics between tonnage of cassava before and after the adoption of mechanization by the cassava producers in Ondo was significant difference (at 5%) therefore we accept the alternative hypothesis (ieH_1 2). This implies that farm mechanization has therefore helped in increasing production which is shown by the significant difference. This signifies that with to farm machines a farmer can expand production scale and produce more than he used to before he adopted the use of farm machines therefore increasing his income.

Table5paired T-Test

Paired test between	Mean	Std. deviation	Std. error mean	t-ratio	Df	Sig.(2-tailed)
Tonnage before adoption and after adoption	1927948.3260870	5830643.7769819	607886.6353665	3.172	91	0.002

Source: field survey data,2014

IV. Conclusion

The result of the findings revealed the constraints to adoption of farm mechanization in Ifedore local government area and Idanre local government area of Ondo state. It identified the constraints that have significant impact on adoption and they are access to extension agent and access to farm machines. Therefore more work should be devoted to increasing the level of access to extension agents in other to increase farmer awareness and benefits of mechanization.

Access to credit by farmers increases the adoption attitude to mechanization since they can afford to pay for their services and thereby increase their output on continuous bases. Credit is the key to growth and development of rural people as it opens latent skills, ability, innovation, and knowledge of farmers. Most importantly is the availability and affordability of machines, this will give incentive to farmers. Farmers respond well to such incentives, they could come inform of subsidizing the price of borrowing farm machines as this will help to improve their productivity in turn improve their income and ensure a better livelihood.

Farmers should be encouraged to join cooperative societies to make extension agent's work easier and adoption faster since people are easily collectively driven and can be persuaded into trying the use of farm machines especially when their leaders are targeted. Government can also easily access farmers to offer support when farmers exist in cooperatives. This could to lead a collective benefit in terms of government incentives in terms of supply of input, donation of farm machines to cooperative etc.

V. Recommendations

Based on the findings, the following recommendations are made for policy action to increase the adoption of farm mechanization by cassava farmers of Idanre Local Government and Ifedore Local Government of Ondo State.

1. Increasing the number of extension workers to farmers to help increase the awareness level of mechanization
2. Machines should be made available and affordable at the proper time for hire. If possible Government should subsidize the price of hire to encourage average and aspiring farmers adopt farm machines.
3. Farmers should be encouraged through extension workers to join cooperative societies to make dissemination of innovations easier even if it means demonstration. Cooperative helps Government to be able to assist farmers collectively in terms of subsidy, provision of incentives, inputs etc as long as they are member of such benefiting cooperative.
4. The government should assist farmers in Ondo State by organizing workshops, conferences and seminars on farm machinery management and maintenance, and make credit available to finance maintenance of these machineries
5. A good maintenance mechanism should be put in place which should include provision of shelter and storage facility for the machineries.

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