NSUK Journal of Science & Technology, Vol. 6: No. 2. 2016. pp. 160-165 ISSN: 1597- 5527

ANALYSIS OF FACTORS INFLUENCING THE ANIMAL TRACTION TECHNOLOGY USAGE BY FARMERS IN NORTHWESTERN, NIGERIA

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ABSTRACT

This study analysed factors influencing animal traction technology (ATT) usage by farmers in Northwestern, Nigeria. Multi-stage sampling technique was used to collect primary data for this study. Primary data were collected from two categories of respondents through the use of random sampling techniques with the aid of structured questionnaire comprising 140 farmers using animal traction technology and 170 farmers who are non- users of animal traction technology to serve as control or counter factual group. Data were analysed using descriptive and multiple regression statistics. The result shows that about 39% of respondents were within the age brackets of 40-49 years with an average age of 46 years. Most,(54%) of respondents had no formal educational qualification,only21% had 11-15 persons per household with mean household size of 11 persons per households head. The result of regression shows a coefficient of multiple determinations (R^2) value of 0.581 which indicates that 58.1% of the variation in output was accounted for by the variation in explanatory variable used in the model. The remaining 41.9% could be attributed to error. The coefficient of household size (X2), farm size (X4) and farming experience (X5)were positive and significant at($P < 0.10$), ($P<0.05$) and ($P<0.01$)respectively. Results further revealed that implements such as Ox-drawn plough (98%), Ox- drawn cultivator (92%) and Ox-drawn ridger (56%) had high acceptability among the ATT users. The study recommends appropriate measures by government that can promote those factors found significantly influencing animal traction technology usage in the study area.

Keywords: Influencing factors, animal traction, usage, Northwestern, Nigeria

INTRODUCTION

Agricultural growth has been described as the most important contributor to the growth of manufacturing and services in Sub-Saharan Africa (SSA) (Diagne *et al.*, 2009). However, most agricultural operations in this region (SSA) are done by hand, and seasonal labour shortage is one of the main factors contributing to low agricultural productivity. For instance, of the 98.3million hectares of Nigeria's arable landmass, empirical records by Abubakar and Ahmad (2010) indicated that 72% of this had cultivation potential and only 35% of the arable land is under actual cultivation. The same authors also stated that low level of mechanical power contributes to the slow growth of agriculture and serves as a major factor which further complicates the plight of more than 80% population who resides in rural areas (Philip *et al.*, 1990).

Domestic work animals according to Musa(2004), exists in all regions of the world. Animals assist in eliminating poverty, reducing drudgery and creation of wealth. Animal traction is particularly important for food security in smallholder farming systems (Ihebe and Arikaibe, 2012). Animals can assist directly with crop production: ploughing, planting, and weeding. Food production, distribution and rural trade are also assisted through animal-powered transport: on-farm, marketing, riding, pack transport. The empirical records by Ambros (2008), has documented the benefits and potential of using animal traction. First, animal traction is labour-saving per hectare as compared with hoe cultivation (Jolly and Gadbois, 1996). For instance, Kate (2009) indicated that a man and his family with a pair of work-bulls can handle 4 to 5 times the area of a hand-cultivated farm.

In addition, some authors (Badgley *et al.*, 2006; Akpoko, 1999) have identified factors influencing farmer's adoption of technology/innovation as follows: Age, family size, farm size, gender, economic status, level of education, social participation level, leadership status, nearness to research station or University, contact with extension agent, cosmopolitans, mass media exposure, and knowledge of recommended practice as well as year of farming experience (Lawrence and Pearson, 1999). Moreover, the socio-economic, institutional, and attributes of the innovations comprise the categories of factors considered in this study. Available studies both in Nigeria and elsewhere have demonstrated that knowledge of innovations and use are all influenced by socio-economic characteristic of the farmers, institutional factors, attributes of the innovations and so on. For instance, Adamade and Jackson (2014) found such characteristics as age, education, frequency of extension contact and farm size to be significantly and positively related with adoption (NAERLS, 1996).

Furthermore, people often take animal traction technology for the sole purpose of improving cultivation practices (tillage, planting, crop maintenance), whereas it could also add value in many other ways on the farm (livestock production, available labour, transport) or outside it. In addition, Nigeria is one of the African countries with long history of animal traction. As opined by Mason (1996), the long history of animal traction dates back to 1922 when the use of cattle as a source of power for agricultural production was first demonstrated with long history, it would not be out of place to think the entire savannah belt of Nigeria would have been covered. However, the introduction of tractors in 1940s impeded the spread of the technology.

The prevailing economic situation has invariably made other alternative such as manual cultivation and tractorization inadvisable and unaffordable has nevertheless made the need for animal traction technology imperative. Animal traction technology is already in use in the savannah zones of Northern Nigeria. Farmers in the areas are already taking full advantage of the technology. It is in realization of this that both federal and state governments through Agricultural Development Programme (ADP) introduced animal traction technology to farmers in the state. It was against this background that this study seeks to identify and categorize factors influencing animal traction technology usage. The objectives of this study therefore, includes to analyze the socioeconomic characteristics of farmers using animal traction technology in the study area and to examine the factors influencing animal traction technology usage in north western zone of Nigeria.

METHODOLOGY

The Study Area

This study was conducted in North western zone of Nigeria. The study area comprised of Kaduna, Kano, Katsina, Kebbi, Sokoto and Zamfara States. The zone is located in northern part of Nigeria. North-Western zone lies between latitudes 9^{o} 10¨ and 11^{o} 30¨ North and longitude, 69^{o} 52¨ and 9^{o} 10¨East of the Greenwich Meridian which falls mostly within the Northern Guinea Savannah zone of the sub humid climate of Nigeria. The zone has a total population of 35, 915,467 million people representing 25.58% of the total population of the country (Mustapha, 2012). The projected population of the zone is put at 46,208,205 people in 2015 at a growth rate of 3.2 % per annum. The sample for the study was drawn from the population of registered farmers in the study area.

According to the information from agricultural development projects (ADPs) zonal office, there are 3344 registered animal traction users in the study area. Based on this information, 10% of the population was selected as the sample size using random sampling technique to select a total of 310 respondents. The basis for this selection was that there was high number of farmers using animal traction technology in the sampled area. Data for this study were generated through primary sources of data collection. The primary source of data collection were anchored on the distribution of questionnaires to the respondents who were randomly selected for the study. This study was carried out in the first quarter of 2016.

Specification of Model

Descriptive statistics such as frequencies and percentages were used to describe the socioeconomic characteristics of respondents, while multiple regression model was used in determining the factors influencing animal traction usage in the study area. Regression Models involves variable such as unknown parameter (β), independent variable (X) and dependent variable (Y) The empirical model can be presented as follows:

$Y_i = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_6\ \beta_7X_7 + \beta_8X_8 + \ldots\ldots + \beta_{11}X_{11} + U_i$

Where:

Yi = Adoption of animal traction technology (extent of usage)

X_1 = Age of household head (in years)

X_2 = Household size (number)

X_3 = Level of Education (in years)

X_4 = Farm size (in hectares)

X_5 = Farming experience (in years of animal traction experience, users)

X_6 = Labour cost (Man days)

X_7 = Access to credit (Actual amount in Naira)

X_8 = Crop output (GWE/Kg)

X_9 = Family income (Naira)

X_{10} = Membership of association (1 if member, 0 otherwise)

X_{11} = Access to extension services (Yes = 1, No = 0)

β_0 = Intercept

$_1 - \beta_{11}$ = coefficients of the variables

α = Constant

The explicit forms include the following:

a. Linear function

$Y_a = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_6\ \beta_7X_7 + \beta_8X_8 + \ldots\ldots + \beta_{11}X_{11} + U_i$

b. Semi-log function

$Y_a = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_7\ \beta_8 \log X_8 + \beta_8 \log X_8 + \ldots\ldots + \beta_{11} \log X_{11} + U_i$

c. Double log function

$\text{Log } Y_a = \beta_0 + \beta_1 \log X_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + \beta_7 \log X_6\ \beta_7 \log X_7 + \beta_8 \log X_8 + \ldots\ldots + \beta_{11} \log X_{11} + U_i$

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondent

The results presented in Table 1 shows that about 39% of the respondents in pooled data were within the age range of 40-49 years with an average of 46 years. Across the users of animal traction technology, 40% of them were within the range of 40-49 years with an average age of 47 years, while about 37% of the non-users of animal traction technology were also within the age range of 40-49 years, with an average age of 46 years. This result shows that there is no significant differences between the age of the users and non-users of animal traction technology in the study area. The implication of these findings is that, large proportions of the respondents were adults and can adequately be regarded as active, agile, and physically disposed to farming activities (Kate, 2009). Age has also been found to affect the rate of household adoption of innovations.

The result of pooled respondents reveal that 40.3% had 6-10 persons per household with mean of 10 persons. Approximately, 29% of users of animal traction technology had 11-15 persons per household with mean household size of 11 persons. Also, 49% of non-users of animal traction technology had 6-10 persons per household with mean household size of 9 persons per households. The larger household size of users of animal traction technology (household size was 11) could be of advantages in terms of family labour supply (Dijkman and Sims, 1997a). Result in Table 1 also, shows that more than half (54% of ATT users, and 58.24% ATT non users) of the respondents had no formal educational qualification. This implies that the educational level of both users and non-users are quite low having more than 50% non-formal education. Studies have shown that, access to education enables households in the rural area to adapt to new agricultural methods, cope with risk, and respond to market signals and consequently improve agricultural productivity.

Table 1: Socioeconomic characteristics of the respondents

	Users		Non –Users		Pooled		
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**	**Statistic**
Age							**0.359**
Less than 20	1	0.7	2	1.1	3	1.0	
20-29	8	5.7	10	5.9	18	5.8	
30-39	20	14.3	22	12.9	37	11.9	
40-49	56	40.0	62	36.5	122	39.4	
50-59	35	25.0	49	28.8	85	27.4	
60-69	13	9.3	18	10.6	31	10.0	
70-79	5	3.6	7	4.1	12	3.9	
80-89	2	1.4	Nil	Nil	2	0.6	
Total	**140**	**100**	**170**	**100**	**310**	**100**	
Household size							**3.96*** **
1-5	27	19.3	45	26.5	75	24.2	
6-10	39	27.9	84	49.4	125	40.3	
11-15	41	29.3	24	14.1	70	22.6	
16-20	16	11.4	14	8.2	24	7.7	
21-25	14	10.0	2	1.2	13	4.2	
26-30	3	2.1	Nil	Nil	Nil	Nil	
Greater than 30	Nil	Nil	1	0.6	1	0.3	
Total	**140**	**100**	**170**	**100**	**310**	**100**	
Personal savings	80	57.14	27	15.88	98	31.61	
Bank loan	10	7.14	13	7.65	51	16.45	
Cooperative society	32	22.86	31	18.24	47	15.16	
Relatives / friends	11	7.86	77	45.29	64	20.65	
Money lenders	7	5.0	22	12.94	50	16.13	
Total	**140**	**100**	**170**	**100**	**310**	**100**	
Farming							**4.13****
Experience							
1-10 years	19	13.6	39	22.9	58	18.7	
11-20 years	31	22.1	45	26.5	76	24.5	
21-30 years	40	28.6	60	35.3	100	32.3	
31-40 years	28	20.0	21	12.4	49	6.8	
41-50 years	17	12.1	4	2.4	21	4.0	
51-60 years	5	3.6	1	0.6	6	1.9	
Total	**140**	**100**	**170**	**100**	**310**	**100**	
Farm size							**5.52****
0.1-1	12	8.6	48	28.2	60	19.4	
1.1-2	19	13.6	55	32.4	95	30.0	
2.1-3	20	14.4	33	19.4	61	19.7	
3.1-4	33	19.4	21	12.4	57	18.4	
4.1-5	56	40.0	13	7.6	37	11.9	
Total	**140**	**100**	**170**	**100**	**310**	**100**	
Educational level							**6.59****
No formal education	76	54.28	99	58.24	176	56.77	
Primary education	43	30.71	35	20.59	78	25.16	
Secondary education	12	8.57	17	10.0	29	9.35	
Tertiary education	9	6.43	19	11.18	28	9.03	
Total	**140**	**100**	**170**	**100**	**310**	**100**	

Source**:** Field survey, 2016

Ambros, (2008); Ibrahim and Onuk, (2010), were of the opinion that education is highly important for sustainable agricultural growth and development. They posited further that formal education is a veritable attribute enhancing farmers to innovate, adapt and adopt improved recommended production practices. The table further revealed that 40% of the users of ATT cultivated farm size of 4.1-5 hectares. The average farm land cultivated by the users in the study was 3 hectare,while the non-users (32%) of ATT cultivated farm size of between 1.1-2 hectares, an indication that all respondents were small scale farmers. Farm size according to Rogers, (1995), is an indicator to the level or scale of production of an individual farmer (Omotayo, 1996).On the farming experience, whereas, the animal traction technology users (29%) had 21-30 years of farming experience with mean of 28 years, the non-users, 35% had 21-30 years of farming experience with mean of 22 years(Table, 1).The average farming experience for the users and non-users of animal traction technology were 28 and 22 years respectively. This shows that the farmers had considerable higher farming experience which could influence their productivity(Akinlade *et al.*, 2011). The significance of farming experience in agricultural production cannot be over-emphasized; because it determines farmers' ability to make effective farm management decisions.

Factors influencing ATT Usage

Distribution of respondents by factors influencing animal traction usage is presented in Table 2. The factors that had significant influence on animal traction technology usage

were marital status (-7.656), household size (0.276), farming experience (0.205), farm size (0.902), income (-4.141), cooperative association (-0264) and distance (-0.978). Household size is positive and significant at 10% level of probability. The implication is that increase in household size leads to increase in animal traction technology usage by the farmers in the study area. This also implies that household size which is used as a measure of labour availability influences adoption process in that, a larger household have the capacity to relax the labour constraints required during introduction of new technology. The study agreed with findings of Hodis (2010), who opined that family size play a vital role in the usage of any particular technology or farm practice. The results further shows that, years of experience had a positive and significant relationship (P<0.001) with extent of animal traction technology usage. With increased farming experience, farmers are generally better able to assess the relevance of new technologies (Obisesan and Omonona, 2013). This is expected because more experienced farmers may have better skills and access to new information about improved technologies. It could also imply that knowledge gained over time from working in uncertain production environment may help in evaluating information thereby influencing their adoption decision (McMichael, 20006).

Table 2: Factors Affecting Extent of Animal Traction Technology Usage

Variable	Coefficient	Standard error	t-value
Constant	50.161	8.427	5.952***
Age	-0.146	0.093	-1.567NS
Marital status	-7.656	4.109	-1.863*
Household size	0.276	0.159	1.732*
Education	0.961	0.699	1.375 NS
Farming experience	0.205	0.080	2.579***
Farm size	0.902	0.380	2.374**
Income	4.141E-6	2.141E-6	1.934*
Cooperative membership	-0.264	0.159	-1.657*
Extension contact	-0.507	2.084	-0.243 NS
Cost of oxen	-1.968E-6	.000	-0.556 NS
Access to oxen	-3.540	2.954	-1.198 NS
Crop output	1.901E-5	.000	0.297 NS
Labour	-0.003	0.019	-0.145 NS
Distance	-0.978	0.286	-3.420***
Compatibility of the Oxen	0.002	0.003	0.475 NS
Complexity of the Oxen	-0.029	0.019	-1.484 NS
R^2	0.581		
R^2 Adjusted	0.524		
F-value	2.672***		

*** P<0.01, ** P<0.05 and * P<0.1

Source: Field survey, 2016.

The result also reveals that income of the farmers had a positive and significant relationship with animal traction technology usage at 10% level of probability. This suggests that farmers who received more income used ATT technology than those who did not have much income. Animal traction practice is capable of extending the per capita cultivation factor by almost double (Sanni, 2008). It has also been observed that it increases the yield and net income of up to 25% per hectare could be attained if more efficient animal-drawn equipment and management techniques are employed (Odoemenem and Obinne, 2010). The collective contribution of the socio-economic factors to the usage of animal traction technology resulted to adjusted R^2 of 0.524.

Extent of Animal Traction Technology Usage

Entries in Table 3 show the breakdown of extent of the animal traction technology usage among ATT users in the study area. The result reveals that, bulk of the ATT users used Ox-drawn plough (97.9%) and Ox- drawn drawn cultivator (92.1%). Result also indicates that about 56% of ATT users used Ox- drawn ridger. However, Ox-drawn cart, Ox-drawn harrow, Ox-drawn sprayer and Ox- drawn weeder had a low usage of 32.1%, 14.3%, 12.9% and 10% respectively. Most of the ATT users hardly use (0.7%) Ox-drawn pod lifter. The result implies that majority of ATT users used the animal traction technology for pre-planting operations.

Table 3: Extent of animal traction technology usage

ATT Component	*No of users	Extent (%)	Decision
Ox-Plough	137	97.9	High
Ox-Cultivator	129	92.1	High
Ox-ridger	78	55.7	High
Ox-Carts	45	32.1	Low
Ox-harrow	20	14.3	Low
Ox-Sprayer	18	12.9	Low
Ox-weeder	14	10	Low
Ox-podlifter	1	0.7	Low

Source: Field survey, 2016

*Multiple users allow

CONCLUSION AND RECOMMENDATIONS

The animal traction technology in Northwestern Nigeria can contribute more to productivity and economy growth if farmers are motivated to practice productivity enhancing technologies such as animal traction. The broad objective of this research was to determine factors influencing animal traction usage in North western zone of Nigeria. Based on the findings of this study, it could be concluded that seven variable significantly influencing the usage of animal traction technology in the study area. These implements includeox- drawn plough, ox- drawn cultivator, ox-drawn ridger, ox- drawn carts, ox- drawn harrow, ox- drawn sprayer, ox- drawn weeder and ox- drawn pod-lifter. The factors that had significant influence on animal traction

technology usage were, household size, farming experience, farm size, income, cooperative association and distance to market. The study recommends that government should take appropriate measures that can promote those factors found significantly influencing the technology through radio, television and extension services.

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