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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. A multistage sampling procedure 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 distribution of respondents according to their age showed that about 39% of respondents were within the age brackets 40-49 years with an average age of 46 years. Most, (54%) of respondents had no formal educational qualification, only 29% had 11-15 persons per household with mean household size of 11 persons per households head. Regression analysis showed a coefficient of multiple determinations (adjusted R^2 value) of 0. 524 which indicates that 52.4% of the variation in output was accounted for by the variation in explanatory variable used in the model. The remaining 47.6% may be attributed to error. The coefficient of household size (X_2), farm size (X_4) and farming experience (X_5) were positive and significant at ($P < 0.10$), ($P < 0.05$) and ($P < 0.01$) respectively. The positive coefficient suggested that a percentage increase in the variable would result in increased output level. 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. To improve on ATT usage, the study recommends that government should take appropriate measures that can promote those factors found significantly influencing the technology usage through radio, television and extension services in the study area.
Keywords: *Influencing factors, animal usage, animal traction technology, 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: Jansen, 2003; Abubakar and Ahmad (2010), indicated that 72% of this had cultivation potential but only 35% of the arable land is under actual cultivation. The same authors (Jansen, 2003; Abubakar and Ahmad, 2010) also stated that low level of mechanical power contributes to the slow growth of agriculture and serve as a major factor which further complicate 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 and they 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 and 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, Akpoko, 1999 and Badgley *et al*, 2006, have also identified factors influencing farmer's adoption of technology/innovation as 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. Akinlade *et al.* (2011), asserted that 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 Omotosho and Mohammed-Lawal (2010), 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 in Funtua, in the present Katsina State, by colonial master (Musa, 2004). However, the introduction of tractors in 1940s impeded the spread of the technology (ILCA, 2004). 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 (World Bank, 2011). Animal traction technology was already in use in the savannah zones of Northern Nigeria. Farmers in the area are already taking full advantage of the technologies such as ox- 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 (Omotayo, 1996; Philip *et al.*, 1990). It is in realization of this that both federal and state governments through Agricultural Development Programmeme (ADP) introduced animal traction technology to farmers in the sampled States (World Bank, 2006). It was against this background that the study seeks to identify and categorize factors influencing animal traction technology usage. This study analysed the socioeconomic characteristics of animal traction users and non-user farmers, and examined the factors influencing animal traction technology usage in Northwestern zone of Nigeria.

Methodology

The Study Area

This study was conducted in Northwestern zone of Nigeria. The study area comprised of Kaduna, Kano, Katsina, Kebbi, Sokoto, Zamfara and Jigawa 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 obtained from agricultural development projects (ADPs) zonal office, there are 3, 344 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 (Akpoko, 1999) 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, approximately 39% of the respondents were within the age bracket 40-49 years with an average age of 46 years. Across the users of animal traction technology, 40% of them were within the age bracket 40-49 years within an average age of 47 years, while 39% non-users of animal traction technology were also within the age bracket 40-49 years, with an average age of 46 years (Dijkman and Sims, 1997a). This result showed that there is no significant differences between the age of the users and non-users of animal traction technology in the study area (Ogunbameru *et al,*. 2008). 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. Also, from the table, by pooling the respondents together 40.6% had 6-10 persons per household with mean of 10 person per household (Joubert and Kotsokoane,

1998). Approximately, 29% users of animal traction technology had 11-15 persons per household with mean household size of 11 persons per household. Also, 49% non-users of animal traction technology had 6-10 persons per household with mean household size of 9 persons per household. The larger household size of users of animal traction technology (household size was 11) could be of advantage in terms of family labour supply (Dijkman and Sims, 1997a). Result in Table 1 also, showed that more than half (54% of ATT users, and 58.24% ATT non users) 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.

Ambros, (2008), Ibrahim and Onuk (2010), were of the opinion that education is highly important for sustainable agricultural growth and development. They posted further that formal education is a veritable attribute enhancing farmers to innovate, adapt and adopt improved recommended production practices. The table further revealed that 29.5% of the users of ATT cultivated farm size of between 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 (Mohammed, 2000). The result also revealed that farmers had many years of practical experience ranging from 16-20%. In addition, the result shows that majority (79.2%) have personal saving as their source of capital with only 9.2% with formal medium accessing capital; this however, can be attributed to the difficulties of obtaining loans/credit from formal sources as explained by the farmers in the study area (Owolabi, 2011).

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 (-0.264) and distance to market (-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 (Dijkman and Sims, 1997a). 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 plays 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, 2006).

The result in Table 2, further reveals that income of the farmers had a positive and significant relationship with animal traction technology usage at 10% level of probability (Charls, 2003). This suggests that farmers who received more income, used animal traction 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. Moreover, 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. The positive coefficient (Table 2) suggests that a percentage increase in the variable would result to increase output level.

Conclusion and Recommendations

The animal traction technology is one major agricultural farming practice found in Northwestern Nigeria. It could 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 Northwestern 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. The factors that had significant influence on animal traction technology usage were, marital status, 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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