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AVAILABILITY AND USE OF AGRICULTURAL INNOVATIONS AND ADOPTION OF ANIMAL AND CROP TECHNOLOGIES AMONG FARMERS IN SOKOTO STATE, NIGERIA

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ABSTRACT: *The study assesses the availability and use of agricultural innovations and adoption of animal and crop technologies among farmers in Sokoto State, Nigeria. Structured interview schedule was used to collect data from one hundred and fifty respondents using a multi-stage sampling technique. Data were analyzed using both descriptive and inferential statistics. PPMC and t-test was used. Respondent's mean age was 48 years' 99.1% had contact with extension agents; 88.4% had access to between 1 and 5 hectares of land; 33.6% engaged in crop production; 29.9% engaged in animal rearing. Recommended crop spacing was adopted by 36.6% of the respondents; while 29.9% adopted improved breeds of livestock. Agricultural Development Project (ADP) was the most accessed (X = 2.97) information source. There was a significant relationship between use of agricultural innovations and adoption of both crop and animal technologies (r = 0.262; p < 0.000), while significant difference (t = 3.068; p < 0.05) existed in the adoption of crop technologies between respondents with low and high access to agricultural innovations. Efforts by relevant agencies to improve the availability and use of innovations relating to appropriate crop and animal technologies will ultimately increase farmer's adoption of these technologies.*

KEYWORDS: availability, adoption, agricultural innovations, crop and animal technologies, sokoto state.

INTRODUCTION

Agricultural innovation is an indispensable factor in the practice of farming and it is the basis of extension delivery. Agricultural Information plays a vital role in our present day society as a result of the advancement in information and communication technologies (ICTs). Information in its most restricted technical sense is an ordered sequence of symbols that record or transmit a message. It can be recorded as signs or conveyed as signal waves. It is defined by Adereti, Fapojowo and Onasanya (2006) as data that have been put into a meaningful and useful context which is communicated to recipient who uses it to make decisions. According to Camble (1992), man

requires information to be able to manipulate factors of production such as land, and capital resources into meaningful and productive use. Agricultural information, as suggested by Agbamu (2006) is defined into four categories namely technical, commercial, socio-cultural and legal information. Agricultural information is needed for overall development of agriculture for the improvement of living standard of farmers. The objectives of agricultural innovations can hardly be realized if farmers have no access to information (Olawoye, 1996). Agricultural information creates awareness among farmers about agricultural technologies for adoption. Agbamu (2006) opined that information is the first and indispensable step of an adoption process. The characteristics of a good information source are relevance, timelessness, accuracy, cost effectiveness, reliability, usability, exhaustiveness and aggregation level. According to Oladele (1999), the efficiency of technologies generated and disseminated depends on effective communication which is the key process of information dissemination.

Technology is the application of knowledge for practical purpose which is generally used to improve the condition of human and natural environment as well as carry out some other socio-economic activities (Rogers, 2003). Agricultural technologies include both physical objects such as feeds or fertilizers as well as new farming techniques. The technology may not be new as such, but novel to the farmer. Thus, following Rogers (2003), a new technology (or innovation) is defined as 'an idea, practice, or object that is perceived as new by an individual or other unit of adoption'. Rogers (2003) identified two characteristics of innovations (from the perspective of the farmers) that best explain different adoption rates. They are the perceived relative advantage of using the technology vis-à-vis the technology it supersedes, and its perceived compatibility with existing values, needs and experiences. Rogers noted that innovations are more likely to be adopted if they are less complex, lend themselves to trials and whose results are visible to others.

Availability and Utilization of proven innovations by the farmers in Sokoto state has the potential to increase technologies' adoption level which in turn increases farmer's income, national economic growth, and conservation of soil. Adoption of agricultural technologies cannot be effective without communication through effective communication channels. More provision of agricultural information to farmers does not guarantee its use. This is because a host of social, economic and psychological factors influence the rate of agricultural innovation use (Akande, 199). Hence, innovations utilized by farmers in an attempt to increase agricultural productivity are issues of concern in Nigeria especially, Sokoto state, where their primary source of income is agriculture. It is imperative therefore to evaluate the availability and use of agricultural innovations on adoption of animal and crop technologies among farmers in Sokoto State, Nigeria.

Objectives of the Study

The general objective of the study was to assess the availability and use of agricultural innovations on adoption of animal and crop technologies among farmers in Sokoto State, Nigeria.

The specific Objective were to:

i. Identify the socio-economic characteristics of the respondents;
ii. Determine respondents' access to agricultural innovations;
iii. Examine respondents' use of agricultural innovations; and

iv. Ascertain farmers' adoption of innovations in animal and crop technologies.

Hypotheses

HO There is no significant relationship between respondents' utilization of agricultural innovations and adoption of animal and crop technologies.
H1 There is significant relationship between respondent's utilization of agricultural innovations and adoption of crop and animal technologies.

METHODOLOGY

Sokoto State in the present form came into being in 1996 when Zamfara State was created out of the former Sokoto State. Sokoto State has a land area of 26,648 square kilometers. It is located on latitude 11^0 30" 13^0 50" East and longitude 4^0 to 6^0 0" North. It is bordered in the North by Niger republic, Zamfara State to the East and Kebbi State to the South and West. Sokoto State has a total of 23 Local Government Areas.

Over eighty percent (80%) of the inhabitants of the state practiced one form of agriculture or the other. The predominant occupation of the people of this area is arable farming and rearing of livestock, cash crops and subsistence crops such as cotton, garlic millet, ground nut, sweet potatoes, maize and cowpea are also produced, blacksmithing, weaving, dyeing, and tanning are other occupational skills practiced widely in the state .In terms of vegetation, the state falls within the savannah zone. This is an open tse-tsefly free grass land suitable for cultivation of grain crops and animal husbandry. Rainfall starts in April/May and ends in October, it is usually followed by dry season from November to March and may extend to May. The topography of the state is dominated by famous Hausa plain of Northern Nigeria. The vast fadama land of River Rima system dissects the plain and provides the rich alluvial soil fit for variety of crops cultivation. There is also isolated hills and mountains ranges scattered all over the state (NPC, 2006)

Sokoto state was the home of many Empires and kingdoms of the pre-colonial western Sudan. These includes, Gobir and Kebbi Kingdom as well as the world renowned Sokoto caliphate who's spiritual and political is the state headquarters. Sokoto state has a population of 2.8 million people based on 1991 census but, there is a projected increase in the present form amounting to 20%. The state is made up of two ethnic groups namely, Hausa Fulani. There are of course Zabarmawa, Gobirawa, Arawa, Tuareg and others in the border local government areas. All these speaks Hausa as common language, Fulfulde is spoken by the Fulani (NPC, 2006

Method of Data Collection

Data were collected from primary source. Primary data were obtained from farmers, who responded to the structured questionnaire administered to elicit information used for the study.

Measurement of Variables

The independent variables of the study were: respondents' socioeconomic characteristics, access to agricultural innovations, and respondents' use of agricultural innovations. The dependent variable is adoption status of animal and crop technologies.

Socioeconomic characteristics: Age, farm size, farming experience were measured at ordinal level; while sex, marital status, religion, educational level, contact with extension agents and types of farming task, were measured at nominal level.

Access to agricultural innovations: Respondents were asked to indicate their access to agricultural innovations from the list provided on a 3-point scale of High Access scored 2, and No access scored 1. The maximum score was 33 and the minimum score was 11. The scores of each item were summed up to form a composite score for access to agricultural innovations for each of the respondents. The weighted mean was computed and used to rank respondents' access to agricultural innovations from high to low in order of accessibility.

Use of agricultural innovations: Even agricultural innovations were presented to the respondents. The sources were measured on a 4-point scale of Always used = 4, sometimes Used = 3, rarely used = 2 and not used at all = 1. Respondents were asked to respond to their use of these agricultural innovations in order to obtain score for each respondent. The maximum score was 44, while the minimum score was 11. The weighted mean was calculated and used to rank the agricultural innovations from high to low in order of frequency of use.

Adoption status of animal and crop technologies: Respondents were asked to indicate their adoption status from the list of crop and animal technologies provided to them. Two options of 'Yes' 'No' were used to elicit their responses.

RESULT AND DISCUSSION

Socio-Economic Characteristics of the Respondents

Table 2 shows that the majority (61.8%) of the respondents were between 41 and 50 years, with a mean age of 48 years, indicating that the farmers in the study area were mainly middle age who were in their economically active age and as such, can undergo the stress relating to the operation of farming enterprise. This result corroborates the finding of Adesope *et al.,* (2012) that higher proportions (37.7%) of the farmers in Sokoto State were between the age of 41 and 50 years. The findings showed that the ageing population was less engaged in the operation, attitude, and adoption of innovation, although other factors may play very important roles. Table 2 also showed that the majority (55.2%) of the respondents were female. This could be expected as Egunjobi (1991) has asserted that women participate actively in all aspects of food product chain. Also, Mgbada (2002) and Rahman (2004) reported that women provide about 60 – 80% of agricultural labour force and constitute about 80% of food production in Nigeria.

Furthermore, most (94.2%) of the respondents were married. This finding is similar to that of Adesope *et al.,* (2012) that the majority of the farmers in Sokoto State were married. This is an indication that farmers in the State were responsible, which implies that they were likely to access innovations for proven agricultural technologies to be adopted for long term sustainability. Ojo and Jibowo (2008) in their study reported that married people, being responsible, their views are likely to be respected within the farming communities as they take decisions on the use of farm inputs.

The table showed further that the majority (88.4%) of the respondents had access to between 1 and 5 hectares of land, with a mean farm size of 3.74. This is an indication that respondents could be closely described as peasant farmers. Brannel (1992) asserted in his study that a farmer with average farm size of 3 hectares is a peasant farmer. Moreover, the majority (63.9%) of the respondents had between 11 and 20 years farming experience with a mean of 18.23 years, which implies that respondents were quite experienced in the agricultural task they perform. Adequate farming experience help to build up farmer's confidence in making and implementing decision regarding proper use of agricultural technologies.

Most (99.2%) of the respondents had contact with extension agents. This is an indication of high technologies communication across farmers via technology transfer that could enhance long term sustainability of technology use. Asiabakar *et al.,* (2002) expressed the view that for farmers of different agricultural zones to adopt new technologies, they must be aware of the technologies, have a valid and up to date information on the technologies, the applicability of the technologies, farming system and receive the technical assistance necessary for the technologies, which are among the key functions of the extension agents. Evenson (1998) stated that contact with extension agents represents a mechanism by which information on new technologies, better farming practices and better management skills can be transmitted to farmers.

Table 2 further showed that 33.6% of the respondents practiced crop farming; 29.9% practiced animal farming; while the remaining 36.5% practiced other agricultural enterprises.

Table 2: Socio-economic characteristics of the respondents

Characteristics	Categories	Percentage	Mean
Age	31 – 40	8.7	48
	41 – 50	61.8	
	51 – 60	29.5	
Sex	Female	55.2	
	Male	44.8	
Marital status	Separated	0.4	
	Widow(er)	4.6	
	Married	94.2	
	Single	0.8	
Religion	Traditional	0.4	
	Islamic	0.4	
	Christian	99.2	
Education	No formal education	0.4	
	Adult education	0.4	
	Primary education	6.6	
	Secondary education	41.1	
	OND	24.9	
	B.Sc.	24.5	
	M.Sc.	2.1	
Farm size	1 – 5	88.4	
	6 – 10	9.5	
	11 – 15	0.8	
	16 – 20	1.2	
Farming experience	<10	4.6	
	11 – 20	63.9	3.74

	21 – 30	31.1	
	31 – 40	0.4	
Contact with extension agents type of farming task	Yes	99.2	
	Crop farming	33.6	
	Animal farming	29.9	
	Others	36.5	18.23

Source: Field Survey, 2017

Respondents Access to Agricultural Innovations

Table 3 showed that ADP (X = 2.97) ranked highest as the most accessed agricultural innovation by the respondents. The highest accessibility of ADP by the respondents as a source of agricultural innovations could probably be due to the favorable extension approaches used by the ADP personnel to extend proven agricultural technologies/innovations to the farmers in the study area. This may include participatory methods in which ADP personnel work together with the farmers to analyze their current farming situations/problems in order to determine appropriate solutions for self-reliance and also regular individual farm and home visit in order to access the practicability of the innovation adopted by the respondents. Access to Radio (X = 2.93) ranked second in the table. This result agreed with that of Ajayi (2003) that the use of radio as a source of technology was one of the most popular among farmers in Nigeria. The popular use of radio by the respondents could probably be due to the fact that many farmers in Nigeria can afford to purchase a transistor radio as it is cheap and easy to maintain with the use of batteries. The least accessed agricultural innovations are Conferences (X = 1.33) and Trade Fair (X = 1.21) ranked tenth and eleventh respectively. The reason for the low accessibility to these innovations could be due the fact that they were located in the urban centers where the innovations were not within the reach of the farmers

Table 3: Respondents access to agricultural innovations

Innovation source	**Access to agricultural innovations**	
	Mean	**SD**
ADP	2.97*	0.21
Radio	2.93*	0.30
Extension agents	2.91*	0.36
Research institutes	2.35*	0.60
Local government	2.07*	0.60
Family members	2.07*	0.35
Farmers' cooperatives	2.05*	0.24
Video	2.03*	0.31
State ministry of agricultural	2.02*	0.24
Conferences	1.33	0.48
Trade fair	1.21	0.43

Source: Field Survey 2017. *Accessible (mean $\geq$ 2.0)

Respondent's use of agricultural innovations

Result in table 4 showed the respondents' use of agricultural innovation sources. ADP (mean = 3.91) ranked first as the most utilized source of agricultural innovation for adopting animal and crop technologies in the study area. it could be inferred from this finding that ADP is effective in carrying out their mandates in the study area which include technology transfer to farmers, distributing modern farm inputs, land development, etc, and as a result farming households in the study area resort to them frequently to source for information on latest innovations. The second most utilized information source was radio (mean = 3.80); while the least utilized information sources were conferences (mean = 2.32) and trade fair (mean = 2.23) ranked tenth and eleventh respectively. Insufficient fund and lack of awareness of these information sources could probably be the reason for their poor utilization.

Table 4: Respondents' use of agricultural innovations

Innovation source	**Access to agricultural innovations**	
	Mean	**SD**
ADP	3.91*	0.36
Radio	3.80*	0.51
Extension agents	3.70*	0.55
Research institutes	3.25*	0.75
Local government	3.17*	0.59
Family members	3.22*	0.54
Video	3.07*	0.44
Farmer's cooperatives	3.03*	0.30
State ministry of agriculture	2.99*	0.35
Conferences	2.32	0.59
Trade fair	2.23	0.56

Source: Field Survey 2017. *Used (mean≥2.5)

Adoption Status of Animal and Crop Technologies

Table 5 showed that higher proportion (33.6%) of the respondents involved in crop farming adopted crop technologies like recommended crop spacing, pesticides application pest and disease control; whereas, 8.3% each adopted thresher and sickle respectively.

The table also showed variation in the adoption status of animal technologies by the respondents involved in animal husbandry. Results showed that 29.9% of the respondents adopted animal technologies like improved breeds of livestock, vaccination date, and de-worming. The least adopted animal technologies were dwarf wall/wire screening and east orientation, where 2.1% and 4.1% of the respondents adopted dwarf wall/wire screening and east west orientation respectively.

Table 5: Respondents' adoption status of technologies

Technologies	Percentage
Crop technologies	
Pest and disease control	33.6
Chemical fertilizer	33.2
Application	32.8
Insecticide application	29.0
Farm yard manure	32.0
Hoe	27.8
Cutlass	33.6
Pesticide application	8.3
Thresher	8.3
Sickle	
Animal Technologies	29.9
Improved breed of livestock	29.9
Vaccination date	22.0
De-worming	27.4
Litter management	2.1
Cross breeding dwarf wall/wire screening east west orientation	4.1

Source: Field Survey, 2017

Relationship between Agricultural Innovations and Adoption Process.

The results in table 6 showed that respondents' use of agricultural innovations was significantly related to adoption of crop technologies ($r = 0.262$, $p>0.000$) at 0.01 level. The positive correlation between respondents' use of agricultural innovations and adoption of crop showed that the more the respondents come in contact with new innovation, the more they adopt it. It could probably be due to the fact that agricultural information relating to adoption of crop were available in the study area which could have served as motivational factor to the respondents to frequently source information on technologies through them. Also, the finding in Table 4 showed that respondents' use of agricultural innovations was not significantly related to adoption of animal technologies ($r = 0.034$, $p>0.604$) at 0.01 level. The non-significant positive correlation between respondents' use of innovations and adoption of animal technologies implied that respondents' use of innovation sources does not increase their adoption of animal technologies significantly. Low availability of innovation on animal technologies could be the limiting factor to the low adoption of animal technologies. Ozowa (1995) affirmed that Nigeria farmers do not feel the impact of agricultural technologies mainly because they have low or no access to such vital information relating to the technologies which also limits their frequency of using the information sources.

Table 6: Relationship between respondents' use of agricultural innovation sources and adoption of crop as well as animal technologies by the farmers.

Dependent variables	R
Adoption of crop technologies	0.262**
Adoption of animal technologies	0.034

*P<0.05. Source Field Survey 2013.

Difference in the Adoption status of respondents with low and high access to agricultural innovation sources

The mean value of adoption for crop technologies according to the findings in Table 7 showed that those with high access (X = 10) adopted more crop technologies than those with low access (X = 5) to agricultural innovation sources, and the t value (t = 3.-68; p < 0.05) showed that there is a significant difference in adoption level between respondents with high access and low access to agricultural innovations at 0.05 level. Accessibility of agricultural innovations through relevant sources is a pre-requisite for technology adoption.

Also, the mean value of adoption for animal technologies according to the findings in Table 7 showed that those with high access (X = 4) adopted more animal technologies than those with low access (X = 1) to agricultural innovations, and the t value (t = 2.696; p < 0.05) showed that there is a significant difference in adoption level between respondents with high access and low access to agricultural innovations at 0.05 level.

Table 7: Difference in the adoption status of respondents with low and high access to agricultural innovations.

Technologies	**Mean**				
	High access	**Low access**	**Difference**	**df**	**T**
Adoption of crop technologies	10	5	5	239	3.068*
Adoption of animal technologies	4	1	3	239	2.696*

*P<0.05. Source: Field Survey 2017.

CONCLUSION AND RECOMMENDATIONS

Farmers accessed ADP, Radio and Extension agents mostly as sources of information for technologies adoption in the study area. Although, a lot of new innovations on agriculture were frequently utilized by the farmers, the influence of these sources on adoption still remain low especially on adoption of animal technologies. In addition, there was a striking difference in the adoption statuses of farmers with low and high access to agricultural innovations.

Frequency of use of innovations among farmers should be improved by making these sources accessible to them. Government and private agencies should invest on improving ADP as a source of technology transfer to farmers in the study area.

Proper adoptions of agricultural technologies enhance productivity; it is therefore crucial that both governmental and non-governmental bodies make innovations on animal and crop timely and accessible to the farmers by ensuring that the extension workers bring these technologies to them

as at when due. Farmers should be encouraged by government and private operators to frequently utilize available agricultural innovation to obtain improved agricultural output.

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