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The Effect Of Socio-Economic Characteristics Of Cattle Farmers On The Adoption Of Artificial Insemination Technology In Kaduna State Of Nigeria.

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Abstract: *This study examined the effect of socio-economic characteristics of cattle farmers on the adoption of Artificial Insemination Technology in Kaduna State, Nigeria. One hundred and twenty respondents were purposively selected for the study, drawing 30 respondents each from the four zonal offices of the Kaduna State Agricultural Development Programme (KADP). The design of the study was a cross sectional survey. Questionnaires were used to collect the data from the respondents. Of the 120 questionnaires administered, 116 were retrieved. The data was analyzed using both descriptive and inferential statistics. The result of the descriptive statistics reveal that 100% of the respondents were males and the average age of the respondents was 57.38 years with an average household size of 13.5. About 89% of the respondents had attended quoranic/adult education and they were majorly pastoralists (88.79%) They had a mean farming experience and herd size of 31.72 and 78.29 respectively. The t-test result revealed that educational attainment, herd size and age had a significant and linear relationship with adoption of AI at $p<0.05$. It was recommended that more enlightenment be done on AI, its services be subsidized and that the coordinating agency be decentralized.*

I. Introduction

Africa has 16% of the world's dairy livestock but produces less than 4% of global milk production with an average cow producing only 454 litres per year compared to 5630 litres for top producing cows in the European Union (EU). This is in spite of the fact that livestock products account for 25-35% of agricultural production in Africa (USDA, 2006). This low level of milk production in Africa can be attributed to a number of constraints that include low quality dairy breeds, limitation imposed by harsh environmental conditions such as high ambient temperatures, high incidence of diseases and parasites and poor nutrition (Gefu, 1989). An equally important factor is the generally low level application of modern technology in the management of dairy cattle, particularly am, nong the small holder dairy farms. Artificial Insemination (AI) is one such technology that can solve these constraints if the necessary conditions are put in place to spur poor rural farmers to adopt the technology.

Artificial insemination (AI) has been used for improvement of livestock production in developed countries. Its use in developing countries has been reported in several literature to be less widespread and the result obtained are far from been satisfactory (Butswat and Choji, 1995). Under tropical small farm conditions, a number of socio-economic, organizational, biological and technical factors make the service more difficult to provide. If the major constraints can be identified and overcome, the technology would become more widely adopted and contribute to an increased production of milk and meat, leading to better food securities and poverty alleviation.

Nigeria's livestock resource base consists of about 15.4 million cattle, 44.1 million goats, 28.0 million sheep, over 150 million poultry, 4.1 million pigs,1.7 million domesticated rabbits, and 0.94 million donkeys, with an estimated value of over 260 billion naira (Nworgu,2006). These livestock resource base if properly harnessed have the potential of meeting up whatever challenges the country faces in terms of the supply of milk and meat. There are prevailing socio-economic and techno-operational including policy constraints limiting the efficiency of production of this cattle population and there is serious need to address these constraints through research support for the generation of producer-implementable technology packages.

The WDR (2008) has it that the cross breeding of dairy cows with exotic breeds has improved livelihood of small holder farmers in high potential areas in the tropics. Those about 100 million cattle and pigs are bred annually in the developing world using AI. It added that 'thanks largely to AI, about 1.8 million small scale farmers in the high land of East Africa draw a significant part of their livelihood from the higher milk yields they obtain from genetically improved dairy cattle. Rozeboom (2007) posit that among all the fundamental systems of animal breeding exercise such as random mating, in-breeding, line breeding and out breeding, artificial insemination has proved to be the best and efficient method. This submission had been expressed by Butswat and Choji (1995) when they said that AI is a vital tool for the rapid improvement of livestock allowing for maximum use of best sires on numerous dams and that it is one of the animal production

techniques which can augment production and returns from livestock at a faster rate through cross-breeding programme.

Zahraddeen et al. (2006) say AI has been used to increase the efficiency of controlled mating of farm animals in various parts of the world. They also posited that the development of AI in Nigeria has been very slow and that few reports are available for example in cattle, sheep, pigs and poultry.

The increasing demand for animal products and the very low production of our indigenous cattle in the country make it imperative for animal scientists and other stakeholders to find a way of improving the productive performance of our indigenous cattle. This is realizable through either appropriate selection, importation of proven cattle from abroad, planned cross breeding or the use of artificial insemination. Artificial Insemination has been acclaimed world-wide as a better, quick and a ready- made alternative to achieve this goal that is very promising.

It is this poor performance rating of our tropical cattle and its attendant effect on eating habits among other issues that has triggered this piece of write-up. To successfully transfer this technology, it is imperative to take stock of the socio- economic characteristics of the end users and the effects these have to AI adoption with a view to creating a conducive environment for the technology to be adopted.

Agriculture is the main stay of the economy of Kaduna State with about 80% of the people actively engaged in farming. Cash and food crops are cultivated and the produce include yam, cotton, groundnut, tobacco, maize, beans, guinea corn, millet, rice and cassava. Over 180,000 tones of groundnut are produced in the State annually. The major cash crops are: Cotton and ginger which the State has a comparative advantage in as it is the leading producer in the country (Kaduna State bulletin, 2009). Another major occupation of the people is livestock husbandry and poultry farming. The animals reared include: cattle, sheep, goats and pigs. In fact, the State has the largest pig market in West Africa located in Katsit, a semi-urban settlement near Kafanchan.

The entire land structure consists of an undulating plateau with major rivers in the State including Rivers Kaduna, Kagom, Gurara, Galma and River Wonderful in Madakiya near Kafanchan. There are two marked seasons in the State, the Dry windy season and the Rainy (wet) season. The wet season is usually from April through October with many variations as one moves north- wards. On the average, the State enjoys a rainy season of about five (5) months. There is heavy rainfall in the southern part of the State in areas like Kachia, Kafanchan, Zonkwa and environs. The average rainfall range is 1016mm.The State extends from the tropical grassland known as the Guinea Savannah in the south to the Sudan Savannah in the north. The global location of the State is between longitude 30'E of the Greenwich meridian and also between latitude 0900^{o} and 11.30^{o}N of the equator (Kaduna State bulletin, 2009).

This paper is thus focused on this class of cattle farmers with a view to determining how their socio-economic characteristics have affected the adoption of artificial insemination and is to provide answers to the following research questions:

What are the socio- economic characteristics of the respondents?

How have these socio- economic characteristics affected AI with regard to its adoption?

The broad objective of the study was to examine the effect of socio-economic characteristics of cattle farmers and how these affect Adoption of Artificial Insemination (AI) adoption in Kaduna State. The specific objectives were to:

i. determine the socio- economic characteristics of the respondents;
ii. determine how these socio-economic characteristics of the respondents affect AI with regards to its adoption;

To address the issues raised in the specific objectives of the study, the following null hypothesis were tested:

Hoi: There is no significant relationship between respondents' socio-economic characteristics and their adoption of AI.

Hai: There is a significant relationship between respondents' socio-economic characteristics and their adoption of AI.

II. Material And Methods

A purposive sampling procedure was used for the study. Since the study is interested in only cattle farmers using or who once used the AI technology, thirty cattle farmers were purposively selected from each of the four zones of the Kaduna State Agricultural Development Programme (KADP) i.e. Maigana, Birnin-Gwari, Lere and Samaru zones. This gave a sample size of 120 respondents.

The primary data were collected through a purposive survey of cattle farmers who are using or once used the artificial insemination technology. Data were collected on the socio-economic and personal characteristics of the respondents, particularly their sex, age, household size, educational attainment, herd size, occupation and farming experience. Secondary data were sourced from journals, books, and unpublished research reports. Data for the study were collected by enumerators specially trained for the work. The

instrument used was a structured questionnaire. The enumerators were village extension agents (VEAs) in the four zones of the KADP. Their posting was based on their familiarity and language compatibility with the respondents.

Both descriptive and inferential statistics were used for the analysis of the data collected. Descriptive statistics such as percentages, mean and frequencies were used to report the socio-economic characteristics of the respondents. In testing the hypothesis for ascertaining factors associated with AI and its adoption, the regression analysis was employed to test the extent of the relationship in hypotheses I and ii. For convenience, the $P< 0.05$ level of significance was used to accept or reject the hypotheses. The Ordinary Least Square Regression model was specifically used. The equation of the model is

$Y= a+ bx_1\ bx_2 \ldots\ldots\ldots\ bx_9 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(1)$

Where: Y= AI adoption by respondents

a= Constant term

b= Coefficient of the variables

x_1= Ages of respondents

x_2= Household size of respondents

x_3= Educational attainment of respondents

x_4= Farming experience of respondents

x_5= Herd size of respondents

x_6= AI efficiency as perceived by respondents

x_7= AI complexity as perceived by respondents

x_8= Cost of AI as perceived by respondents

x_9= Difficulty of heat detection as perceived by respondents

In doing this, adoption was measured by multiplying the actual value of those respondents who adopted to those who did not by one hundred (100) and the result of this method helped to transform the variables into quantitative measurements. This procedure made it possible for the application of the Ordinary Least Square Regression (LSR) model for the analysis of the data.

III. Results And Discussion

The socio-economic characteristics of the respondents were analyzed using descriptive statistics. They included age, household size, educational attainment, farming experience and herd size of the respondent. The results are hereby presented in Table 1.

Table 1: Distribution of Respondents based on their socio-economic characteristics

Age class (years)	**Frequency**	**Percentage**	**Mean age**
31-40	3	2.59	57.38
41-50	32	27.59	
>50	81	69.82	
Total	**116**	**100**	
Household size			
1-5	3	2.59	13.5
6-10	31	26.72	
11-15	38	32.76	
>15	44	37.93	
Total	116	100	
Educational attainment			
Primary education	7	6.03	
Secondary education	2	1.72	
Qur'anic/Adult education	103	88.79	
Post secondary education	4	3.45	
Total	116	100	
Occupation			
Pastoralist	103	88.79	
Agro-pastoralist	12	10.34	
Civil servant	1	0.87	
Total	116	100	
Herd size			78.25
21-30	2	1.72	
>30	114	98.28	
Total	116	100	
Farming experience (years)			
1-5	**1**	**0.86**	**31.72**

6-10	**3**	**2.59**
11-15	**4**	**3.45**
>15	**108**	**93.10**
Total	**116**	**100**

Source: Field survey data 2012

Table 2: Result of Least Square Regression (LSR) Analysis

Model	Unstandardized coefficients	Standardized Coefficients		t- calculated	t-critical	significance level
		Std. Error	Beta			
(Constant)	7.217	29.658		.234		.808
Age _ x_1	-.357	.142	-.125	-2.532	2.00	.013
House Holdsize _x_2	3.86	.305	.055	1.264	2.00	.209
Educational Attainment _x_3	30.164	2.757	.652	10.939	2.00	.000
Farming Experience _x_4	.182	.146	.056	1.245	2.00	.216
Herd size _x5	.256	.046	.317	5.543	2.00	.000

a. Dependent variable: Adoption _Y

Table 3: USL Statistics.

Model	U.S.L. Statistics R Square Change	F change	Df 1	Df 2	Sig. change	F
1	.855	69.697	9	106	.000	

Predictor (constant), Farming exp. _x_4 Herdsize _x_5, Household size _x_2, Age _x_1, Education _x_3.

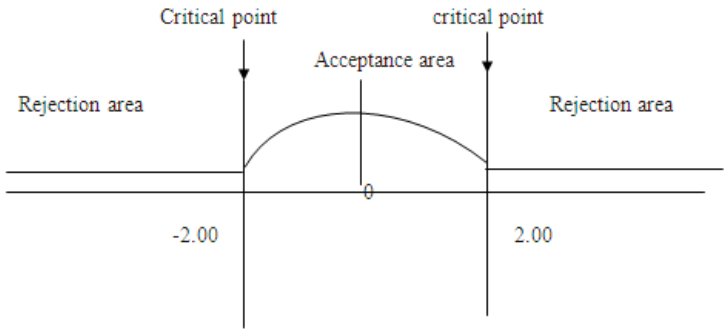

Figure 1: Two tailed normal distribution curve for t- test

Gender of the respondents

The distribution of the respondents according to their gender revealed that 100% of the total respondents are males. This shows that herding is chiefly a male dominated art. The reason for this may not be unconnected to the hazards associated with cattle rearing.

Chronological ages of the respondents

The chronological age of a person is the stage of development of the person either young or old. It is measured in years, and is expected to influence decision making and analysis of situations to aid decision making. Jabil (2009) submitted that age is one of the important determinant of human reasoning and responsibilities. The result of the study as it pertains the chronological ages shown in Table 1 revealed that

69.82% of the total respondents were above 50 years old. While 2.59% of them were between the ages 31-40 years, 27.59% were between 41-50 years. The mean age of the respondents was 57.38 years.

Household sizes of respondents

The household size of the respondents is also shown in Table 1. The result revealed that 37.93% of the total respondents had more than 15 persons staying with them. About 33% of the respondents had between 11-15 persons living with them. The least household size was between 1-5 and constituted 2.59%. The mean household size was 13.5. This may be understood from the view point of the African's polygamous tendencies and also the extended family setting. In fact, most of the respondents are Muslims and polygamy is not abhorred by its adherents.

Educational attainment of respondents

The result of the educational level of the respondents in Table 1 revealed that 88.79% had attended Qur'anic/Adult education and could read and/or write in Hausa and/ or Fulani. This could be explained too, by the fact that Qur'anic education is usually taught to the youth at tender ages.

Occupation of respondents

The main occupational engagement of the respondents was also studied. Table 1 showed that 88.79% of the respondents were pastoralists while 10.34% and 0.87% respondents were agro- pastoralists and civil servant, respectively. The finding is supported by the fact that the fulanis are still the major cattle owners in the study area. Majority of them still have not adopted sedentary life-styles.

Distribution of respondents by farming experience

Information on respondents' farming experience is reported in Table 1. The distribution showed that 93.10% of the respondents have been herding for more than 15 years. The least farming experience is 1-5 years constituting only 0.86%. The mean farming experience is 31.72 years. This may be explained by the fact that the household head in most communities is almost always the eldest member of that household.

Distribution of respondents by herd size

Table 1 shows the distribution of the number of cattle owned by the respondents. The result revealed that 98.28% of the respondents had a herd size of over 30 cattle while the remaining 1.72% had a herd size of between 21-30 cattle. The mean herd size was 78.25.

Relationships between Socio-Economic Characteristics and AI Adoption

The Least Square Regression analysis was carried out between the level of adoption and other important variables. The variables used were: age (x_1), household size (x_2), educational attainment (x_3), farming experience (x_4) and herd size (x_5).

The result of the regression is summarized in Table 2. The coefficient of determination for the model (r^2) as seen in the USL statistics (Table 3) is 0.855 which implies that 85.55% of the variation in the dependent variable (adoption) is explained by variation in the explanatory variables included in the model i.e. the selected variables could be possible determinants of the farmers' adoption of AI. The calculated f-value for the model is 69.697 which all indicate that the model was significant as a chosen tool for this analysis (Table 3).

The normal t-test curve included was to further give a pictorial justification as to why a stated hypothesis is accepted or rejected (Figure 1).

i. Artificial Insemination adoption and Age of respondents (X_1)

From the observed t value in the model in Table 1, the t-calculated for age (X_1) was found to be -2.532 while the t-critical was 2.00. This implies that the calculated value falls within the rejection area. The null hypothesis was rejected; suggesting that there is no significant relationship between age and AI adoption by farmers and accept the alternative hypothesis which states otherwise. This result supported the works of many researchers of adoption of agricultural technologies (Adekoya and Ajayi; 2000; Iyere, 1985).This is explained by the reasoning that older farmers tend to speak, think and reason traditionally. They tend to stick to what they are used to and hardly venture into new ways of doing things. Onazi (1973) in a study of Northern Nigeria discovered that among other reasons given by farmers for non adoption of agricultural practices is the issue of their reluctance to let go their old ways.

ii. Artificial Insemination adoption and Household size of respondents (X_2). The calculated t-value for household size was 1.264 while the t-critical value was 2.00 (Table 3).This implies that the calculated t-value is less than the critical t-value. Hence the null hypothesis which states that there is no significant relationship

between respondents' household size and their adoption of AI was accepted and rejected the alternative which states otherwise. This means that the larger the household size, the less likely are the respondents' willingness to adopt the AI technology. This finding is in tandem with that of Adebayo (1994). This can also be understood from the fact that the status quo tend to see the large household size as an asset to the family since this avails the famer ready workforce. This may be the possible reason why household size could induce AI adoption.

iii. Artificial Insemination adoption and Literacy level of respondents (X_3)

The information in Table 1 shows that the calculated t- value for literacy level was 10.939 while the critical t-value was 2.00. The calculated t-value for this variable thus falls within the rejection area. Therefore, the null hypothesis that states that literacy level has no significant relationship with AI adoption was rejected and the alternative which states otherwise was accepted. This finding is in consonance with works done in other studies that had to do with the adoption of agricultural innovations (Asifat, 1986; Akinola, 1986; Raza, 1969 and Voh, 1984) shared the same sentiments when they reported that there existed a positive relationship between level of education and adoption of farming innovations. The implication of this finding is that the adoption of Artificial Insemination technology by cattle farmers in Kaduna State is a function of the farmers' educational attainment. This can be explained by the fact that an educated farmer tends to be more exposed to new ways of doing things because of his level of interaction with the world outside his immediate milieu. This fact allows him to welcome change as soon as it is introduced in the locality.

iv. Artificial Insemination adoption and farming experience of respondents (X_4)

The farming experience variable (Table 1), has a t-calculated value of 1.245 and a t-critical value of 2.00. This implies that farming experience is not significantly related to AI adoption. The null hypothesis is therefore accepted and the alternative hypothesis rejected. This is also supported by other studies where it was found that farming experience does not contribute to farmers' acceptance of new innovations (Agbamu, 1993).

i. Artificial Insemination adoption and Herd size of respondents (X_5)

The study showed that herd size has a positive and linear impact (t-calculated=5.543) on the adoption of AI by respondents (Table 1), This means that respondents with larger herd sizes are more likely to adopt than those with less herd sizes. This finding is corroborated by the findings of Ladebo (1999) and Adekoya and Ajayi (2000). They also reported a positive and significant relationship between herd size and the acceptance and use of new technologies by farmers. This can be understood from the fact that herd size translates to economic standing which tends to spur farmers to venture into even the unknown in terms of risk taking. The import of this is that the more the herd size, the wealthier the farmer is and so the more his tendency to experiment and take risks. The null hypothesis is thus rejected and the alternative hypothesis accepted.

IV. Summary, Conclusion And Recommendations

The broad objective of this study was to examine the influence of socio- economic characteristics of cattle farmers towards the adoption of artificial insemination technology in Kaduna State. The State is divided into four Agricultural Development zones by the Kaduna State Agricultural Development Programme (KADP) with zonal offices in Samaru, Maigana, Lere and Birnin Gwari. Thirty respondents were purposively selected from each of these zones, making a total of 120 respondents. Questionnaires were administered to the 120 respondents and a total of 116 questionnaires were recovered.

The respondents' socio-economic variables examined were: age, house hold size, educational attainment, farming experience and herd size. The descriptive statistics revealed that 69.82% of the sampled population was above 50 years old with a mean age of 69.82 years and 100% were males. As for household size, 37.93% of the respondents had a household size of greater than 15 and the mean household size was 13.5; and 88.79% of them had qu'ranic/ adult education. The major occupation of the respondents was pastoralism (88.79%) while 93.10% of them had a farming experience of upward of 15 years with a mean of 31.72 years. About 98% of the respondents had a herd size of over 30 heads of cattle. The mean herd size was 78.25.

The regression analysis reveals that among the socio- economic factors influencing the adoption of AI, as indicated by the observed 't' value in the model, age, educational attainment and herd size had a positive and linear impact on the adoption of AI by the respondents. .Household size and farming experience did not show any significant contribution to AI adoption by the respondents. This may be attributed to the fact that most of the respondents did not adopt AI.

The findings of this research work showed that most of the respondents did not adopt AI in their farms. The introduction of AI by cattle farmers the world over has been known to improve beef and milk production. Its adoption in the study area will do no less than what is obtainable elsewhere.

To address the constraints of AI as they relate to its adoption in the study area, the following recommendations were made:

i. A more aggressive campaign should be launched with a view to enlightening cattle farmers on the practice and its benefits.
ii. The agency saddled with the task of introducing AI to the farmers should be reorganized and decentralized such that the agency maintains a functional unit in all the Local Government Areas (LGAs) of the federation, fully equipped with cold rooms, liquid Nitrogen and tetra oxo carbon iv oxide (CO2) etc.
iii. Governments at all levels should take interest in the AI technology and encourage potential end users through subsidies, grants, soft loans and other such measures that can encourage its adoption.
iv. Governments and the private sector should invest in power generation so that stable and reliable power supply can be guaranteed.

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