

Cattle Farmers' Attitude Towards Artificial Insemination Technology in Kwara State, Nigeria

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Abstract

This study examined the factors influencing cattle farmers' attitudes towards Artificial Insemination in Kwara State. A total of 140 indigenous cattle farmers were sampled using a snowball sampling technique, which involved initial participants referring additional farmers until the desired sample size was reached. Data collection was conducted through a structured interview schedule. Descriptive statistics were used to analyze the data. The findings revealed that most respondents were male (90.7%) and aged between 41 to 50 years (43.6%). Almost half of the respondents had no formal education (49.3%). The average household size was approximately 8 people, with an average of 12 years of experience in cattle production. The main breed reported was White Fulani (50.0%), with an average herd of 103 cattle. The average monthly income was N78,742.8. The study showed that 67.1% of respondents had a favourable attitude towards using AI, while 59.3% lacked an understanding of AI and 51.4% were unaware of its existence. Factors such as compatibility with culture/beliefs (25.0%), access to credit facilities (50.0%), and encouragement from government agencies (17.9%) were identified as important attitudinal factors for promoting the use of AI. Based on these findings, the provision of credit facilities, establishment of semen banks, improvement of infrastructure, and virile extension and veterinary services to increase farmers' interest in AI technology for improved productivity were recommended.

Keywords: AI adoption, animal breeding, cultural compatibility, Indigenous cattle, semen banks.

Introduction

Cattle are essential domesticated ruminants, primarily raised for meat, milk, and other by-products, playing a crucial role in global agriculture and food production (Salami *et al.* 2019). In Nigeria, the cattle population is estimated at 15.3 million, comprising indigenous breeds such as White Fulani, Red Bororo, Sokoto Gudali, Adamawa Gudali, Muturu, Keteku, and Ndama (Kubkomawa, 2017). These cattle are primarily raised for subsistence, providing milk and beef for personal consumption, with any surplus available for sale (Robinson, 2020). Traditional farming practices often involve maintaining native cattle varieties for both livestock and draught purposes, while commercial operations aim to maximize profit through enhanced beef and dairy production (Greenwood, 2021).

Artificial insemination (AI) has emerged as a transformative biotechnology that enhances cattle reproduction by allowing the introduction of superior male sperm to a wider population of females, thereby minimizing disease transmission compared to natural mating (Said *et al.*, 2020; Shanku, 2023). The introduction of AI in Nigeria began in 1949 at the Livestock Improvement Centre in Vom, Plateau State, using imported exotic bull semen (Ogunjeiofor, 2019). The National Animal Production Research Institute (NAPRI) was established in 1976 to extend AI services across the country, yet the adoption of AI remains limited among farmers (Ibrahim, 2019).

The successful adoption of AI hinges on farmers' attitudes, knowledge, and socioeconomic factors, which can significantly influence its implementation and effectiveness. Despite AI's

potential benefits, including improved herd performance, enhanced reproductive efficiency, and genetic improvement (Mwaipopo & Mbagala, 2022), many farmers in developing countries like Nigeria remain hesitant to adopt this technology due to various barriers. Concerns regarding technical complexity, costs, and the need for specialized equipment can deter farmers from utilizing AI (Howley *et al.*, 2012; Kumar *et al.*, 2018). Additionally, cultural beliefs and traditional practices related to animal husbandry can shape attitudes towards AI, further complicating its adoption (Ingabire *et al.* 2018).

While some studies have documented the advantages of AI, there is a notable gap in understanding how these factors affect farmers' attitudes towards AI technology. Despite governmental efforts to promote its use in Northern Nigeria, farmers' limited participation in AI technology indicates a pressing need to explore the underlying reasons for this reluctance (Ibrahim, 2019; Rasak *et al.*, 2023). This study, therefore, examined the factors influencing cattle farmers' attitudes towards AI technology in Kwara State, described how the socio-economic status of cattle farmers influenced their attitude towards AI technology, examined their level of knowledge and awareness about it, and assessed the institutional and environmental policies affecting its implementation.

Materials and methods

Description of Study Area

This study was conducted in Kwara State, situated in the Northern central geopolitical zone of Nigeria. It is bordered to the East by Kogi State, to the North by Niger State, and the South by Ekiti, Osun, and Oyo states. The western border of Kwara State forms part of the international boundary with the Benin Republic. The capital city is Ilorin, and the state encompasses 16 local government areas, with geographical coordinates of 8°30'N 5°00'E. The state has been inhabited for many years by various ethnic groups, with the majority being Yoruba people, alongside significant minorities such as the Nupe people in the Northeast, Bariba (Baatonu) and Busa (Bokobaru) peoples in the west, and a small population of Fulani people in

Ilorin, who are known to move through the state as nomadic herders.

Kwara State's economy is predominantly based on agriculture, emphasising the cultivation of grains and the herding and ranching of cattle, goats, and sheep. Additionally, the state boasts the joint-twentieth highest Human Development Index in Nigeria and is home to numerous tertiary education institutions, contributing to its socio-economic development.

Study Design

The study employed a snowball sampling technique, resulting in a total of 140 cattle farmers being selected for participation. The sample comprised 32 respondents from Asa Local Government Area, 34 from Ilorin-East LGA, 36 from Ilorin-South LGA, and 38 from Moro LGA. To ensure the validity of the survey, expert reviews were conducted, and the reliability of the instrument was assessed using the test-retest method. Data collection was done using interview schedule, eliciting responses covering the study objectives. The socio-economic attributes of farmers, including sex and marital status, were measured at the nominal level. Others, such as age, household size, years of experience in cattle farming, cattle breed, herd size, and monthly income, were operationalized at the ratio level. The level of knowledge and awareness regarding AI were assessed by asking farmers about their familiarity with the technology, its importance, advantages, and limitations. The attitudes toward AI technology were assessed using a 5-point Likert-type scale, ranging from strongly agreed (5) to strongly disagreed (1), which evaluated respondents' disposition, understanding, and acceptance of AI.

Statistical Analysis

Descriptive statistics, including percentages, frequencies, means, and standard deviations, were utilized to summarize the data corresponding to each study objective. Also, the relationship between selected socio-economic characteristics—such as years of education and herd size—and attitudes towards AI technology was examined using Pearson Product Moment Correlation analysis. Hypothesis was tested at

significance level $p < 0.01$, ensuring a rigorous analysis of the data collected.

Results and discussion

Socio-economic characteristics of the cattle farmers

Table 1 presents the socio-economic characteristics of the respondents, revealing that a significant number (43.6%) were aged between 41 to 50 years, with an average age of 44.4 years. This demographic insight

suggests that the cattle farmers in the study area are predominantly middle-aged, which may positively influence their attitudes toward adopting improved technologies such as AI. Middle-aged individuals often possess a blend of experience and openness to innovation, making them more likely to explore and integrate new technologies into their farming practices. This finding aligns with Olawepo *et al.* (2021), which similarly reported a similar average age of cattle herders in Kwara State.

Table 1: Socio-economic characteristics of cattle farmers (n=140)

Variables	Frequency	Percentage (%)	Mean	Standard dev.
Age (years)				
≤ 30	4	2.9		
31 – 40	46	32.9	44.4	7.91
41 – 50	61	43.6		
Above 50	29	20.7		
Sex				
Male	127	90.7		
Female	13	9.3		
Marital Status				
Single	16	11.4		
Married	82	58.6		
Divorced	22	15.7		
Widow	20	14.3		
Level of education				
No formal education	69	49.3		
Primary education	39	27.9		
Secondary education	31	22.1		
College and above	1	0.7		
Household size (people)				
≤ 5	49	35		
6 – 10	54	38.6	7.5	3.45
11 and above	37	26.4		
Household Headship				
Yes	127	90.7		
No	13	9.3		
Number of household members participating in cattle rearing				
≤ 5	71	50.7		
6 – 10	64	45.7	5.6	2.6
11 and above	5	3.6		

Source: Field Survey, 2023

Moreover, the demographic profile shows that the majority of respondents (90.7%) were male, and a significant proportion (58.6%) were married. This male predominance in cattle rearing may influence perceptions of AI, as traditional gender roles could affect the willingness of female farmers to engage with new technologies. The marital status may also correlate with a greater responsibility towards family welfare, potentially motivating farmers to adopt AI to enhance productivity and ensure better livelihoods for their households.

The educational background of the respondents reveals that a considerable percentage (49.3%) had no formal education, while others had primary (27.9%), secondary (22.1%), or tertiary education (0.7%). This limited educational attainment reflects a potential barrier to understanding and utilizing AI technologies effectively. Previous studies, such as that by Shanku (2020), have shown that higher educational levels positively influence the extent of AI usage among farmers. Therefore, the low educational levels in this study could correlate with a lack of familiarity and comfort with AI, limiting the farmers' positive attitudes towards its adoption.

Regarding household composition, the results indicate that 35% of households have five or fewer members, and 38.6% have between six and ten members. This demographic structure may impact the labour availability for adopting AI technologies. Smaller households might have fewer hands to assist in implementing and managing new technologies, possibly leading to hesitance in adopting AI. Conversely, larger households may have more resources and support for integrating advanced technologies, potentially fostering a more favourable attitude towards AI.

Economic activities of the respondents

Table 2 reveals that a significant proportion of the respondents (32.9%) rely solely on cattle herding as their primary source of livelihood. On average, the cattle herders in the study area had 11.6 years of experience, indicating a considerable level of expertise in this field. The most commonly reared cattle breeds were White Fulani (50%), and Adamawa Gudali

(25%). The results also found that cattle herding was mainly driven by economic gain (50%) or as a supplementary enterprise (50%), and it was observed that respondents typically started with 2 cattle (50%). Over 11 years, the average number of cattle owned by the herders reached 103 and the average monthly income reported was ₦78,742.8. These findings provide valuable insights into the livelihoods and practices of cattle herders in the study area, which can contribute to a better understanding of the dynamics within the industry.

Cattle Farmers' attitude towards artificial insemination technology

Table 3 displays the result of the attitudinal statement on AI technology. The high percentage of respondents who strongly agreed that AI is easy to implement (56.4%) and that they know AI utilization (52.9%) suggests that cattle farmers perceive AI as a user-friendly technology. This finding is consistent with a study by Caffaro *et al.* (2003), which found that the ease of use of a technology is a significant predictor of its adoption. Therefore, the perceived ease of implementation and knowledge utilization of AI technology can be a driving force for its adoption among cattle farmers.

The significant percentage of respondents who strongly agreed that AI is a low-cost technology (50.7%) and that it is relatively culture-compatible (47.9%) implies that AI technology is perceived as an affordable and culturally acceptable technology. This finding is supported by a study by Bialas *et al.* (2023) which found that the cost-effectiveness of a technology and its cultural compatibility are significant factors influencing its adoption. Therefore, the perceived cost-effectiveness and cultural compatibility of AI can enhance its adoption and utilization among cattle farmers.

The significant percentage of respondents who agreed that AI technology provides high motivation for future herd quality (38.6%) and that AI improves the meat quality potential of beef cattle (34.2%) suggests that AI is perceived as a technology that can improve the quality of cattle herds and meat production. This finding is consistent with a study by Mottaleb (2018), which found that the perceived benefits

Table 2: Economic activities of the respondents (n=140)

Variables	Frequency	Percentage	Mean	Standard dev.
Main occupation				
Civil Servant/NGO	16	11.4		
Cattle herding	46	32.9		
Petty business	34	24.3		
Craftsman	2	1.4		
Crop farming	19	13.6		
Fishing	10	7.1		
Casual labour	13	9.3		
Years of experience in keeping cattle				
≤ 5	25	17.9		
6 – 10	60	42.9		
11 – 15	10	7.1	11.57	7.24
Above 15	45	32.1		
Breed of cattle reared				
White Fulani	70	50		
Sokoto Gudali	25	17.9		
Adamawa Gudali	35	25		
Red Bororo	2	1.4		
Exotic	8	5.7		
Purposes of keeping cattle				
Main economic enterprise	70	50		
Supplementary enterprise	70	50		
Home consumption	0	0		
Sources of cattle				
Local market	105	75		
Relative	35	25		
The number of cattle started with				
2	70	50		
3	35	25		
6	35	25		
Number of cattle				
1 – 50	35	25		
51 – 100	45	32.1	103.1	64.12
101 – 150	29	20.7		
Above 150	31	22.1		
Monthly income from cattle rearing				
≤ 500,000	34	24.3		
500,001 – 1,000,000	72	51.4	78,742.8	58059.92
Above 1,000,000	34	24.3		

Source: Field Survey, 2023

of technology, such as improved quality and productivity, can enhance its adoption. Therefore, the perceived motivation and meat quality potential of AI can be a driving force for its adoption among cattle farmers. genetic potential of their animals. Similarly, a study by Akinsola *et al.* (2020) in Nigeria reported that the majority of farmers (73.3%) had a positive attitude towards AI technology, with the main reason for adoption being to

Table 3: Cattle farmers’ attitude towards artificial insemination technology (n=140)

Variables	SA	A	U	D	SD	Mean
	F (%)	F (%)	F (%)	F (%)	F (%)	F (%)
Cattle farmers use AI because the service is readily available	63(45)	49(35)	5(3.6)	4(2.9)	19(13.6)	3.95
Cattle farmers know AI utilization	74(52.9)	56(40)	0	9(6.4)	1(0.7)	4.37
Cattle farmers use AI because it is a low-cost technology	71(50.7)	55(39.3)	2(1.4)	9(6.4)	3(2.1)	4.30
Cattle farmers use AI because it is easy to implement	79(56.4)	50(35.7)	1(0.7)	9(6.4)	1(0.7)	4.40
Cattle farmers use AI regardless of herd size	58(41.4)	32(22.9)	14(10)	12(8.6)	24(17.1)	3.62
AI improves the meat quality potential of beef cattle	36(25.7)	48(34.2)	12(8.6)	12(8.6)	32(22.9)	3.31
The market value of AI offspring is higher	32(22.9)	50(35.7)	17(12.1)	9(6.4)	32(22.9)	3.29
AI provides high motivation for future herd quality	68(48.6)	54(38.6)	5(3.6)	4(2.9)	9(6.4)	4.20
AI is relatively culture-compatible and women are involved	21(15)	67(47.9)	10(7.1)	11(7.9)	31(22.1)	3.25
AI can be used in any type of herd	73(52.1)	56(40)	3(2.1)	7(5)	1(0.7)	4.37

Where: F - Frequency; % - Percentage; SA – Strongly Agree; A – Agree; U – Undecided; D – Disagree; SD – Strongly Disagree

Source: Field Survey, 2023.

Categories of cattle farmers’ attitude towards AI

Figure 1 categorizes respondents based on their attitudes towards AI technology. The results show that 20% of the respondents had an unfavourable attitude, 12.9% had a neutral attitude, and 67.1% had a favourable attitude. This indicates that a majority of cattle herders in the study area hold a positive view towards the use of AI technology.

The findings suggest that implementing extension programs focused on disseminating improved practices related to AI technology would be well-received by the cattle herders. This aligns with a previous study conducted by Sahin *et al.* (2021) which also found a majority of farmers with a positive attitude towards AI, with the main motivation being to improve the

enhance the quality of their herd. Additionally, the study found that cattle farmers who knew AI technology exhibited a more positive attitude towards it compared to those who did not. These findings highlight the importance of addressing attitudes and providing knowledge about AI technology to promote its adoption and improve herd quality in the cattle herding community.

Knowledge and awareness of artificial insemination technology

The findings in Table 4 indicate that among the cattle farmers in the study area, 51.4% were not aware of AI technology. This implies that the level of awareness of AI technology is below average, with the majority (64.3%) still using natural flock mating. Of those who understand AI technology, 32.9% agreed that it is important

Table 4: Knowledge and awareness of cattle farmers on artificial insemination technology (n=140)

Knowledge areas	Frequency	Percentage
Are you aware of AI technology?		
Yes	68	48.6
No	72	51.4
Understanding about AI		
Collecting semen and inserting it into a female cow's reproductive ovary	63	40.7
Don't know	77	59.3
Importance of Artificial insemination		
To improve cattle breed and weight gain, increase yield (milk and meat)	46	32.9
To improve herd performance	16	11.4
To cross-breed animals	34	24.3
To prevent the spread of disease	31	22.1
Advantages of Artificial insemination		
To increase cattle production	17	12.1
To get a better breed	21	15
To improve the animal breed	25	17.9
For high growth of cattle	4	2.9
Animals with more meat	8	5.7
Limitations of Artificial insemination:		
It takes a long time	25	17.9
Lack of fund	47	33.6
High cost/capital intensive/expensive	10	32.1
Inadequate technical know-how	45	32.1
Sign of estrous in cattle herds		
Standing to mount each other	35	26
Anorexia	15	10.7
It will be restless	31	22.1
Off-feeding	27	19.3
Virginal swell up	19	13.6
The average age at first mating in a cattle herd	2.4 years	
The average age at first calving in the cattle herd	5.3 years	
Average weaning age in your cattle herd	1.2 years	
Average suitable time to cow inseminated after heat detection		
After few hours	60	42.9
Second day	16	11.4
When it rains/rainy season	51	36.4
Average suitable time to cow inseminated after heat parturition		
In the morning	77	55.0
During cool weather	50	35.7

Source: Field survey, 2023

FARMERS' CATEGORIZATION BY ATTITUDINAL DISPOSITION TOWARDS AI

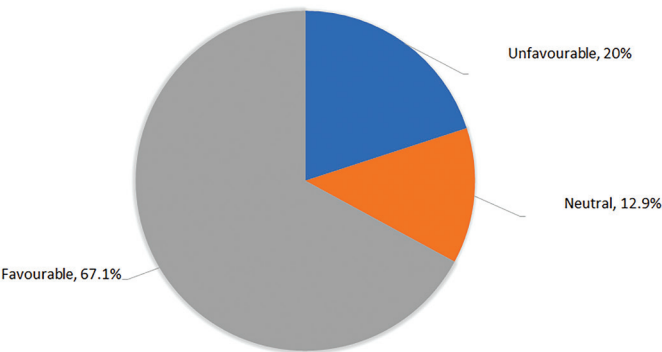


Figure 1: Cattle farmer's categorization on their attitudinal disposition towards AI

in improving cattle breed and weight gain and increasing yield (milk and meat), while 12.1% indicated that the advantage of AI technology was to improve cattle production. The study also identified limitations such as lack of funds (33.6%), high cost/capital intensity/expensiveness and inadequate technical know-how at 32.1% each.

Furthermore, the study found that the average age at first mating in cattle herds was 2.4 years, the average age at first calving was 5.3 years, and the average weaning age in cattle herds was 1.2 years. The suitable time for cow insemination after heat detection was mainly after a few hours (42.9%) and when raining (36.4%), while the suitable time for cow insemination after heat parturition was indicated to be in the morning (55.0%) and during cool weather (35.7%). These findings are consistent with a study by Augustine *et al.* (2019) who found

that farmers had a low level of formal education and varying levels of understanding about the benefits of AI technology.

Factors affecting AI technology

According to Figure 2, several factors (attitudinal and contextual) were found to influence AI technology among cattle herders in the study area. These factors include adequate access to veterinary extension officers (65.0%), membership in a group/cooperative union of cattle farmers (62.1%), and access to credit facilities (50.0%). Additionally, compatibility with culture/beliefs (25.0%) and encouragement by government leaders (17.9%) were mentioned, although to a lesser extent. This finding suggests that the availability of veterinary extension officers, membership in a cattle farmers' group or cooperative union, and access to credit facilities were perceived as the primary factors

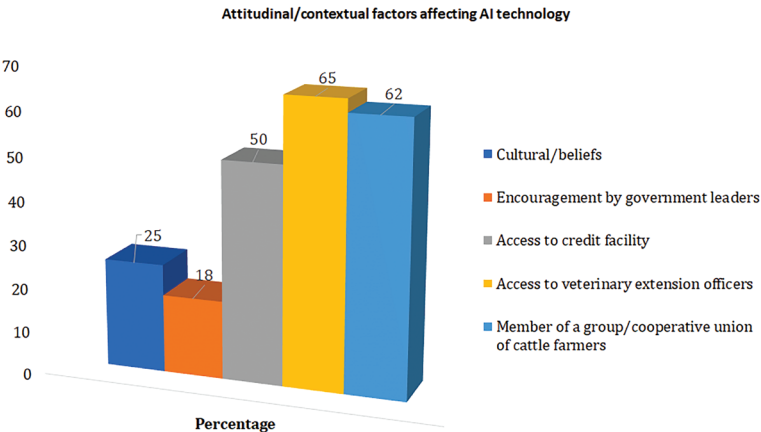


Figure 2: Attitudinal/contextual factors affecting AI technology

influencing AI technology among cattle herders in the study area. This finding aligns with a previous report by Abraha *et al.* (2020), which emphasized the significance of credit facilities and access to extension services in influencing the attitude toward AI technology among farmers in Ethiopia.

Relationship between selected socio-economic characteristics of cattle farmers and attitude towards AI technology

According to the results presented in Table 5, there is a positive and significant correlation between the years of education ($r = 0.35$; $p < 0.01$) and herd size ($r = 0.21$; $p < 0.05$) of the respondents and their attitude towards AI technology. This indicates that adequate education and the number of cattle owned are likely to support a positive attitude towards the adoption of AI in the study area. Hence, the null hypothesis is rejected for both the level of education and size of cattle.

aligns with previous research by Martinez-Garcia *et al.* (2015).

Conclusion and recommendations

The study found that the majority of cattle farmers in the study area are middle-aged, which is expected to support the adoption of AI technology as less older individuals are generally more receptive to innovations. The attitude of cattle farmers towards AI technology in Kwara State was found to be favourable. However, the level of knowledge and awareness about AI technology was below average. Increasing education levels and promoting awareness can positively influence the attitude towards AI technology. Adequate access to veterinary extension services, membership in a group/cooperative union of cattle farmers, and access to credit facilities were perceived as the primary attitudinal factors influencing cattle herders. Education and the herd size were also found to influence a positive attitude towards AI

Table 5: Pearson Product Moment Correlation analysis between selected socioeconomic characteristics of respondents and their attitude towards artificial insemination technology

Variables	Pearson coefficient (r)	Sig. (p)
Age (years)	-0.03	0.72
Years of education	0.35	0.00**
Household size (people)	-0.16	0.05
Years of experience in keeping cattle	0.06	0.49
Herd size	0.21	0.01**
Monthly income from cattle rearing	0.14	0.09

**Correlation is significant at 0.01 level.

The finding suggests that farmers with formal education may have a better understanding of the technical aspects and benefits of AI technology in cattle farming, while an increase in the number of cattle may lead to a favourable attitude towards AI technology. This result is consistent with previous studies that have reported a positive influence of education level on the attitude towards AI adoption (Martinez-Garcia *et al.*, 2015; Rathod *et al.*, 2017; Mushonga *et al.*, 2017; Ingabire *et al.*, 2018). Additionally, the study found that the level of herd size significantly influenced cattle farmers' attitudes towards AI adoption, which

technology adoption in the study area.

In light of the foregoing, the following are recommended:

1. The government and financial institutions should provide loans or credit facilities to assist cattle farmers, as the high capital requirement for cattle production can be a barrier. Access to capital will enable farmers to utilize modern technologies like AI, leading to improved herd performance.
2. The establishment of semen banks and other necessary infrastructure can attract and stimulate the interest of cattle farmers in adopting AI technology. This would reduce

- the cost of shipping semen per farmer and provide easier access to exotic semen.
3. Providing nomadic schools for Fulanis can help improve their educational level. Since cattle production is an inherited occupation for them, enhancing education can contribute to a better understanding and utilization of technologies like AI technology.
 4. Extension organizations should organize programs for both cattle farmers and AI technicians to enhance their knowledge and skills in AI technology. This would improve the effective adoption and use of AI technology among farmers and ensure proper implementation.
 5. Encouraging cattle farmers in the study area to form groups or unions can facilitate mutual assistance in accessing modern technologies like AI technology. Collaborative efforts can lead to shared resources, knowledge exchange, and overall improvement in the adoption and utilization of AI technology.
- Acknowledgement**
- The authors would like to acknowledge the support from the Tertiary Education Trust Fund (TETFUND) for providing financial resources for the study under the Institutional Based Research (IBR) fund window.
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