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Socio-economic determinants of farmers' utilisation of helpline call centres for extension service delivery in Northeastern Nigeria

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ABSTRACT: The study examined the utilisation of the Farmers' Helpline Call Centre (FHCC) for extension service delivery in North-eastern Nigeria. Specifically, the research described the socio-economic characteristics of FHCC users, analysed the levels of FHCC utilisation, and determined the relationship between socio-economic variables and levels of FHCC utilisation. The study also examined constraints to FHCC utilisation in the location. A multistage sampling technique was employed to select 300 respondents across Borno, Bauchi, and Yobe States. The first stage involved purposive selection of three (3) out of the six (6) States in north-east Nigeria. The selection was based on the high prevalence of registered members in the states. The second and third stages involved a random and proportionate selection of 10% FHCC users to obtain the sample size. There was a total of 3000 registered farmers from the sample frame obtained from Lake Chad Research Institute. Data were collected through structured questionnaires and analysed using descriptive and inferential statistics. Descriptive statistics such as frequencies, percentages, and means were used, while the inferential statistic used was multinomial regression. The results obtained revealed that the majority (70%) were male, with a mean age of 45 years. Half of the respondents (50%) had a household size of 5- 10, with a mean household size of 9 members per household. Farm output stood at 2817 kg, with a mean annual farm income of 1,496,667 naira. The majority (91.3%) had fewer than 5 farm visits by field extension agents. The multinomial regression results revealed that age, education, household size, farm income, farm output, years of experience, and extension contact significantly influenced FHCC utilisation. The results also revealed a strong relationship between farm output (β=0.7843, $p<0.01$) and type of farming practices (β=0.7304, $p<0.10$) in high-level utilisation, while sex and marital status were statistically insignificant. The findings demonstrate that FHCC can function as an effective ICT-enabled extension model capable of bridging gaps in traditional extension coverage. To enhance general utilisation, the study recommended that government policies be established to ensure that telecommunication companies provide stable and efficient network connectivity. FHCC services should incorporate women-based training to encourage more women farmers' utilisation. Additionally, there should be an active partnership between government agencies, telecommunications companies, FHCC and funding bodies to create effective policy interventions to subsidise FHCC services.

Keywords: Extension services, Farmers' Helpline Call Centre (FHCC), socio-economic.

INTRODUCTION

Agricultural extension services are vital for improving one of the lowest in Sub-Saharan Africa, hindering farmers' productivity and livelihoods by linking them to effective outreach (Ifeanyi-Obi, 2023). In order to narrow innovations, markets, and relevant knowledge. In Nigeria, the extension agent to farmer ratio, and create a wider the ratio of extension agents to farmers (1:7500) remains communication scope, a farmer participatory approach

strategy was adopted and intertwined with Information and Communication Technology (ICT), to create a contemporary method of Internet Extension (e-extension) Service delivery approach. The recognition of farmers' willingness to frequently use ICT services through mobile phones in accessing relevant agricultural information informed the creation of Farmers Helpline Call Centres (FHCC) (Pallavi *et al*., 2023). The centre's main function was to provide a comprehensive platform that enabled farmers to have contact with field agents and access new innovations through live communication lines. FHCCs emerged as an ICT-based response, providing toll-free platforms where farmers can directly access advisory support in their local languages in real time. Choruma *et al*. (2024) emphasised the significant role the e-extension approach plays in facilitating electronic delivery of skills and knowledge that promotes high crop yield, ensures sustainable farming practices, improves decision-making, and reduces production cost through precision and smart agricultural techniques.

FHCC structures consist of complex ICT infrastructure, combined with competent human resources to provide real-time solutions to farmers. Sustaining the efficiency of the helpline centres and building trust among farmer clients are important factor that determines the success of call centres over time. The presence of in-house specialists and professional consultants from different segments of agriculture remains a key factor in ensuring efficient delivery service. Additionally, the ability of FHCC extension agents (call operators) to speak the languages of different farmer groups consolidates client confidence and trust.

Despite the promise of FHCCs in addressing gaps in extension delivery, their sustainability depends on consistent farmer utilisation. While several studies have examined awareness and benefits of FHCCs (Anadozie *et al*., 2019; Ayim *et al*., 2022), there exists limited empirical evidence on how socio-economic characteristics influence FHCC usage. Understanding these dynamics is crucial for designing inclusive extension strategies that will reach remote farmer groups. For this reason, the broad objective of the study is to analyze the utilization of FHCC in the study area. The specific objectives are to;

1. describe the socio-economic characteristics of farmers using FHCC;
2. analyse the level of FHCC utilisation among the respondents;
3. determine the relationship between farmers' socioeconomic characteristics and level of FHCC utilisation; and,
4. examine constraints to FHCC utilisation.

METHODOLOGY

The study was carried out In the North-Eastern part of Nigeria, which is located between latitude 11°32' and 11°4' north and longitude 13°32' and 13°25' east. Northeast Nigeria comprises six states: Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe (United Nations, 2021). Based on the 2006 population census conducted by the National Population Commission, the population of Northeast Nigeria was 18,671,086, out of which Borno, Yobe, and Bauchi States recorded 4,171,104, 2,320,002, and 4,675,289, respectively (Ishaku *et al*, 2024). Using an annual growth rate of 3.8 per cent and projecting over 18 years to 2024, the population of Northeast Nigeria is estimated at 36,536,079. Within this, Borno State is projected at 8,162,127, Yobe State at 4,539,841, and Bauchi State at 9,148,730 (City Population, 2025).

The region is characterised by a hot Sahel and semi-arid climate, with annual rainfall starting from June to September within a range of 500 mm to 750 mm. The rest of the year is hot and dry. The major occupation of the people in these states is agriculture, with high production in crops ranging from maize, wheat, millet, beans, groundnuts and cotton. The region is also known for high vegetable and fruit production. Livestock such as cattle, sheep, goat also thrive well due to abundant grassland for pasture. The indigenes are also known for high fish farming activities (Dauda, 2020). Northeast Nigeria is characterised by generally high temperatures throughout the year. Mean annual temperatures in the region typically range between 28°C and 33°C, with Borno and Yobe recording higher averages compared to Bauchi State due to their more northerly Sahelian location. Average yearly temperatures have been reported at approximately 32.5°C in Borno, 31.3°C in Yobe, and about 29°C in Bauchi, indicating persistent thermal conditions across the study area in Nigeria [Meteorological Agency (NIMET, 2022)].

The hottest period occurs between March and May, when temperatures frequently exceed 40°C, while slightly lower temperatures are experienced during the rainy season as cloud cover increases. High temperature conditions in northeastern Nigeria have been associated with increased evapotranspiration, drought vulnerability, and land degradation risks, all of which influence agricultural productivity and farming decisions in the region (NIMET, 2022). These thermal characteristics significantly shape cropping patterns, soil moisture availability, and farmers' demand for timely agricultural advisory services such as the Farmers' Helpline Call Centre (FHCC), which supports climate-responsive farm management practices.

Sampling procedure and sample size

A two-stage sampling procedure was used to select respondents for the study. The first stage involved purposive selection of three (3) out of the six (6) States in Northeast Nigeria. The selection was based on the high prevalence of registered members present in the states (based on a reconnaissance survey, 2024). These states

Table 1. Sampling procedure and sample size

States	Total FHCC Users	Sample size selected
Yobe	1,400	140
Borno	900	90
Bauchi	700	70
Total	3,000	300

Source: Lake Chad Research Institute (2024).

were Bauchi, Borno, and Yobe. The second stage involved a proportionate and random selection of 10% FHCC users to obtain a total of three hundred (300) farmers based on the number of registered farmers from each state (Table 1). The sample frame for the study was the list of registered users of FHCC obtained from Lake Chad Research Institute.

Analytical techniques

Descriptive statistics such as frequencies, percentages and means were used to summarise objectives (i), (ii), and (iv). Multinomial regression analysis was employed to determine objective (iii), which is to determine the relationship between socio-economic factors and three categories of FHCC utilisation: low (<20 calls/farming season), medium (20–40), and high (>40), as provided in Table 3. The multinomial logistic regression model was used to examine the influence of farmers' socioeconomic characteristics on their level of FHCC utilisation (Low, Medium, and High). The Low utilisation group was set as the reference category. The model was statistically significant, with a pseudo-R^2 of 0.6373, which is considered strong (Hu *et al*, 2006). The likelihood ratio Chi^2 test, which is the primary indicator of the model, was statistically significant at Chi^2 (20) = 82.26, $p < 0.001$. Therefore, both indicators suggest that the model fits well and explains a meaningful portion of variation in FHCC utilization. The Multinomial regression model is given by the formula:

$$P(Y=j|X) = e\beta 0+\beta 1X1+...+\beta pXp1+\sum J-1k=1e\beta 0k+\beta 1kX1+...+\beta pkXp$$

Where: $P(Y=j|X)$ = The probability of the dependent variable Y belonging to category j, given the independent variable X ; Y = dependent variable (levels of utilization = L1, L2, L3); j = the baseline category (L1 = low taken as reference category); J = the total number of categories (L2 = medium, L3 = high); $\beta 0$j = intercept; $\beta 1$j = coefficients estimated for independent variables; k = possible outcomes; e = exponential function for log-odds; $X_1 \ldots, X_p$ = Independent variables; X_1 = Sex (1=male, 0=otherwise); X_2 = Age (Years); X_3 = Marital Status (1 = married, 0 = otherwise); X_4 = Educational level (years); X_5 = Household size (number of people per household); X_6 = Type of Farm Practice (1 = mixed farming, 0 = otherwise); X_7 = Farm output (kg); X_8 = Farming experience (years); X_9 = Farm income (naira); and X_{10} = Extension contact (Number of visits in one farming season).

The coefficients are estimated using the maximum likelihood method, and their exponential values were interpreted as relative risk ratios (RRR). These indicate how a one-unit change in each socio-economic variable affects the likelihood of being in a particular utilisation category relative to the base category.

RESULTS AND DISCUSSION

The distribution of respondents according to sex, age, marital status, educational level, household size, farming experience, net farm income, farm output, type of farming practice and extension contact is provided in Table 2. The socioeconomic characteristics of respondents revealed that 70% of the respondents were male, while 30% were female. Men dominate farming activities in many rural Nigerian communities, often making them more exposed to agricultural information services. However, women's lower representation could indicate gender-based digital inadequacy. Thus, indicating male farmers were more likely to use the FHCC due to more access to phones and decision-making power. Sex is a significant sociodemographic determinant in the usage of agricultural information and communication technologies (ICTs), including Farmers Helpline Call Centres (FHCC). Male farmers are often the primary decision-makers in agricultural households, especially in patriarchal societies, where land ownership, access to resources, and contact with extension services are predominantly male dominated. This dominance often translates into a higher likelihood of male farmers seeking agricultural support services, including helplines. Male farmers, due to their perceived control over production decisions and resource allocation, may feel more empowered to utilize support services from FHCC. Additionally, men are generally more mobile and have better access to mobile phones and airtime, which are prerequisites for engaging with helpline services. This finding agrees with the reports from a study by Patil *et al*. (2024), which showed that the sex of farmers plays a key role in access to agricultural information. The results in Table 2 showed that most of the respondents

Table 2. Socioeconomic characteristics of the respondents (n=300).

Variables	Frequency	Percentage (%)	u
Sex			
Male	210	70	
Female	90	30	
Age (years)			
20-29	28	9	
30-39	57	19	45
40-49	130	43.3	
>50	85	28.3	
Marital Status			
Single	08	2.67	
Married	252	84	
Divorced	13	4.33	
Widowed	27	9	
Educational level			
No formal Education	13	4.33	
Primary	61	20	
Secondary	65	55	
Tertiary	61	20	
Household Size			
<5	42	14	
5-10	152	50	9
>10	107	35	
Farming methods			
Crop farming	245	81	
Fishery	22	7	
Mixed farming	275	91	
Years of Farming Experience			
<5	32	10	
5-10	180	60	8
>10	88	29.33	
Farm output (per farming season)			
<1000kg	50	16	
1000kg-3000kg	90	30	2817
>3000kg	160	53	
Farm Income (₦)			
<500,000	51	17	
500,00-2,000,0000	149	50	1,496,667
>2,000,000	100	33.3	
Extension Contact (no. of farm visits/year)			
<5	274	91.3	
5-10	22	7	3
>10	04	1.33	

Source: Field Survey, 2025.

(43.3%) were between the ages of 40-49, with a mean age of 45years, suggesting an active and mature age group capable of independent decision-making. This is supported by reports from Osei-Kofi *et al*. (2023), who revealed that the majority of their respondents were between the ages of 41 and 50 years. Generally, middle-aged farmers have been shown to be more open to adopting new innovations and online packages, unlike older farmers who are more averse to risk.

As shown in Table 2, the majority (84%) of the respondents were married, suggesting that married farmers were more likely to seek support for improving farm productivity. Married farmers often have larger households and more farm responsibilities, increasing their need for reliable information. Marital status significantly influences the behaviour, access to resources, and decision-making autonomy of farmers, especially in rural agrarian communities. Married farmers often manage larger and more complex households that demand higher agricultural productivity to meet food and financial needs. This finding is supported by Ajie and Uche (2025) study on e-market usage in Nasarawa State, where married farmers used ICT and internet services more for making timely farm decisions.

Results in Table 2 showed that 36.15% of the respondents had a tertiary education, while 32.82% had a secondary education. This indicates a high literacy rate that could aid in understanding agricultural messages among the respondents. Education has been shown to enhance farmers' capacity to seek, interpret, and apply advice received through FHCC. This is supported by the findings of a study by Umeh and Igwe (2019) in Ebonyi State, which showed that most of their respondents had secondary school education, which facilitated access to FHCC services. Additionally, Sati *et al* (2025) study on ICT utilisation by rice farmers in Nasarawa state found that higher educational levels significantly predicted increased usage of agricultural FHCC among farmers in northern Nigeria.

Distribution of the respondents according to household size in Table 2 shows that 50% had 5-10 members per household, while a sizeable number (35%) had over 10 members per household. Large households have been shown to have access to more labour, which can be coordinated better with FHCC support. Such households additionally have more need for increased productivity and technical information, further endorsing the usage of FHCC. This finding aligns with a study by Onyemauwa *et al*. (2023), who reported a comparable average household size of 6-10 in Cross River, Nigeria. Their report indicated reliance on family labour in rural farming communities and frequent use of ICT to seek relevant form information.

The study examined types of farming (crop-only, livestock-only, or mixed) shown in Table 2. The majority (91%) of the respondents were into mixed farming practices. Mixed farmers often show higher demand for FHCC in order to access diverse information to successfully manage both crop production and livestock management. The complexity of farm operations increases farmers' reliance on remote advisory support. This is supported in Touch *et al*. (2024) study, which elucidates that risk management was a crucial driver of technology usage among smallholders, particularly when farmers engage in mixed farming practices.

Years of farming experience affect how farmers perceive the value of new technologies like FHCCs. The majority (60%) of the farmers had 5-10 years of farming experience, suggesting that farmers were knowledgeable, yet enthusiastic about trying new information channels. Given the years of experience, farmers have enough exposure to recognise the importance of real-time advisory services at impeding complex farm problems to minimise loss. Technology-aided solutions to contemporary issues such as pest outbreaks, input selection and climate variability often motivate seeking FHCC services. This is supported by Olatinwo *et al*. (2024) study, where it was reported that farmers with 5–10 years of experience in Anambra State were more likely to subscribe to mobile advisory services.

Most of the respondents (53%) shown in Table 2 had farm yields of over 3000 kg per season, while 30% of the respondents produced between 1000 and 3000 kg. Farm output refers to the total quantity of produce harvested within the farming season. It indicates the scale of operation, the farmer's investment level, and the technical information required for sustained productivity. High output farmers are more likely to utilise FHCC due to the high risks and complexities involved in managing large-scale farms. The respondents relied on real-time advice to make informed decisions. This is supported by reports from Ijigbade *et al*. (2021), where farmers with high output in Ogun State were more inclined to use mobile advisory services to safeguard their larger investments.

Results in Table 2 revealed that half (50%) of the respondents realised a net farm income of ₦500,000-₦2,000,000, while 33% of the respondents obtained a higher income of over ₦2,000,000 annually, revealing a high tendency to utilise FHCC services due to financial capability. Access to high income also affords farmers the privilege of subscribing and paying for modern, innovative information compared to low-income farmers. This finding is in line with the study of Shemfe and Modirwa (2026), who reported that high-income farmers were twice as likely to use FHCC compared to low-income farmers.

Based on the results displayed in Table 2, almost all the respondents (91.3%) had fewer than 5 contacts with field agents per farming season. The average number of farm visits in a year was 3, meaning the farmers had three farm visits by extension agents on their farm. Access to agricultural extension agents often exposes farmers to the benefits of formal advisory systems like FHCC and how to ask the right questions and follow through on recommendations. Extension contacts build trust in formal agricultural information channels. For instance, farmers

Table 3. Call Distribution for one year (n=300).

Number of calls/years	Frequency	Percentage
1-10	46	15.3
11-19	41	13.7
20-30	52	17.3
31-40	47	15.7
>40	114	38

Source: Field Survey, 2025.

who received field visits or participated in workshops often show more likelihood of utilising FHCC for continued guidance. This is supported by findings from Edward *et al*, (2025) study on experience and information-seeking behaviour among rural farmers in Nigeria, where farmers with at least one contact with agricultural extension agents were 3 times more likely to use FHCC.

Utilisation based on the number of calls

The general utilisation pattern of call volume distribution among the 300 respondents in Table 3 shows varied patterns of mobile phone engagement. In the lower usage bands, 46 respondents (15.3%) made 1–10 calls and 41 respondents (13.7%) made 11–19 calls per farming season, accounting for 87 individuals (29%) in the low-frequency category. By contrast, moderate users of 52 respondents (17.3%) in the 20–30 call band and 47 respondents (15.7%) in the 31–40 call band account for 99 individuals (33%), showing increased frequency and potentially broader communication purposes connected to the call centre. The largest segment (114 respondents; 38%) made more than 40 calls, indicating highly frequent usage and deep integration of FHCC service usage into their farming activities.

These findings align with existing studies that conceptualise mobile phone engagement as a continuum, ranging from casual, occasional use to habitual, intensive interaction (Luo *et al*, 2023). Prior research suggests that individuals with higher communication demands, whether social, educational, or professional, tend to exhibit greater phone use frequency (Gupta *et al*, 2020).

The type of mobile phone services used varied significantly across frequency levels. While traditional voice calling remains central across all FHCC users, high-frequency users (>40 calls) extensively employ messaging and call services on a broader level to boost farm production. These high-frequency calls could be indicative of farmer satisfaction derived from feedback received from the call centre.

Research on smartphone utilisation supports this trend, reporting that modern users engage with an array of services including voice calls, instant messaging, social networking, and internet browsing (Mucoki *et al*., 2022). Moderate users often combine traditional calls with digital communication tools, while low-frequency users tend to rely more heavily on basic call or SMS features, possibly due to limited data access (Nyaplue-Daywhea *et al*., 2021). These patterns underscore how the intensity of use influences the diversity of mobile services adopted.

Levels of utilisation based on calls

The classification of respondents into low (1–19 calls), moderate (20–40 calls), and high (>40 calls) usage categories provides an analytical foundation for understanding patterns of technology utilisation beyond mere frequency counts. By transforming raw call distributions into behavioural usage levels. The study moves from descriptive statistics toward interpretation of user engagement intensity, which is central to assessing sustained utilisation of mobile phone services. Findings show that 38% of farmers were high-level users (>40 calls), 33% were medium-level (20–40 calls), and 29% were low-level users (<20 calls) (Table 4). This trend indicates steady adoption but also highlights barriers among low-level users.

Regression analysis of socio-economic determinants

This segment provides multinomial regression results revealing the relationship between ten socioeconomic characteristics of the respondents and levels of FHCC utilisation.

Age

Table 5 shows a positive correlation between the age of respondents and utilisation ($\beta=0.8319$, $p<0.01$), with log odds of 831 times, at mid-level compared to the reference (low-level) category. This suggests that for every one unit increase in age, the odds ratio of farmers participating in the mid-level category compared to the reference category increases by 2.297 times. Farmers (40–49 years) were most likely to engage consistently in moderate use of FHCC to obtain agricultural information. However, the findings suggest that there was more likelihood of a decline in utilisation as age progresses. This result is supported by Babuga *et al*. (2020) and Sood *et al*. (2023) studies, where

Table 4. Level of utilisation based on calls (n=300).

Call frequency 2021 farming season	Yobe (n=140)	Borno (n=90)	Bauchi (n=70)	F	%
<20 (Low-level)	18	30	40	88	29
20-40 (Mid-level)	42	45	11	98	33
>40 (High-level)	80	15	19	114	38

Source: Field Survey, 2025.

Table 5. Relationship between socioeconomic variables and levels of utilisation.

Utilization levels	Variables	Coefficient	Std. Err	Z
Low (1-19)	(Base outcome)			
	Age	0.8319	0.1852	7.9***
	Sex	-0.8413	0.8252	-1.0
	Marital status	0.7804	0.0630	4.3***
	Household size	0.1978	0.0663	3.0***
	Net-farm income	0.7793	0.0887	8.8***
Medium (20-40)	Educational level	0.2094	0.0305	6.9***
	Years of Farming exp.	0.2133	0.0270	7.9***
	Farm output	0.4214	0.0454	9.38***
	Type of Farming	0.5708	0.2620	2.2**
	Extension Contact	0.6264	0.1878	3.3***
	_cons	29.3578	3.49418	8.4***
	Age	0.3282	0.0984	3.3***
	Sex	-0.5088	1.0485	-0.5
	Marital status	0.0638	0.9025	0.1
	Household size	0.5011	0.2000	2.5**
	Net-farm income	0.3516	0.1171	3.0***
High (>40)	Educational level	0.9517	0.4082	2.3**
	Years of Farming exp.	0.1179	0.0506	2.3**
	Farm output	0.7843	0.1200	6.5***
	Type of Farming	0.7304	0.3803	1.9**
	Extension Contact	0.0112	0.0029	3.9***
	__cons	1.7865	0.8932	2.0**

, *, Significant at 5% and 1% respectively (Source: Field Survey, 2025).

it was revealed that farmers within the mid-age group tend to utilise FHCC services due to increased financial obligations compared to much older farmers.

Marital status

The potential chance of married farmers utilising FHCC at the middle level compared to the baseline/reference category was shown to be statistically significant (β=.27040, p<0.01) as shown in Table 5. This means that married farmers were more likely to engage in moderate utilisation of FHCC services, with an odds ratio of 2.18 times the likelihood compared to the reference low-level group. The coefficient for high-level usage was statistically insignificant, indicating that the positive correlation at mid-level usage could have stemmed from the need to balance family and farming obligations. This often requires seeking more information and assistance from FHCC to boost farm output. Marital status may influence farmers' decisions to use FHCC at mid-level, potentially due to household or family responsibilities and farm-related challenges. This aligns with Ragasa and Mazunda (2018) study, where marital status correlates positively with access to ICT usage. At high-level usage, marital status becomes less prominent, probably due to other factors, such as farming experience, education, or farm size, overriding the influence of marital status (Table 5).

Table 6. Constraints to utilisation of Farmers' Helpline Call Centre (n = 300).

Constraints	Frequency (f)	Percentage (%)	Significance
Poor network connectivity	210*	70	Significant
High call tariff	200	67	Significant
Delayed feedback	195	65	Significant
Lack of farm visit	185	62	Significant
Lack of innovative ideas	180	60	Significant
Language barrier	170	57	Significant
Unclear Automated voice message	165	55	Insignificant
Complex information	140	47	Insignificant
Information not applicable	130	43	Insignificant
Information not relevant	120	40	Insignificant
Weighted % mean		56.6	

*Multiple Response Exist (Source: Field Survey, 2025).

Household size

The results revealed in Table 5 show a notable usage pattern at both mid and high levels of usage, compared to the reference category (low-level), with log-odds of 0.1978 and an odds ratio of 1.218. This suggests that large family size may facilitate utilisation of e-centres and FHCC to search for innovative or revamped farming information to boost farm production. This finding is supported by results obtained from Bashir *et al*. (2021) study, where a larger family size motivated search for innovative knowledge to attain higher income. Over time, other dynamics such as access to other forms of social networks within larger households or limited resources stretched among large households may be responsible for subsequent decline. A similar pattern of decline in usage for a one-member increase in household size was seen in Mutuku *et al*. (2026). The presence of communication devices owned by different family members served as an alternate means of accessing information other than FHCC. Large household size often increases the likelihood of utilisation, though the effects may diminish at higher utilisation points.

Net farm income

The relationship between farm income and utilisation was positive and significant (β=0.7793, $p<0.01$ at mid-level), suggesting a more efficient usage trend at mid-level compared to the reference category. Log-odds were 0.7793, with an odds ratio of 2.1799, indicating that a unit increase in net farm income increases the likelihood of farmers engaging in mid-level utilisation compared to the baseline group. FHCC provide real-time advisory support on weather, input use, pest/disease control, and market prices. Accessing this type of information improves farm efficiency, decision-making, and output, which directly boosts net income. Farmers who use FHCC gain timely agronomic advice, reducing crop failure and increasing yields. Additionally, FHCC provide guides on optimal fertiliser, seed, and pesticide usage, cutting unnecessary expenses. The positive coefficient at both middle and high usage levels suggests that any meaningful engagement with FHCC contributes to higher net farm income. This finding aligns with Quandt *et al*, (2020) study on phone use among smallholder farmers in Tanzania, where farmers who used FHCC services had moderately higher net farm income than nonusers.

Education

The results from Table 5 revealed that education had a positive relationship with the level of utilisation at mid-level (β=0.2094, $p<0.01$), with an odds ratio of 1.23 times the probability of educated farmers utilizing FHCC at mid-level compared to the reference category. Education often exposes farmers to awareness campaigns, training, and extension programs. It also enhances farmers' capacity to understand and apply information to their farming practices. Hence, awareness and understanding of educated farmers may promote utilisation of FHCC services among farmers. This finding is supported by Bindawa (2024) study, which assessed ICT adoption among maize farmers in Katsina State, and also in Olaitan *et al*. (2024) study among women farmers in the northeast. It is also supported by Ghosh *et al*. (2022) study in Bangladesh, where education also influences farmers' analytical skills, enabling them to apply FHCC advice more effectively.

Years of farming experience

Years of farming experience were found to be statistically significant across both levels of utilisation, suggesting that for every single year increase in experience, there will be a higher recorded usage of FHCC, especially at mid-level

compared against the reference category. The usage pattern appeared to be more significant at mid-level (β=.2133, p<0.01) (Table 5). Farmers with more years in farm practice are often more aware of FHCC and more confident in asking for help. With time, they accumulate trust in institutional support systems and are strongly motivated to try modern tools. Overall, more years of experience appear to motivate the use of FHCC regularly to sustain or increase productivity. More experience usually enhances the likelihood of moderate use, though at very high levels, some experienced farmers may seek alternative advisory sources. This finding is supported by Edward *et al* (2025), who recount that experience often exposes farmers to more agricultural challenges; hence, they tend to value external expert advice.

Farm output

The results in Table 5 showed a positive correlation to output obtained per farming season at both mid and high levels of usage (β=0.4214, β=0.7843, p<0.01, respectively). This indicates a probable likelihood of farmers with large farm output engaging in high-level usage of FHCC compared to low-level utilisation. The regression results indicate a positive correlation at mid-level usage that progressively picks up when farmers experience more output. High-level utilisation of FHCC is observed to form a trend among farmers who engage in integrated farming practices and among farmers with high production capacity. This result aligns with Key (2019) study in the United States, where farm productivity had a positive and significant effect on the utilisation of digital platforms for accessing input, technical skills and markets among farmers. Farmers with higher crop yields were more likely to utilise e-extension enabled solutions for input acquisition, leading to increased productivity and profitability.

Type of farming practice

Table 5 shows that FHCC usage based on farming type had a significant and positive association at high-level usage (β=0.7304, p<0.01). Mixed farming practices showed higher engagement, due to diverse and complex information needs. Mixed farming refers to a farmer being a crop farmer, livestock farmer, or engaged in an integrated farming practice. The relationship between farming practice and usage was significant at both mid-level and high-level usage. This suggests a high likelihood of mixed farming practice serving as motivation for high-level usage of FHCC by farmers compared to the reference low-level category. The type of farming activity tends to push farmers to seek FHCC services for proper farm management techniques. Additionally, integrated farming may require more technical knowledge with regard to resource management on both crop and livestock farms; hence the desire to succeed at both often facilitates FHCC usage. This result concurs with findings from Aliyu and Usman (2021), who found that mixed farming households used FHCC more frequently than crop-only farmers in Kaduna and Borno States due to diverse information needs.

Extension contacts

Extension farm visits had a positive and significant relationship at mid-level (β=0.626, p<0.01), indicating that traditional extension reinforced FHCC adoption (Table 5). The results suggest a high likelihood of farmers with previous extension contacts utilising FHCC at mid-level compared to the reference category. A unit increase in contact with field agents will promote 626 times utilization of FHCC at the mid-level. This result reaffirms that the classical extension service system abridges communication gap while promoting the role and benefits of FHCC. This finding is supported by the results obtained from the UNCDF (2021) study, where contact with field agents facilitated the desire to seek additional assistance and support from FHCC. The positive association revealed in Table 5 clearly reveals a huge decline in the relationship between usage and extension contact (β-0.0112, p<0.01). This suggests that although extension contact may facilitate FHCC usage at an initial stage, farmers were more likely to experience dissatisfaction and may desire face-to-face meetings with agents in some peculiar instances.

Constraints to FHCC utilization

Constraints to the utilisation of FHCC are presented in Table 6. The breakdown identified important constraints hindering farmers' effective use of FHCC according to whether they were significant or less significant. A weighted percentage mean of 56.6% was used as a threshold for the measurement of significance. The constraints were poor network connectivity (70%), high call tariff (67%), delayed feedback (65%), lack of farm visits (62%), and inadequate innovative ideas (60%) as the most significant constraints affecting the effectiveness and utilisation of the Farmer Helpline Call Centre (FHCC). The prominence of these constraints was compared against a weighted percentage value of 56.6%; other constraints which fall below the weighted value were considered insignificant.

Poor network connectivity emerged as the most critical constraint, reflecting persistent infrastructural gaps within rural telecommunication systems. Effective operation of call-based advisory platforms depends largely on stable communication networks; however, rural agricultural communities in many developing countries continue to experience weak signal strength and inconsistent connectivity. Studies have shown that inadequate internet

and mobile network infrastructure significantly reduce farmers' ability to access digital extension services and discourage continuous usage (Bawuro *et al*, 2021). Similarly, recent empirical evidence indicates that lack of connectivity remains the leading barrier to agricultural ICT utilisation among smallholder farmers, limiting real-time interaction with extension providers and reducing service reliability (Manzoor *et al*., 2025). This suggests that technological innovation alone cannot guarantee service effectiveness without parallel investment in rural digital infrastructure.

High call tariffs were another major constraint reported by respondents, underscoring affordability limitations associated with ICT-enabled advisory services. Although digital extension platforms are designed to democratize access to agricultural information, recurring communication costs may disproportionately affect smallholder farmers who operate under limited financial capacity. Evidence from Sub-Saharan Africa shows that high costs of ICT services and mobile communication significantly restrict adoption and sustained engagement with digital agricultural platforms (Ayim *et al*., 2022). When communication expenses are perceived as burdensome, farmers tend to minimise interactions, thereby weakening the continuous advisory relationship required for improved farm decision-making.

Delayed feedback also ranked among the most significant constraints, highlighting operational inefficiencies within advisory response systems. Agriculture is highly time-sensitive, and delayed responses to farmers' inquiries may result in inappropriate agronomic decisions, pest escalation, or yield losses. Digital extension systems are expected to provide timely, demand-driven information; however, institutional bottlenecks such as inadequate staffing, poor coordination, or limited knowledge databases can slow response delivery. Research on e-extension services in West Africa emphasises that the timeliness of advisory support strongly influences farmers' trust, satisfaction, and willingness to continue using ICT based extension services (Ayisi-Nyarko *et al*., 2024). Consequently, delays in feedback may reduce confidence in the FHCC as a dependable source of agricultural information.

The lack of farm visits further indicates that FHCC services may not fully substitute traditional face-to-face extension interactions. While call centres enhance information dissemination efficiency, agricultural production remains context-specific and often requires physical observation for accurate diagnosis of farm problems. Literature consistently supports a hybrid extension approach combining digital communication with periodic field visits to enhance effectiveness and farmer confidence [Food and Agriculture Organisation (FAO, 2019)]. Farmers may therefore perceive advisory recommendations delivered solely through phone interactions as insufficient when practical demonstrations or on-site assessments are required.

Inadequate innovative ideas were also identified as a significant constraint, suggesting perceived limitations in the novelty or contextual relevance of advisory information provided through the FHCC. Farmers increasingly face complex challenges such as climate variability, emerging pests, and market uncertainties, which require adaptive and locally tailored solutions. Studies indicate that digital agricultural platforms achieve higher adoption when advisory content is innovative, localised, and responsive to farmers' evolving needs (Agritech Digest, 2026). Where information appears repetitive or generalised, farmers' perceived usefulness of the service declines, thereby affecting sustained utilisation.

This result is supported by the findings from Nwachukwu *et al*. (2022) study, where delayed feedback and inadequate follow-up by service providers of FHCC were the major constraints to utilisation. It also aligns with results obtained from FGD conducted in the study and that of Ayim *et al*. (2022) study, where network connection and delayed feedback were major constraints of FHCC usage in most African countries. In contrast, results from Olatinwo *et al*. (2024) study relate how information obtained from FHCC was irrelevant and inapplicable to farming situations in their study. These factors (irrelevant message 43%, applicability 40%) were shown to be less significant in the study area. Such constraints often underscore the potential sustainability of FHCC. When operational constraints are systematically addressed, the platforms can transition from moderate utilisation to high-intensity, sustained adoption (Mdoda *et al*., 2023).

Conclusion

The study revealed that farmers' socio-economic characteristics significantly shape FHCC utilization patterns in Northeastern Nigeria. Age, education, household size, income, farm output, type of farming practice and extension contact emerged as strong determinants. Conversely, sex and marital status were not significant predictors. Findings suggest that FHCC effectively bridges information gaps, especially in regions challenged by insecurity and limited extension outreach. The positive associations found in the regression model reinforce the role of tailored and accessible digital solutions in advancing sustainable agriculture growth within the region. This indicates that FHCC can potentially be utilized as an effective medium for agricultural extension service delivery, especially when network connectivity is improved, call tariff is reduced, delays in the feedback loop tackled, and follow-up strategies are incorporated into the services provided.

Recommendations

1. FHCC should tailor their communication methods and

support packages to reflect variations among farmers. Aligning service delivery with farmers' socioeconomic characteristics in terms of farm output and type of farming practices will improve relevance and encourage wider FHCC usage.
2. Partnership between FHCC, government agencies and telecommunication companies should be pursued to ensure efficient network service connectivity and prompt feedback loops.
3. Women's utilisation of FHCC should be encouraged by organising bi-annual ICT literacy training for rural women farmers through existing FHCC centres.
4. There should be adequate Government intervention to regulate and subsidise call tariffs for registered low-income farmers across the geopolitical regions.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

REFERENCES

Agritech Digest (2026). Tech Adoption Challenges for Rural Farmers in Sub-Saharan Africa. Retrieved from https://agritechdigest.com/tech-adoption-challenges-for-ruralfarmers-in-sub-saharan-africa/

Ajie, E. N., & Uche, C. (2025). Climate Smart Agriculture in Food Insecurity Mitigation in Nigeria: A Conceptual Evaluation. *Asian Journal of Agricultural Extension, Economics and Sociology, 43*(1), 63-71.

Anadozie, C., Fonkam, M., Cleron, J. P., & Kah, M. M. (2021). The impact of mobile phone use on farmers' livelihoods in post-insurgency Northeast Nigeria. *Information Development, 37*(1), 6-20.

Ayim, C., Kassahun, A., Addison, C., & Tekinerdogan, B. (2022). Adoption of ICT innovations in the agriculture sector in Africa: a review of the literature. *Agriculture and Food Security, 11*(1), 22.

Ayisi-Nyarko, D., Masambuka-Kanchewa, F., & Yakubu, B. N. (2024). Post-COVID-19 pandemic extension delivery: A systematic review of E-extension services prospects in Ghana. *Heliyon, 10*(4), e26058.

Babuga, U. S., Ali, A. M., & Garba, A. (2020). The Effect of Information and Communication Technology (ICT) utilisation among Small Scale Farmers in Bauchi Local Government Area, Bauchi State, Nigeria. *Direct Research Journal of Agriculture and Food Science, 8*(9), 332-339.

Bashir, M. B., Augustine, A. N., Faruk, A. U., Abubakar, J. A., Kyaru, M. T., & Peter, I. (2021). Rural farmers' readiness to access information from the national farmers helpline centre, national agriculture extension and research liaison services Abu Zaria, Kaduna State, Nigeria. *Journal of Agricultural Extension, 26*(1), 120-128.

Bawuro, M. B., Ndaghu, A. A., Umar, A. F., Abdulkadir, A. J., Tikwe, M. K., & Ishaya, P. (2021). Rural farmers' readiness to access information from the national farmers helpline centre, national agriculture extension and research liaison services Abu Zaria, Kaduna State, Nigeria. *Journal of Agricultural Extension*, *26*(1), 120-128.

Bindawa, A. S. (2024). Factors Influencing the usage of Agricultural information and communication technologies (ICT) among maize farmers in Malumfashi Local Government Area of Katsina State, Nigeria. *International Journal of Innovative Food, Nutrition and Sustainable Agriculture, 12*(2), 73-81.

Choruma, D. J., Dirwai, T. L., Mutenje, M. J., Mustafa, M., Chimonyo, V. G. P., Jacobs-Mata, I., & Mabhaudhi, T. (2024). Digitalisation in agriculture: A scoping review of technologies in practice, challenges, and opportunities for smallholder farmers in sub-Saharan Africa. *Journal of Agriculture and Food Research*, *18*, 101286.

City Population (2025). The population of the states of Nigeria according to census results and latest population projections. Retrieved 26/10/2025 from https://www.citypopulation.de.

Dauda, S. R. (2020). Conflict and development in the North-East, Nigeria: the case of Boko Haram insurgency. Retrieved from https://www.mondopoli.it/wp-content/uploads/2021/02/CONFLICTS-AND-DEVELOPMENT-IN-THE-NORTH-EAST- REGION-OF-NIGERIA.pdf.

Edward, H., Juliana, I. G., & Manzo, G. C. (2025). Information seeking behaviour of rural farmers in Hong Local Government Area of Adamawa State, Nigeria. *Samaru Journal of Information Studies*, *25*(1), 270-281.

FAO (2019). E-Agriculture in Action: Blockchain for Agriculture - Opportunities and Challenges. Retrieved from https://openknowledge.fao.org/items/4e845185-7953-44169abe-a77cd2ffcb0b.

Ghosh, M. K., Rafi, S. M., Mahmud, I. H., & Turin, M. Z. (2022). Assessment of the farmers' use of ICT tools in farming practices. *European Journal of Applied Sciences, 10*(3), 381-395

Gupta, A., Ponticelli, J., & Tesei, A. (2020). Information, technology adoption and productivity: the role of mobile phones in agriculture. *Working Paper Series - National Bureau of Economic Research* (Massachusetts), No. 27192, 53p.

Hu, B., Shao, J., & Palta, M. (2006). PSEUDO-R 2 in Logistic Regression Model. *Statistica Sinica, 16*(3), 847-860.

Ifeanyi-Obi, C. C., & Corbon, B. L. (2023). Utilisation of digital tools in extension service delivery amongst extension agents in Akwa Ibom State, Nigeria. *Journal of Agricultural Extension, 27*(4), 67-76.

Ishaku, D., Umaru, E. T., Adebayo, A. A., Löwner, R., & Okhimamhe, A. A. (2024). Analysis of the observed trends in rainfall and temperature patterns in North-Eastern Nigeria. *Climate*, *12*(12), 219.

Key, N. (2020). Off-farm income, credit constraints, and farm investment. *Journal of Agricultural and Applied Economics, 52*(4), 642-663.

Luo, X., Zhu, S., & Song, Z. (2023). Quantifying the income-increasing effect of digital agriculture: Take the new agricultural tools of smartphone as an example. *International Journal of Environmental Research and Public Health*, *20*(4), 3127.

Manzoor, F., Wei, L., Siraj, M., Lu, X., & Qiyang, G. (2025). Digital agriculture technology adoption in low and middle-income countries—a review of contemporary literature. *Frontiers in Sustainable Food Systems, 9*, 1621851.

Mdoda, L., Christian, M., & Agbugba, I. (2024). Use of Information systems (Mobile phone app) for enhancing smallholder farmers' Productivity in Eastern Cape Province, South Africa: Implications on food security. *Journal of the Knowledge Economy, 15*(1), 1993-2009.

Mucoki, S. W., Nkurumwa, A. O., & Maina, S. W. (2022). Effectiveness of the Nakuru farmers' call centre in linking

farmers to agricultural extension stakeholders in Nakuru County, Kenya. *International Journal of Agricultural Extension, 10*(2), 491-498.

Mutuku, B., Akuffobea-Essilfie, M., Kansiime, M., Duah, S., Oppong-Mensah, B., Mibei, H., ... & Akiri, M. (2026). Understanding gender disparities in access to digital advisory services among women and men farmers in Ghana. *Frontiers in Sustainable Food Systems, 10*, 1614245.

NIMET (2022). Seasonal climate prediction (SCP). Abuja, Nigeria, 12-14. Retrieved from https://nimet.gov.ng/publication_detail?id=5.

Nwachukwu, C., Vu, H. M., Chládková, H., & Agboga, R. S. (2022). Psychological empowerment and employee engagement: role of job satisfaction and religiosity in Nigeria. *Industrial and Commercial Training, 54*(4), 666-687.

Nyaplue-Daywhea, C., Ahiakpa, J. K., Mensah, O. A., AnnorFrempong, F., & Adjei-Nsiah, S. (2022). Mobile phone-assisted agricultural extension services: User competency and usage frequency in eastern Ghana. *African Journal of Food, Agriculture, Nutrition and Development, 22*(10), 18886-18911.

Olaitan, M. A., Bamidele, J., Joel, O. J., Akor, B. A., & Joel, A. F. (2024). Utilisation of information and communication technologies (ICTs) among women farmers in North-Eastern Nigeria. *Direct Research Journal of Agriculture and Food Science, 12*(2), 253-262.

Olatinwo, L. K., Yusuf, O. J., & Wahab, M. J. (2024). Farmers' use of phone applications in accessing information for maize production in Kwara State, Nigeria. *Journal of Kerbala for Agricultural Sciences, 11*(4), 44-56.

Onyemauwa, N. C., Nwafor, S. C., Aroh, K., & Ugbem-Onah, C. (2023). Assessment of labour choice decisions among smallholder cassava farmers in Ikom LGA, Cross River State, Nigeria. *Nigeria Agricultural Journal, 54*(1), 467-473.

Osei-Kofi, P. S., Badu, E. E., Dadzie, P. S., & Bandanaa, J. (2023). Demographic characteristics of farmers and the effectiveness of disseminating information on agriculture in Ghana. *Ghana Journal of Agricultural Science, 58*(2), 98-114.

Pallavi, G., Santosh, D. T., & Ashoka, N. (2023). E-Extension for agriculture development: ICT tools, implementation, and impacts. In Recent advances in agricultural sciences and technology, (pp. 609-618), Dilpreet Publishing House, New Delhi.

Patil, M. S., Padalikar, H., & Hembade, S. (2023). Empowering farmers: assessing awareness and utilisation of Kisan Call Centre Services in Kadegaon Taluka of Maharashtra. *The Online Journal of Distance Education and e-Learning, 11*(2), 2160-2166.

Quandt, A., Salerno, J. D., Neff, J. C., Baird, T. D., Herrick, J. E., McCabe, J. T., Xu, E., & Hartter, J. (2020). Mobile phone use is associated with higher smallholder agricultural productivity in Tanzania, East Africa. *PloS one*, *15*(8), e0237337.

Ragasa, C., & Mazunda, J. (2018). The impact of agricultural extension services in the context of a heavily subsidised input system: The case of Malawi. *World Development, 105*, 25-47.

Raji, R. O., Salami, O. S., Aladejubelo, O. S., & Ishola, S. A. (2026). Digital agricultural extension systems, mobile communication adoption, and financial inclusion among smallholder farmers in Southwest Nigeria. *British Journal of Interdisciplinary Research*, *3*(12), 1-14.

Sati, Y. G., Zaki, A. B., & Idu, E. E. (2025). Assessment of utilisation of information and communication technologies (ICTs) by rice farmers in production in Nasarawa State, Nigeria. *Global Academic Journal of Agriculture and Biosciences, 7*(4), 64-72.

Shemfe, O., & Modirwa, S. (2026). Barriers to the adoption of Information and Communication Technology (ICT) for accessing agricultural information by small-scale farmers in Mahikeng, Northwest Province. *South African Journal of Agricultural Extension, 54*(1), 190-223.

Sood, A., Bhardwaj, A. K., & Sharma, R. K. (2023). Perception of facilitators towards adoption of AI-based solutions for agriculture. *Journal of Decision Systems*, 1-35, https://doi.org/10.1080/12460125.2023.2294398

Touch, V., Tan, D. K., Cook, B. R., Li Liu, D., Cross, R., Tran, T. A., Utomo, A., Yous, S., Grunbuhel, C., & Cowie, A. (2024). Smallholder farmers' challenges and opportunities: Implications for agricultural production, environment and food security. *Journal of Environmental Management, 370*, 122536.

Umeh, G. N., & Igwe, G. V. C. (2019). Adoption of sustainable agricultural practices among farmers in Ohaukwu Local Government Area of Ebonyi State, Nigeria. *Agricultural Extension Journal, 3*(4), 224-232.

United Nations Capital Development Fund (2021). Digital extension services improve farmer productivity: Using a farmer call centre and digital extension agents in delivering extension and agronomic services: A case study of Kilimo Farmers Call Centre in West Nile, Uganda. Swedish International Development Cooperation Agency (SIDA). Retrieved from https://www.uncdf.org/Download/AdminFileWithFilename?id=13739&cultureId=127&filename=250321farmer-call-centreugidepdf.