

Farmers' Interaction, Perception, and Accessibility to Public Agricultural Extension Services in Kaduna State, Nigeria

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Abstract

This study examined farmers' interaction, perception, and accessibility to Public Agricultural Extension Services (PAES) in Kaduna State, Nigeria. Specifically, the study assessed the extent of farmers' interaction with extension agents, examined their perceptions of extension service delivery, and evaluated their level of accessibility to these services. A multistage sampling technique was used to select 625 farmers, comprising 281 beneficiaries and 344 non-beneficiaries. Primary data were collected using a structured questionnaire and analyzed using descriptive statistics, an interaction index, and Likert scale techniques. The socio-economic results showed that beneficiaries were slightly male-dominated, had a mean age of 45.2 years, average household size of 8 persons, mean farming experience of 24 years, and larger farm size of 5.5 ha compared to non-beneficiaries. Beneficiaries also recorded substantially higher mean farm income (₦301,420) than non-beneficiaries (₦81,635), with higher participation in cooperatives and access to credit. The interaction results revealed that 52.0% of farmers had moderate interaction with extension agents, 29.5% had high interaction, while 18.5% had low interaction, indicating moderate engagement. Farmers' perceptions were generally positive, with a grand mean score of 3.78, reflecting effectiveness in timely information delivery, productivity improvement, and input linkage. However, gaps were identified in follow-up services, accessibility, inclusiveness, and ICT use. The study concludes that although PAES improves farmers' productivity and livelihoods, its effectiveness is constrained by moderate interaction levels, unequal access, and limited inclusiveness. Strengthening extension capacity, promoting gender-sensitive approaches, and expanding ICT-based advisory services are recommended to enhance performance.

Keywords: *Extension, Interaction, Perception, Accessibility, Farmers, Kaduna, Nigeria*

Introduction

Agricultural extension services are essential for improving farm productivity, facilitating technology adoption, and strengthening rural livelihoods in developing countries (Anderson & Feder, 2007; Swanson & Rajalahti, 2010). In Nigeria, where smallholder farmers dominate agricultural production (FAO, 2022), Public Agricultural Extension Services (PAES) remain a key mechanism for linking research innovations to farmers. Empirical evidence shows that effective extension delivery significantly enhances productivity, as demonstrated among maize farmers in northern Nigeria (Abdulwahab *et al.*, 2023; Ragasa *et al.*, 2019). Farmers' interaction with extension agents is central to the effectiveness of these services. Regular contact improves

knowledge transfer, adoption of improved technologies, and farm performance (Adebayo *et al.*, 2017; Agbamu, 2016). However, weak extension–farmer ratios and institutional constraints in Nigeria often limit meaningful interaction (Chekene & Shehu, 2025). In addition, farmers’ perceptions of extension services—particularly regarding relevance, quality, and timeliness—shape their willingness to engage and utilize advisory support (Chianu *et al.*, 2012).

Accessibility to extension services further determines their impact. Evidence indicates that socio-economic factors such as education, income, gender, and location significantly influence farmers’ ability to access extension support (Akinwale *et al.*, 2021; Adewuyi *et al.*, 2023; Okeke *et al.*, 2022). In Kaduna State, where agriculture is a major livelihood activity (Kaduna State Government, 2023; Addah, 2023), challenges such as infrastructural gaps, climate variability, and institutional limitations may further constrain access to extension services (Daikwo *et al.*, 2024; Lai-Solarin *et al.*, 2024). Despite the importance of PAES, there is limited empirical evidence integrating farmers’ interaction, perception, and accessibility within a single framework in Kaduna State. This study therefore assesses the extent of farmers’ interaction with extension agents, and examines their perceptions of extension service delivery in the study area.

Methodology

The study area

The study was conducted in Kaduna State, located in North-Western Nigeria, between latitudes 9°02′–11°32′ N and longitudes 6°15′–8°50′ E. The state shares boundaries with Kano, Katsina, Zamfara, Niger, Bauchi, and Plateau States, and is a key agricultural hub with diverse agro-ecological conditions (Kaduna State Government, 2023). Kaduna State had a population of 6,113,503 according to the 2006 National Population Census (NPC, 2006). Using an annual growth rate of about 3%, the population is projected to be approximately 11 million in 2025. The state comprises 23 Local Government Areas and established agricultural zones that support extension service delivery, making it suitable for examining farmers’ interaction, perception, and accessibility to public agricultural extension services. Agriculture is the dominant livelihood, with smallholder farmers engaged in the production of staple crops such as maize, sorghum, and millet, alongside livestock rearing (Aminu, 2021; FAO, 2022). The state experiences a tropical climate with distinct wet and dry seasons, and annual rainfall ranging from about 1,000 mm to 1,500 mm, which supports rain-fed agriculture but is subject to climate variability (Addah, 2023; Daikwo *et al.*, 2024).

Sampling procedure and sample size

A multistage sampling approach was adopted for the study. In the first stage, four Agricultural Development Programme (ADP) zones—Birnin-Gwari, Maigana, Lere, and Samaru-Kataf—were purposively selected due to their high level of agricultural activities and the presence of public extension services. In the second stage, two Local Government Areas (LGAs) were randomly chosen from each selected zone, resulting in a total of eight LGAs. The third stage involved the selection of 40 farming communities across the LGAs. In the final stage, individual farmers were randomly selected from sampling frames compiled with the assistance of extension agents and local farmer groups in each community.

The required sample size was determined using the Yamane (1967) formula:

The sample size was determined using Yamane’s (1967) formula:

$$n = \frac{N}{1 + N(e)^2} \dots \dots \dots (1)$$

Where: n = required sample size; N = total population of registered farmers = 682,869; e = level of precision (sampling error) = 0.04 (4%)

$$n = \frac{682,869}{1 + 682,869(0.04)^2} = \frac{682,869}{1,094} \approx 625$$

Accordingly, a total of 625 farmers were selected for the study. Of this number, 281 (45%) were beneficiaries of public agricultural extension services (PAES), while 344 (55%) were non-beneficiaries, allowing for meaningful comparison between the two groups.

Method of data collection

Primary data were collected for this study through the use of a structured questionnaire administered to the sampled farmers. The questionnaire was designed to capture information on farmers' socio-economic characteristics, level of interaction with extension agents, perceptions of extension service delivery, and accessibility to public agricultural extension services. The instrument was administered through face-to-face interviews with the assistance of trained enumerators to ensure clarity and improve response accuracy, especially among respondents with low literacy levels. Prior to the main survey, the questionnaire was pre-tested in a community outside the sampled areas to ensure validity and reliability, and necessary adjustments were made accordingly.

Analytical techniques

Descriptive statistics

Descriptive statistics such as frequencies, percentages, means, and standard deviations were employed to summarize the socio-economic and institutional characteristics of the respondents. These tools were also used to examine the extent of farmers' interaction with public agricultural extension agents, as well as their accessibility to extension services. To further assess the level of interaction, an Interaction Index was developed to categorize farmers into different interaction levels. The index was constructed by assigning scores to key interaction indicators such as extension visits, participation in training, and attendance at field days and aggregating them for each respondent as follows:

$$II_i = \sum_{j=1}^k X_{ij} \dots \dots \dots (2)$$

Where: II_i = interaction index for farmer i , X_{ij} = score assigned to interaction indicator j (e.g., visits, training, field days), k = number of interaction indicators. The index was used to classify farmers into low (0-3), moderate (4-7), and high (8-10) interaction categories.

Likert Scale Technique

The Likert scale technique was utilized to evaluate farmers' perceptions of the current status of public agricultural extension service delivery. Respondents were asked to rate a series of perception statements on a 5-point Likert scale ranging from strongly disagree to strongly agree. Mean scores for each statement were computed using the standard Likert formula:

$$\bar{X} = \frac{\sum(F \cdot X)}{N} \dots \dots \dots (3)$$

where $\bar{X}$ represents the mean score for an item, F is the frequency of responses in each category, X is the Likert scale value assigned to each response, and N is the total number of respondents. A cut-off means of 3.0 was adopted for interpretation, with scores equal to or greater than 3.0

indicating high interaction, high effectiveness of service delivery, or high accessibility, while scores below 3.0 indicated low interaction, low effectiveness, or low accessibility.

Results and discussion

Socio-economic and institutional characteristics crop farmers in the study area

Table 2 presents the socio-economic and institutional characteristics of farmers by access to Public Agricultural Extension Services (PAES). The results show some differences between beneficiaries and non-beneficiaries. Male farmers were slightly more represented among beneficiaries (49.11%), while females were more prominent among non-beneficiaries (57.85%), indicating gender disparities in access. This agrees with Doss *et al.* (2011), who reported that women often face structural constraints in agricultural systems, and Atsbeha and Gebre (2021), who found that socio-cultural barriers significantly limit women's access to extension services.

The mean age of beneficiaries (45.2 years) and non-beneficiaries (44.1 years) is similar, suggesting that age does not significantly influence access to extension services. This supports Adewuyi *et al.* (2023), who found that age mainly reflects active participation in farming rather than determining access to extension. Educational attainment is also comparable, with an average of 9 years of schooling, although beneficiaries had a slightly higher proportion with primary education (50.36%). This aligns with Adebayo *et al.* (2017), who reported that education enhances farmers' ability to understand and adopt extension recommendations. Household size averaged 8 persons for beneficiaries and 7 for non-beneficiaries, with larger households more common among non-beneficiaries (56.12%), indicating that household size does not necessarily improve access to institutional services. This is consistent with Adegeye and Dittoh (2006), who noted that household size alone does not guarantee improved access to productive resources or services. Beneficiaries had slightly higher farming experience (24 years) and farm size (5.5 ha) compared to non-beneficiaries (22 years and 5.1 ha), supporting Akinwale *et al.* (2021), who found that more experienced farmers with larger farm holdings are more likely to engage with extension services. A notable difference exists in farm income, with beneficiaries earning a higher average income (₦301,420) than non-beneficiaries (₦81,635), indicating the positive effect of extension access on productivity. This corroborates Ragasa *et al.* (2019), who found that access to extension services significantly improves technology adoption and farm productivity, leading to higher incomes. Furthermore, cooperative membership (51.02%) and access to credit (47.33%) were higher among beneficiaries, supporting Chianu *et al.* (2012), who found that farmers involved in social groups have better access to extension information, and Banful *et al.* (2010), who reported that access to financial resources enhances farmers' ability to utilize agricultural technologies and services.

Table 2: Socio-economic and institutional characteristics of farmers by access to public agricultural extension services (PAES)

Variable	Beneficiaries		Non-Beneficiaries	
	Freq.	%	Freq.	%
Gender				
Male	197	49.11	201	52.15
Female	84	42.15	143	57.85
Age (years)				
20–29	58	44.62	72	55.38
30–39	61	48.03	66	51.97
40–49	59	45.04	72	54.96

50–59	55	41.67	77	58.33
60–69	48	47.06	54	52.94
Mean ± SD		45.2 ± 13.8		44.1 ± 14.1
Education (years)				
No formal	18	41.86	25	58.14
Primary (1–6)	109	50.36	107	49.64
Secondary (7–12)	101	44.1	128	55.9
Tertiary (13–16)	53	43.09	70	56.91
Mean ± SD		9 ± 4.5		9 ± 4.7
Household size				
Small (1–4)	68	48.23	73	51.77
Medium (5–8)	123	46.24	143	53.76
Large (9–11)	90	43.88	115	56.12
Mean ± SD		8 ± 2.9		7 ± 2.6
Farming experience (years)				
1–10	52	41.94	72	58.06
11–20	63	42	87	58
21–30	78	52.35	71	47.65
31–40	88	45.36	106	54.64
Mean ± SD		24 ± 11.8		22 ± 12.2
Farm size (ha)				
<1	16	40	24	60
1–2.99	58	44.27	73	55.73
3–4.99	61	45.19	74	54.81
≥5	146	46.35	169	53.65
Mean ± SD		5.5 ± 2.8		5.1 ± 2.6
Marital Status				
Single	50	41.67	70	58.33
Married	205	45.96	241	54.04
Divorced	13	52	12	48
Widowed	13	43.33	17	56.67
Farm Income (₦)				
Low	5	10.42	43	89.58
Medium	146	36.87	250	63.13
High	130	89.66	15	10.34
Mean ± SD		301,420 ± 90,315		81,635 ± 120,442
Cooperative Membership				
Non-member	92	38.98	144	61.02
Member	189	51.02	200	48.98
Credit Access				
No credit	148	43.66	191	56.34
Accessed credit	133	47.33	148	52.67

Field survey, 2025

Extent of farmers' interaction with public agricultural extension agents

Table 3 presents the distribution of farmers based on key indicators of interaction with public agricultural extension agents, including frequency of extension visits and participation in training activities. The findings show that 43.1% of farmers received 3–5 extension visits, 34.2% received more than 5 visits, and 22.8% had only 1–2 visits, indicating generally moderate to high contact levels. Additionally, 69.0% of farmers participated in training, although only 12.1% attended five or more sessions, while 31.0% had no training, suggesting limited intensity of engagement. The interaction index further shows that 52.0% of farmers had moderate interaction, 29.5% high interaction, and 18.5% low interaction. These results support Abdulwahab *et al.* (2023), who found that frequent contact improves productivity, and Ragasa *et al.* (2019) who reported that sustained interaction enhances adoption. However, the dominance of moderate interaction indicates intermittent engagement, which may limit effectiveness, consistent with Anderson and Feder (2007). The presence of 18.5% low interaction also aligns with Nwaru *et al.* (2011) who identified uneven extension access among farmers.

Table 3: Distribution of Farmers by Extension Interaction Indicators

Variable	Category	Freq. (n=281)	Percentage (%)
Number of Extension Visits	1–2 visits	64	22.8
	3–5 visits	121	43.1
	Above 5 visits	96	34.2
Training Participation	Yes	194	69.0
	No	87	31.0
Number of Trainings Attended	None	87	31.0
	1–2 trainings	102	36.3
	3–4 trainings	58	20.6
	5 and above	34	12.1

Source: Field survey, 2025

Table 4 presents the distribution of farmers based on the constructed Interaction Index, which captures the overall intensity of engagement with public agricultural extension services. The grand mean score of 3.78 indicates that farmers generally perceive extension service delivery as effective. High ratings were observed for timely information (3.78), improved farming activities (3.79), productivity increase (3.78), input linkage (3.82), climate adaptation training (3.82), and consideration of local context (3.83). Farmers also agreed on regular visits (3.72) and clarity of messages (3.63). These findings align with Yitayew *et al.* (2021) and Mapiye & Dzama (2024) who found that relevant and timely advisory services improve productivity. However, moderate ratings for follow-up visits (3.37), accessibility (3.41), and responsiveness (3.47) indicate gaps in sustained support, consistent with Daikwo *et al.* (2024). Lower ratings for ICT use radio (3.20) and SMS (3.03) and inclusiveness gender sensitivity (3.04) and equal access (2.93) support IFAD (2019) findings of weak digital integration and inequality in extension delivery.

Table 4: Distribution of Farmers by Interaction Index

Interaction Level	Frequency	Percentage (%)
Low (0 – 2)	52	18.5
Moderate (3 – 5)	146	52.0
High (6 – 7)	83	29.5
Total	281	100

Source: Field survey, 2025

Farmers' perceptions of the current status of public agricultural extension service delivery

Table 5: presents farmers' perceptions of the current status of service delivery of Public Agricultural Extension Services (PAES) in Kaduna State. The responses, evaluated using weighted mean scores (WMS), show the degree to which farmers agreed or were uncertain about different aspects of extension service delivery. The grand mean score of 3.78 indicates that farmers generally perceive extension service delivery as effective. High ratings were observed for timely information (3.78), improved farming activities (3.79), productivity increase (3.78), input linkage (3.82), climate adaptation training (3.82), and consideration of local context (3.83). Farmers also agreed on regular visits (3.72) and clarity of messages (3.63). These findings align with Yitayew *et al.* (2021) and Mapiye & Dzama (2024) who found that relevant and timely advisory services improve productivity. However, moderate ratings for follow-up visits (3.37), accessibility (3.41), and responsiveness (3.47) indicate gaps in sustained support, consistent with Daikwo *et al.* (2024). Lower ratings for ICT use radio (3.20) and SMS (3.03) and inclusiveness gender sensitivity (3.04) and equal access (2.93) support IFAD (2019) findings of weak digital integration and inequality in extension delivery.

Table 5: Perception of the current status of service delivery of public agricultural extension services to farmers

Service Delivery Statement	SD	D	UD	A	SA	WMS	WM	Remark
Extension agents regularly visit my farm	14	34	44	115	74	939	3.72***	Agree
I frequently have contact with extension agents	20	27	64	106	64	916	3.59***	Agree
Extension agents follow up on previous visits	22	45	70	95	49	848	3.37**	Undecided
It is easy to reach extension agents when needed	16	45	77	93	50	841	3.41**	Undecided
PAES provides timely information	19	35	26	111	90	1061	3.78***	Agree
Advice from extension agents is useful	11	27	74	113	56	894	3.63***	Agree
Messages from extension agents are clear and understandable	14	35	57	109	66	913	3.63***	Agree
Extension agents respond promptly to farm problems	20	45	62	91	63	871	3.47**	Undecided
Extension services consider local context	15	21	49	108	88	1076	3.83***	Agree
I participate in training organized by extension agents	14	39	69	97	62	888	3.55***	Agree
I attend field days and demonstrations	19	41	78	85	58	848	3.43**	Undecided
Extension agents provide post-training follow-up	24	44	80	74	59	822	3.36**	Undecided
Extension services improved my farming	15	29	42	108	87	1066	3.79***	Agree
Extension advice has increased productivity	14	34	35	116	82	1062	3.78***	Agree
PAES improves my access to agricultural inputs	16	35	39	101	90	1056	3.76***	Agree
PAES links farmers to input suppliers	12	30	47	100	92	1074	3.82***	Agree
PAES provides training on climate change adaptation	13	30	33	124	81	1074	3.82***	Agree
Extension agents use radio programmes to provide information	27	59	77	67	51	812	3.20**	Undecided
Extension agents send mobile SMS to provide information	31	65	88	58	39	762	3.03**	Undecided
Extension services are gender-sensitive	29	68	82	66	36	779	3.04**	Undecided
Women and youth have equal access to extension services	35	79	77	52	38	753	2.93**	Undecided
Overall, I am satisfied with extension services	10	26	59	111	75	912	3.77***	Agree
Grand mean							3.78***	

Note: * Disagree (WMS of less than 2.50), ** Undecided (WMS between 2.5 to 3.49) and *** Agree (WMS of 3.50 and above) WS = weighted score, WMS= weighted mean score, SDA=strongly disagree, DA=disagree, UD=Undecided, A=Agree, SA=strongly agree

Conclusion and recommendations

The study concludes that while farmers in Kaduna State maintain moderate levels of interaction with public agricultural extension agents and generally perceive extension service delivery as effective, significant gaps persist in accessibility, inclusiveness, and sustained engagement. Although extension services contribute positively to productivity, income, and knowledge dissemination, disparities in access particularly along gender and institutional lines limit their full impact. The predominance of moderate interaction and constraints in follow-up support, ICT use, and equitable access suggest the need for strengthening extension systems to ensure more frequent contact, improved responsiveness, and inclusive service delivery for enhanced agricultural outcomes. Based on the findings, the following recommendations were made to improve the effectiveness of public agricultural extension services in the study area:

- i. Kaduna State Government and Agricultural Development Programme (ADP) should strengthen extension delivery by recruiting more extension agents and providing adequate logistics, as the study found that farmers' interaction with extension agents was largely moderate with noticeable gaps in follow-up and sustained contact.
- ii. Government, NGOs, and development partners should promote inclusive and gender-sensitive extension strategies, since the results revealed gender disparities in access and limited inclusiveness in extension service delivery, particularly for women and youth.
- iii. Extension agencies and policymakers should enhance the integration of ICT-based extension methods such as mobile advisory services and radio programs, as the findings showed low utilization of these channels despite their potential to improve accessibility and information dissemination.

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