ASSESSMENT OF DIGITAL EXTENSION TOOLS FOR INCLUSIVE AGRICULTURAL KNOWLEDGE DISSEMINATION AMONG SMALL-SCALE COCOA FARMERS IN IKOM AGRICULTURAL ZONE, CROSS RIVER STATE, NIGERIA

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Abstract
This study examined the utilization of digital extension tools for inclusive agricultural knowledge dissemination among small-scale cocoa farmers in the Ikom Agricultural Zone, Cross River State, Nigeria. A total of 180 cocoa farmers were selected using a multistage sampling technique, and primary data were collected through questionnaires. Descriptive statistics, including frequency, percentage, and mean, were used to analyze the data. Findings revealed that farmers had a moderate level of awareness of digital tools, with higher familiarity for mobile phones, short message service, and agricultural radio/television programs, while awareness of platforms such as WhatsApp, YouTube, and formal e-extension services was low. Digital tools were perceived as effective for accessing market information, communicating with extension agents, and saving time, but their role in improving learning and knowledge sharing was limited. The study identified poor network coverage, irregular power supply, high cost of smartphones and data, and inadequate government support as major barriers to digital tool utilization. Based on these findings, it is recommended that farmers receive regular digital literacy training, rural ICT infrastructure be improved, access to digital tools be subsidized, and government support for integrating digital tools into extension services be strengthened to enhance inclusive and sustainable cocoa farming.
***Keywords**: Digital extension tools, knowledge dissemination, cocoa farmers.*

Introduction

In the 21st century agricultural development is increasingly being transformed by digital technologies that enhance access to information and improve decision-making among farmers. Digital extension tools such as mobile applications, interactive radio, online platforms, and social media have become vital in disseminating agricultural knowledge efficiently and inclusively (Akinola & Olayemi, 2022). These tools serve as innovative channels for bridging communication gaps between farmers and extension agents, enabling the rapid transfer of knowledge on improved agricultural practices, pest control, and climate-smart farming techniques (Munyua, 2021).

For small-scale cocoa farmers, access to timely and accurate agricultural information is essential for improving productivity and sustainability. However, traditional agricultural extension systems are often constrained by limited human resources, poor logistics, and inadequate funding, which restrict their ability to reach a wider population of farmers (Adebayo, 2020). Consequently, many farmers still depend on informal and sometimes unreliable sources of information, which affects the adoption of improved technologies and best practices (Osei & Boateng, 2023).

The emergence of digital extension tools offers an opportunity to overcome these barriers by providing farmers with on-demand, localized, and up-to-date information through mobile phones and other ICT-based platforms (Ezeh & Onwubiko, 2021). Despite these

gains, the actual use and integration of digital tools in agricultural knowledge dissemination remain relatively low among smallholder farmers in many developing countries. This situation may be factored low awareness, limited digital literacy, poor internet connectivity, and inadequate institutional support (Mensah & Dzanku, 2022).

The challenge, therefore, lies not only in the availability of digital tools but also in their effective utilization to promote inclusive knowledge sharing among farmers. Hence, understanding how farmers perceive these tools, their level of awareness, and the factors influencing their use is crucial for designing policies and programs that can enhance agricultural productivity and rural livelihoods.

Based on the above premise, this study focuses on the utilization of digital extension tools for inclusive knowledge dissemination among small-scale cocoa farmers. The specific objectives are to:

1. assess the level of awareness of digital extension tools among small-scale cocoa farmers.
2. determine the extent to which digital tools are perceived as effective in disseminating agricultural knowledge.
3. identify the factors affecting the utilization of digital extension tools among small-scale cocoa farmers.

Materials and Methods

The population of the study consisted of all registered small-scale cocoa farmers within the Ikom Agricultural Zone. A two stage sampling technique was employed to select respondents. In the first stage, the six major cocoa-producing communities were purposively selected due to their high concentration of cocoa farmers. In the second stage, lists of 1200 registered farmers were obtained from local cooperatives and agricultural offices. A total of 180 respondents were then randomly selected using Yamane's (1967) formula for determining sample size, ensuring fair representation across the selected communities.

Primary data were collected using a questionnaire which was divided into four sections. Item 3 and 4 were measured on a 5-point Likert scale. Data collected were analyzed using descriptive statistics such as frequency, percentage, and mean to address the study objectives. A decision mean of 3.0 was adopted as the benchmark for interpretation, where mean values of 3.0 and above indicated agreement, while values below 3.0 indicated disagreement.

Results and Discussion

Socio-Economic Characteristics of the Respondents

Table 1 shows the socio-economic characteristics of the 180 cocoa farmers surveyed. Most were male and married, reflecting a male-dominated farming population (Adedeji & Ademola, 2022). Majority of the respondents had primary or secondary education, indicating moderate literacy that may influence their ability to use digital tools (Okon & Essien, 2021). Many combined cocoa farming with other activities such as trading and livestock rearing, typical of smallholders who diversify income sources (Oluwatusin & Adebayo, 2023).

Most respondents earned between ₦100,000 and ₦499,999 annually, consistent with findings that small-scale farmers generally have modest incomes (Adeniyi *et al*., 2020). The dominant age group was 30–49 years, suggesting an active farming population (Eze & Nwachukwu, 2021). With farm sizes mostly between 1–2 hectares, respondents were largely smallholder farmers with considerable expertise in cocoa cultivation (Olatunji & Ojo, 2020).

Table 1: Socio-Economic Characteristics of the Respondents (N=180)

S/N	Item	Frequency	Percentage (%)
1	**Sex**		
	Male	130	72.2
	Female	50	27.8
	Total	**180**	**100**
2	**Marital Status**		
	Married	130	72.2
	Single	24	13.3
	Divorced	14	7.8
	Widow(er)	12	6.7
	Total	**180**	**100**
3	**Highest Educational Level**		
	No formal education	36	20.0
	Primary school only	64	35.6
	Secondary school only	60	33.3
	Tertiary institution	20	11.1
	Total	**180**	**100**
4	**Primary Occupation**		
	Trading	54	30.0
	Artisan work / craftsmanship	36	20.0
	Civil service / salaried work	22	12.2
	Livestock rearing	38	21.1
	Fishing / other activities	30	16.7
	Total	**100**	**180**
5	**Estimated Annual Income**		
	<100,000	28	15.6
	100,000–499,999	72	40.0
	500,000–999,999	50	27.8
	≥1,000,000	30	16.6
	Total	**180**	**100**
6	Age (Years)		
	20–29	24	13.3
	30–39	54	30.0
	40–49	63	35.0
	50–59	30	16.7
	60 and above	9	5.0
	Total	**180**	**100**
7	**Farm size**		
	<1	30	16.7
	1–2	82	45.6
	3–4	48	26.7
	5 and above	20	11.0
	Total	**180**	**100**

Source: Field survey, 2024

Level of awareness of digital extension tools among small-scale cocoa farmers

Table 2 shows that awareness of digital extension tools among cocoa farmers was generally moderate. While most farmers recognized that digital tools can facilitate communication with extension agents (71.1%) and provide information through mobile applications and SMS

platforms (56.7% and 61.1%), awareness of tools for marketing, finance, and institutional e-extension platforms remained low. This suggests uneven exposure to different digital resources.

These findings align with Adebayo (2020) and Akinola and Olayemi (2022), who observed that farmers' digital awareness in sub-Saharan Africa is growing but remains limited to basic platforms like mobile phones and radio. Similarly, Mensah and Dzanku (2022) attributed low awareness of advanced tools to poor digital literacy and infrastructure gaps. Overall, while cocoa farmers show interest in using ICTs for agricultural learning, enhanced sensitization and training are needed to strengthen their knowledge and use of digital extension platforms.

Table 2: Level of awareness of digital extension tools among small-scale cocoa farmers (N = 180)

S/N	Statements	Frequency*	Percentage	Level of awareness
1	I am aware that information and advice about cocoa can be accessed through mobile phones	70	38.9	Low
2	I know about the use of WhatsApp groups for sharing cocoa farming information	78	43.3	Low
3	I am familiar with agricultural radio or television programs that promote digital learning about cocoa	96	53.3	High
4	I have heard about agricultural mobile applications that provide information to farmers about cocoa.	102	56.7	Moderate
5	I am aware that YouTube and other video platforms can be used to learn improved cocoa farming techniques.	88	48.9	Low
6	I know that agricultural extension agents use social media platforms like Facebook and WhatsApp to reach farmers	78	43.3	Low
7	I am aware of SMS-based agricultural information services available to farmers.	110	61.1	Moderate
8	I know about online platforms that provide weather, pest, and market information to farmers about cocoa	96	53.3	Moderate
9	I have heard about e-extension platforms developed by government or NGOs for cocoa learning.	78	43.3	Low
10	I am aware that digital tools can be used to communicate directly with extension agents	128	71.1	High
11	I know that mobile-based tools can provide training materials and demonstration videos on cocoa production	104	57.8	Moderate
12	I am aware that digital platforms can connect farmers with buyers and input suppliers	86	47.8	Low
13	I have heard about digital tools that promote climate-smart and sustainable cocoa farming practices	92	51.1	Moderate
14	I am aware that digital tools can improve farmers' access to financial and credit services for cocoa production	74	41.1	Low

Source: Field survey, 2024; * Multiple responses

knowledge among small-scale cocoa farmers

The results in Table 3 show that small-scale cocoa farmers in the study area had mixed perceptions of the effectiveness of digital tools in disseminating agricultural knowledge. While farmers acknowledged some benefits, the overall perception was moderate. Specifically, digital tools were considered effective for obtaining market prices (mean = 3.69), saving time and cost in accessing farm advice (mean = 3.59), improving communication with extension agents (mean = 3.40), and receiving weather and pest updates (mean = 3.26). These findings indicate that farmers recognize the practical benefits of digital platforms in enhancing access to vital agricultural information.

Table 3: Extent to which digital tools are perceived as effective in disseminating agricultural knowledge among small-scale cocoa farmers (N=180)

S/N	Statements	VE	E	U	IE	VIE	Σ*fx*	Mean	Decision
1	Digital tools gives me timely farm information	28 (140)	37 (148)	32 (96)	46 (92)	37 (37)	513	2.85	Not Effective
2	Digital tools make it easier for me to get farming advice	30 (150)	41 (164)	29 (87)	47 (94)	33 (33)	528	2.91	Not Effective
3	WhatsApp helps me share farming ideas with others easily	28 (140)	41 (164)	36 (108)	45 (90)	30 (30)	532	2.96	Not Effective |
4	I get weather and pest updates through phones	40 (200)	52 (208)	30 (90)	34 (68)	24 (24)	590	3.26	Effective
5	Phones helps me talk quickly with extension agents	43 (215)	57 (228)	28 (84)	32 (64)	20 (20)	611	3.40	Effective
6	Digital tools helps me learn better farming methods	29 (145)	38 (152)	34 (102)	47 (94)	32 (32)	525	2.90	Not Effective
7	Videos and voice notes make learning easier for me	34 (170)	48 (192)	36 (108)	40 (80)	22 (22)	572	2.99	Not Effective
8	Digital tools help me solve farming problems	36 (180)	49 (196)	33 (99)	39 (78)	23 (23)	576	2.96	Not Effective
9	Information from digital tools is easy to use	41 (205)	62 (248)	27 (81)	28 (56)	22 (22)	612	3.38	Effective
10	Digital tools saves my time and cost in getting farm advice	51 (255)	64 (256)	23 (69)	25 (50)	17 (17)	647	3.59	Effective
11	Digital tools increase my participation in trainings	45 (225)	59 (236)	30 (90)	28 (56)	18 (18)	625	3.47	Effective
12	I use digital tools to get market prices for my farm produce	53 (265)	68 (272)	25 (75)	21 (42)	13 (13)	667	3.69	Effective
13	Audio and video messages improves my learning	50 (250)	63 (252)	27 (81)	22 (44)	18 (18)	645	3.57	Effective
14	I believe digital tools improve learning	47 (235)	61 (244)	28 (84)	26 (52)	18 (18)	633	3.52	Effective

Source: Field survey 2024

However, some aspects such as learning better farming methods (mean = 2.90), accessing timely farm information (mean = 2.85), and sharing farming ideas through WhatsApp (mean = 2.96) were perceived as not effective. This suggests that while digital tools play a supportive role in information dissemination, their full potential in improving learning and participation has not been fully realized among cocoa farmers. Hence, greater efforts are needed to strengthen farmers' digital literacy and access to reliable extension content.

Factors affecting the utilization of digital extension tools among small-scale cocoa farmers

Table 4 reveals that several challenges hinder the utilization of digital extension tools among small-scale cocoa farmers, with mean scores ranging from 3.43 to 4.17. The most critical factors were poor network coverage ($\bar{x}$ = 4.17), irregular power supply ($\bar{x}$ = 4.12), and high cost of smartphones and data ($\bar{x}$ = 4.06), which significantly limited farmers' access to digital services.

Table 4: Factors affecting the utilization of digital extension tools among small-scale cocoa farmers (N=180)

S/N	Statements	SA	A	U	D	SD	Σ*fx*	Mean	Rank
1	Poor internet connectivity limits my access to digital tools	72 (360)	64 (256)	20 (60)	16 (32)	8 (8)	716	3.98	5th
2	High cost of smartphones and data discourages usage	80 (400)	60 (240)	18 (54)	14 (28)	8 (8)	730	4.06	3rd
3	Low digital literacy prevents me from using mobile apps effectively	66 (330)	58 (232)	24 (72)	22 (44)	10 (10)	688	3.82	9th
4	Irregular power supply affects my ability to charge and use digital devices	78 (390)	70 (280)	14 (42)	12 (24)	6 (6)	742	4.12	2nd
5	I am not aware of many agricultural digital tools	68 (340)	62 (248)	22 (66)	18 (36)	10 (10)	700	3.89	8th
6	Language barrier makes it difficult to use some digital tools	64 (320)	56 (224)	26 (78)	22 (44)	12 (12)	678	3.77	11th
7	I do not fully trust information received from digital platforms	54 (270)	52 (208)	30 (90)	26 (52)	18 (18)	638	3.54	13th
8	I prefer face-to-face contact with extension agents over digital communication	60 (300)	58 (232)	24 (72)	26 (52)	12 (12)	668	3.71	12th
9	Lack of technical support or training reduces my use of digital tools	70 (350)	64 (256)	22 (66)	16 (32)	8 (8)	712	3.96	6th
10	Women farmers have less access to digital tools and training in my locality	58 (290)	60 (240)	28 (84)	22 (44)	12 (12)	670	3.72	10th
11	Older farmers find it difficult to adopt new technologies	72 (360)	66 (264)	18 (54)	16 (32)	8 (8)	718	3.99	4th
12	Poor network coverage in my area limits digital communication	82 (410)	68 (272)	14 (42)	10 (20)	6 (6)	750	4.17	1st
13	There is little government support for digital extension services in my area	76 (380)	70 (280)	16 (48)	12 (24)	6 (6)	738	4.10	2nd
14	I don't see much benefit from using digital tools in my farming activities	52 (260)	48 (192)	28 (84)	30 (60)	22 (22)	618	3.43	14th

Source: Field survey, 2024

These findings align with Mensah and Dzanku (2022) and Eze and Nwachukwu (2021), who identified infrastructural gaps and affordability issues as major barriers to digital inclusion in rural areas. Other notable constraints included poor internet connectivity ($\bar{x}$ = 3.98) and lack of government support ($\bar{x}$ = 4.10), emphasizing systemic weaknesses in rural ICT infrastructure (Adebayo, 2020; Akinola & Olayemi, 2022). Conversely, low trust in digital information ($\bar{x}$ = 3.54) and perceived low benefits ($\bar{x}$ = 3.43) ranked lowest, indicating that most farmers recognize the potential value of digital tools but are constrained by accessibility and reliability issues rather than attitude.

Conclusion

The study revealed that small-scale cocoa farmers had a moderate level of awareness of digital extension tools, with most familiarity centered on mobile phones, SMS services, and agricultural radio or television programs. Awareness and use of platforms such as WhatsApp, YouTube, and formal e-extension services were notably low, indicating that many farmers had limited exposure to more interactive or advanced digital tools. Farmers perceived digital tools as helpful for saving time, accessing market information, and communicating with extension agents, but their effectiveness in improving learning and idea-sharing was not fully realized.

The utilization of digital tools was constrained by several factors, including poor network coverage, irregular power supply, high cost of smartphones and data, and insufficient government support for digital extension services. These barriers suggest that while digital tools have significant potential to enhance agricultural knowledge dissemination and improve cocoa production, infrastructural and socioeconomic challenges must be addressed.

Recommendations

Based on the findings of the study, the study recommends the following:

1. Regular training should be provided in order to improve cocoa farmers' skills in using digital tools for effective knowledge sharing.
2. Rural ICT Infrastructure should be expanded in order to increase network coverage and ensure reliable electricity to support uninterrupted access to digital extension services.
3. Access to digital tools should be subsidized as this will make smartphones and data packages more affordable to reduce financial barriers for cocoa farmers.
4. The government and other stakeholders should support and promote policies and programs that integrate digital tools into formal extension services.

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