OPEN ACCESS

Bulletin of Humanities and Social Sciences

Abbreviated Key Title: Bull. Humanit. Soc. Sci. | ISSN 3139-3640 (E) |
Greenfort International Publisher, Assam, India
Journal homepage: https://gipublisher.com/index.php/bhss

Research Article Volume-02, Issue-02; 2026 (Jul-Dec)

Mobile Phones and Agricultural Information Dissemination in Nigeria

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DOI: 10.62046/bhss.2026.v02i02.000 | **Received:** 28.05.2026 | **Revised:** 23.06.2026 | **Accepted:** 30.09.2026 | Published**:** 03.11.2026

Abstract: This study explores mobile phone usage for communicating agricultural information to farmers in Akwa Ibom State, Nigeria, regarding the usage level, the information accessed, and the challenges faced. Specifically, the study aimed to find out the level of farmers' usage of mobile phones for agricultural purposes, the agricultural information accessed through mobile phones, and the constraints to effective usage. To conceptualise the study, Diffusion of Innovations Theory and Uses and Gratifications Theory were used to analyse the adoption of mobile phones among farmers and to assess mobile communication to satisfy their information needs. A cross-sectional survey was conducted and out of the 70,535 let farmers in the Akwa Ibom State Agriculture Development Project (AKADEP) register, 400 farmers were selected through multistage sampling. Questionnaires were used to collect data that were analysed using frequency and percentages. The study found that 70% of farmers use mobile phones for accessing agricultural information The least accessed information was weather (5%) and crop/livestock advisory (4%) and the most accessed was financial and institutional information (51%) and market prices (22%). The most common challenges were high airtime/data costs (23%) and low literacy and language barriers (21%). The study concluded that mobile phones are important for agricultural communication, but their effectiveness requires more relevance, institutional support, and accessibility. To improve information access and farm decision-making, it's recommended that farmers receive training tailored to local needs using voice messages in local languages, as well as improving network coverage and connections with extension services.

Keywords: Mobile phones, agricultural information, dissemination, farmers, Akwa Ibom State.

Citation: Esther George NTEGWUNG. Mobile Phones and Agricultural Information Dissemination in Nigeria. Bull. Humanit. Soc. Sci, 2026 Jul-Dec 2(2): 98-105.

INTRODUCTION

Most Nigerians now use mobile phones for much more than social interactions. Even in rural areas, mobile phones have become essential in farming. The National Bureau of Statistics [1] reports rural farmers, who constitute the majority of the rural families, mobile phone ownership, and internet access are on the rise. Mobile phone ownership for rural farmers means the timely access to critical farming information such as market prices, pest outbreaks, and weather changes which can determine the success of a farming season can be easily accessed. Even where extension agents are available, mobile phones are the most preferred information access means. Farming communities have witnessed better farm condition responsiveness, price negotiations and reduced post-harvest losses as a result of simple mobile calls, texts, and mobile advisory services. The practical uses of mobile phones in farming communities have shown mobile phones provide better farm level decision making and problem solving than just being digital innovations.

Face-to-face methods, radio broadcasts, and print materials have all proven to be ineffective in the consistent reach of dispersed rural farmers in Nigeria. Due to limited funding, poor road networks, and insufficient staffing, public extension services have been further streamlined. Although mobile phones cannot solve all of these issues, they can help relay information more quickly and cheaply. In Nigeria, studies have shown that farmers who utilize mobile phones for agricultural advice and market information, achieve more production and greater incomes than those without mobile phones [2]. Farmers often refer to mobile phone communication as the most reliable way to consult other farmers, traders, and extension officers, and are able to confirm information prior to making decisions about their farms. In addition to that, mobile applications are useful for planning and coordinating activities of groups and cooperatives, and for responding to emergencies that may occur due to climate change. The development of mobile

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communication with agriculture has become increasingly popular with development agencies and policymakers. The Food and Agriculture Organization has pinpointed mobile technology as a major resource for small-sized farmers in Africa, Nigeria included, where extension services are not adequately provided [3].

Despite progress, mobile phone use for dissemination of agricultural information in Nigeria is affected by varying network coverage, cost of data, cost of data, varying literacy levels, and the relevance of information shared. Merely having access to mobile devices is not enough to ensure the effective use of phones. Voice calls provided in the local dialect are most preferred by rural farmers as they often use basic mobile phones, and digital services are often text based and/or data driven. The use of phones is also impacted by gender and age, with distinct challenges for older and women farmers. Digital agriculture in Nigeria is documented to have programmes that succeed when they fit farmers' everyday activities, honour local communication customs, and solve actual problems on the farm, as opposed to the generic messaging. Mobile phones are documented to have expanding penetration in rural Nigeria, which is present for agricultural information services to rural farmers to better address the structural challenges [4]. In this regard, studying mobile phone use in agriculture information dissemination in Nigeria is important in order to shape interventions and policies that improve the everyday lives of poor farmers and promote sustainable agriculture in the country.

Statement of the Problem

In Nigeria, information relevant to agricultural decision-making has not yet reached farmers in a timely, clear, and usable manner, hindering productivity, income stability, and food security. Public extension services are clear underachievers, with a lack of personnel, poor coverage, and a deficiency of contact with farmers. This has been a common issue despite policy overtures to farmer-centred information provision. While mobile phone penetration is increasing and is being widely used at the household level by farmers, the role of mobile phones in information provision and the gap-filling role of mobile phones is being little studied in rural Nigeria. Previous studies show that the use of mobile phones has a positive effect on farmers' access to production and market information. The research gap in the use of mobile phones is the agricultural information that is not in tune with the farmers' information needs, communication preferences, and capacities. Numerous studies document the negative impact of poor network coverage, high cost, low literacy, and irrelevant content on the use of mobile services by farmers. The research gap this study aims to fill is the unfulfilled promise of mobile phone ownership that exists alongside a lack of meaningful agricultural information.

Objectives of the Study

The specific objectives of this study are to:

1. assess the level of mobile phone usage and it's role in the dissemination of agricultural information among farmers in Nigeria;
2. determine the principal forms of agricultural data provided to farmers via mobile phones; and
3. evaluate the obstacles that farmers encounter in utilizing mobile phones for agricultural information dissemination in Nigeria.

Research Questions

The study aimed to provide answers to the following research questions:

1. What is the level of participation of mobile phones in the dissemination of agricultural information among farmers in Nigeria?
2. What forms of agricultural information are provided to farmers in Nigeria via mobile phones?
3. What obstacles do farmers in Nigeria encounter in using mobile phones for the dissemination of agricultural information?

LITERATURE REVIEW

Use of Mobile Phones for Agricultural Information Dissemination among Farmers in Nigeria

Mobile phones have transitioned from simple communication devices to tools for decision making in farming. Farmers rely on phones for production advice, input procurement, and clarification on farming practices away from contact with extension workers. The National Bureau of Statistics 2022 report shows that mobile phones, even in smallholder farming communities, are frequently owned by farmers [1]. This widespread ownership of mobile phones in rural communities has changed the flow of agricultural information. Extension officers do not visit farmers and instead, farmers communicate with each other more often. A study of crop farmers in northern Nigeria by Oyinbo et al. [2], indicated the primary communication tools that fit the simple local literacy levels and language preferences and therefore are used the most, are voice calls and SMS. Farmers often call extension workers to report changes in crop and weather conditions, reducing delays that would otherwise result in yield losses. Mobile phones are tools for everyday problem solving and their integration into a farming routine further emphasize their importance.

The advent of mobile communication technology has revolutionized how farmers share information among themselves; information sharing among farmers remains the most trusted and reliable source of information in the agricultural sector in Nigeria. Communication theorists have established that farmers mostly trust information provided by people with similar farming backgrounds. Mobile communication technology has provided the means for the extension of

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these trusted sources, enabling farmers to provide feedback to one another regardless of distance. In south western Nigeria, it was found that most farmers used mobile communication technology to obtain information about the prices of farm inputs and the quality of farm inputs before buying them to avoid being exploited by middlemen [5]. Although the authors explored the use of mobile communication technology in Africa as a whole, the results were consistent with findings in Nigeria that described the importance of mobile technology in farm negotiation. The Food and Agriculture Organisation has also noted how mobile communication technology provides informal means of agricultural extension in countries where formal agricultural extension systems are non-existent or inadequate; this is especially true for Nigeria where the extension worker to farmer ratio is extremely poor [3]. Mobile communication technology also helps to strengthen the informal agricultural advisory networks. Farmers are also observed to trust the information being disseminated via mobile communication technology if, and only if, the information being shared is consistent with the prevailing local agricultural conditions and if the person who provides the information is someone whom the farmers are familiar with. Mobile phones, therefore, do not displace social networks, they only extend these networks.

The Nigerian government's initiatives, private agribusinesses, and development partners have enhanced mobile agricultural advisory services in Nigeria. These services often provide information via text messages, voice response systems, and call centers connected to extension agents. Evaluation of mobile extension services in Nigeria shows different results which depended on service offerings and farmer's needs. A study on mobile advisory services in the Nigeria, indicated that older and less educated farmers preferred voice messages in the local dialects over text messages [6]. Field experience demonstrates that farmers disregard messages that are not easy to understand, and certainly not messages that are not relevant to current farming conditions. The government-sponsored e-wallet system under the Growth Enhancement Support Scheme shows that mobile technology, when combined with the farmers' requirements and the system's registration requirements, can provide direct access to farmers [7]. These initiatives indicate that mobile technology has the potential to support agricultural development, however, the focus should be on effective design, local context, relevance, and timing rather than being technologically advanced.

In addressing the role of mobile phones in disseminating agricultural information in Nigeria, researchers are more concerned with questions of sustained use and the tangible benefits of the mobile phones to the farmers. It has been argued that having mobile phones does not necessarily mean that information is used effectively or that farming practices are improved. The World Bank reported that farmers used mobile phones for agricultural purposes when the information received was not general, but spoke to time-sensitive decision making, such as pest control, weather, and market access [8]. Similar findings were reported by GSMA where farmers, even with an active mobile phone subscription, were disengaged from information mobile platforms [4]. Mobile phones, in the opinion of many farmers, should be used to facilitate communication and disseminate information that will complement the farmer's knowledge. Because of the knowledge system that has been created by the farmers, it is important to study the use of mobile phones and how they actually contribute to the agricultural system of Nigeria.

Types of Agricultural Information Accessed through Mobile Phones by Farmers

Farmers in Nigeria use mobile phones to access various types of agricultural information that aid in making daily on-farm decisions as well as for long-term planning. Research shows that information sought by farmers, for the most part, does not concern them in the abstract. Any information of an almost immediate or specific production and marketing value is more important to them than any information that is of a general or long-term value. Information accessed or sought is a function of the farming system, the season, and the exposure, or lack thereof, to the extension, or lack of, education system. Studies in Nigeria show that mobile phones, as a tool for information access, are most appreciated and valued when the information is practical, specific and relevant to the area as opposed to general information [8]. Several types of agricultural information accessed by mobile phones have become popular and formed distinct patterns when it comes to mobile mediated communication.

i. Weather and climate related information

Research shows that one of the most sought after types of agricultural information via mobile phones by farmers in Nigeria is weather and climate information. Farmers seek information on the weather and climate to determine when to plant, when to apply fertilizer, and when to harvest. A study of smallholder farmers in North Central Nigeria, for example, revealed that those who received weather forecasts via mobile phones were more successful in adjusting their planting dates than those who relied on traditional methods of forecasting [9]. Farmers often use voice calls and text message systems in order to receive weather information, especially in periods of rainfall uncertainty. Farmers value agricultural weather information via mobile phones as poor decisions or poor timing can lead to total crop failure. Mobile access to weather information serves to assist farmers in making decisions to reduce

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the risks associated with rain-fed agriculture, which is the most common type of farming in Nigeria.

ii. Market price and marketing information

Market price and marketing information are other categories accessed via mobile phones. Farmers use their phones to check current price's of crops in nearby markets, find buyers, and negotiate sales before transporting their crops. Empirical studies in southern Nigeria show that mobile phone price information access decreases middlemen and increases farmer's bargaining power [2]. Trading and farming phone calls are very common during peak harvesting times. Farmers report that this information helps them decide when and where to sell, and store, their crops. This practice is a change from reactive selling to a more strategic marketing practice enabled by mobile marketing.

iii. Crop and livestock production advice

Mobile phones are commonly used to access production/management advice, including information about planting, inputs, pest management, and livestock health. When farmers encounter a crop symptom or livestock disease that is unfamiliar to them, they often seek help from extension agents, agro dealers, or more experienced colleagues. In the studies of digital extension services in Nigeria, farmers prefer personalised advice when dealing with pests and diseases, and particularly via direct calls instead of generic messages [6]. Younger farmers with smartphones are increasingly using messaging applications to share photos. These exchanges allow farmers to respond quickly to production challenges, reducing delays that were common under face to face extension systems.

iv. Input availability and farm services information

Farmers use mobile phones to find services and formulate information about seed and fertilizer availability, and costs of agrochemicals and mechanization services. Farmers confirm stock, set up deliveries, and arrange service payments by calling and texting. Mobile phones are an access channel. Evaluations of the Growth Enhancement Support scheme found mobile phones to be an access channel. Farmers have informal mobile phone networks to find affordable inputs. Timeliness of information about inputs is critical for productivity.

v. Financial and institutional information

Mobile phones are also used to access information about financial services, institutional credit, cooperatives, and government interventions. Farmers learn about loan schemes, changes to registration, and meeting schedules through calls and texts from cooperative leaders and extension officers. The World Bank has recognized mobile phone use for participant access to institutional programs for farmers, especially when notice boards and meetings are ineffective [8]. Although access to this information is low, it makes farmers more connected to institutional programs.

Challenges Associated with the Use of Mobile Phones for Agricultural Information Dissemination in Nigeria

Mobile phones have not solved Nigeria's agricultural information dissemination problems. Research and field reports show that having a mobile phone doesn't mean having mobile access to agricultural information. Farmers use their mobile phones differently and not acquire information. All these negative challenges lead to inadequate utilisation of mobile phones for extension services and digital agriculture initiatives in the country.

i. Poor network coverage and unreliable connectivity

Remote rural farming communities have less mobile network coverage. Many agricultural zones have unstable mobile signals and unavailability which prevents farmers from being able to make important calls. Mobile phone coverage and internet access in rural communities have not improved despite improved rural mobile phone usage. Farmers report poor calls and messages during important planting and harvesting seasons which causes them to loss trust in mobile advisory services.

ii. Cost of mobile services and data

Smallholder farmers frequently face high costs associated with airtime, data subscriptions, and phone maintenance. While mobile phones are common, constant use for the purpose of accessing agricultural information involves competing costs. Research conducted on the use of mobile technology in African agriculture show that farmers often focus their calls and data usage on communications that are absolutely necessary, and avoid costs that are considered as non-essential and data services that are deemed non urgent [5]. In Nigeria, the absence of airtime causes farmers to postpone the pursuit of information related to advice and the market, which negatively impacts their ability to make decisions in a timely manner.

iii. Low literacy levels and language barriers

Farmers with literacy challenges have difficulty engaging with mobile-text services and info. services. Most farmers, unfortunately, have little formal education and have difficulty reading or interpreting English text messages. In a study about digital extension services in Nigeria, participants preferred to engage more with voice messages in local languages than with text messages [6]. Farmers ignore or misunderstand messages that are not in their language or their preferred form of communication. This problem diminishes the message's value.

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iv. Limited relevance and poor targeting of information

Farmers do not appreciate receiving mobile message services that are too general, too frequent or too poorly timed. Mobile agriculture advisory services do not consider the significant variation that exists in agricultural practices across regions, crops and seasons. Farmers are less likely to engage with digital services because the services do not consider their direct problems or the conditions on their farm [8]. Information that arrives too late or does not reflect current problems is often disregarded, reinforcing scepticism towards digital advisory systems.

v. Gender and social inequalities in phone use

Differences in mobile ownership and usage based on gender influence access to agricultural information. Among women farmers, there are additional constraints in terms of ownership of phones, time, and control over communication resources. Research on digital inclusion in Nigeria shows that women are less likely to use mobile phones for farming purposes, even though they are involved in farming [4]. Their participation in mobile information networks is also constrained by social and economic factors.

vi. Weak integration with extension services

Mobile technology is most useful when integrated with proactive extension services, but the coordination of digital systems and public extension services is very weak. Extension agents themselves face workload, time, and budget constraints, all of which limit their ability to respond to farmers' calls and messages. The Food and Agriculture Organization has stated that while mobile tools are useful, they cannot substitute for extension services and that mobile tools require organizational support to work effectively [3]. In the absence of this support, mobile communication is fragmented and inconsistent.

THEORETICAL FRAMEWORK

This study examines the use of mobile devices for the dissemination of agricultural information among Nigerian farmers using the Diffusion of Innovations Theory and the Uses and Gratifications Theory. The Diffusion of Innovations Theory was first developed by Everett M. Rogers in 1962 and subsequently revised in editions of Diffusion of Innovations [10]. The theory describes the process by which an idea, new technology or practice is communicated and adopted by members of a social system. Rogers identifies four key elements of innovation diffusion; the innovation, communication, time and a social system. Each of the components of the social system are adopters, who are segmented from innovators to laggards. The adoption or rejection of an innovation is influenced by perceived utility, incorporation into existing practices, and ease of use. The theory applied to this study demonstrates how mobile phones are seen as accepted tools for agricultural communication by Nigerian farmers. Farmers assess mobile phones against their socio-economic status, levels of literacy, and how mobile phones fit into their farming practices before deciding to use mobile phones to access agricultural information. Rogers [10] critique the theory for presumed equal access to innovation, and for overlooking the impact of the poverty and inadequate infrastructure that are the hallmarks of rural areas of the world. Nevertheless, the theory is still relevant to for explaining differences in the use of mobile phones to access information among different Nigerian farming communities.

By leveraging the Uses and Gratifications Theory in regard to farmers' information needs, the study perceives farmers as active information seekers who make conscious and informed decisions to utilize mobile technologies. This theory originated from the mass communication studies with noteworthy proponents being Katz, Blumler and Gurevitch [11] and calls for consideration to the active role of the audience in the use of media [11]. Instead of viewing farmers as hold information receivers, the theory posits that people use means of communications depending on the returns they hope to realise. This has been a widely applied perspective in communication studies with a focus on digital and mobile communication technologies even in the developing world [12,13]. In this context, the theory helped understand why farmers prioritised mobile phones for receiving information on weather updates, market prices and production advice. When information is rendered timely, pertinent, and affordable, farmers use mobile phones to access this information. When information fails to meet these conditions, farmers stop using phones to access information. Some of the criticisms of the theory may be that it under-represents the social and economic circumstances, particularly limited choices of the users who are economically disadvantaged. The theory has helped to explain how farmers are actively using mobile telephone technologies in addressing their information needs vis-a-vis the existent social and economic circumstances.

RESEARCH METHODOLOGY

The study used a descriptive survey design focused on mobile phone use for the dissemination of agricultural information among the farmers in Akwa Ibom State, Nigeria. A descriptive survey aids the study in choosing a study design that supports the systematic collection and analysis of primary data from real farmers in order to document their experiences, behaviours, and perceptions [14]. The study focused on registered farmers in Akwa Ibom State. This means that the population studied was acknowledged by agricultural authorities, thus improving the reliability of the sampling frames and reducing estimation errors. The population figures were obtained from the Akwa Ibom State Agriculture Development Project (AKADEP) records, which provided a total of 70,535 registered

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farmers in the six agricultural zones of the State (AMADEP data as cited in Umoh et al., [15]) (scholarlinkinstitute.org). This number was used for sample and sampling procedure determination. A sample size was determined using the Taro Yamane formula, which was applied at a 95 per cent confidence level and a 5 per cent margin of error, resulting in a sample of approximately 399 respondents. This sample size was adjusted to 400 farmers to account for potential non-responses as well as provide adequate analytical power. Subsequently, a multistage sampling method was applied to the selection of respondents. In the first step, the six agricultural zones of Akwa Ibom were used as units of stratification. In the second step, local government areas were randomly selected within each zone.

The local agricultural extension offices were used to create sampling frames and ensure that individual farmers were randomly selected. Data were collected using face-to-face interviews to capture nuances across different literacy levels of rural farmers. Rural farmers' varying levels of literacy were accommodated by using questionnaires that were structured in a particular manner. Descriptive statistics (frequencies and percentages) were used to analyze the data qualitatively.

Data Presentation and Analysis

Table 1: Extent of Mobile Phone Use for Agricultural Information Dissemination

Response Category	Frequency	Percentage (%)
Always use	152	38
Often use	128	32
Sometimes use	88	22
Rarely use	24	6
Never use	8	2
Total	400	100

Table 1 shows that 70\% of farmers use mobile phones always or often for agricultural information which shows high use for farm decision-making. Only 8\% state that they use phones for this purpose rarely or never.

Table 2: Types of Agricultural Information Accessed through Mobile Phones

Type of Information	Frequency	Percentage (%)
Weather and climate updates	21	5
Market price and marketing information	88	22
Crop and livestock production advice	15	4
Input availability and farm services	71	18
Financial and institutional information	205	51
Total	400	100

Data reveal five types of information accessed by farmers via mobile phone, with financial and institutional information being the most accessed type, with 51% of farmers accessing financial information through mobile phones. Market prices and marketing information and services are accessed by 22% and 18% respectively. Weather updates and advice on crop production and livestock are accessed the least, at 5% and 4% respectively. This shows that farmers in Akwa Ibom State use mobile phones predominantly for information on financial services, government services, and institutional services, but not for production information and weather services. Low access to technical and climate information could be reliance on traditional information sources, or that mobile-based information on these topics is perceived less relevant to farmers' needs.

Table 3: Challenges Associated with Mobile Phone Use for Agricultural Information

Challenge	Frequency	Percentage (%)
Poor network coverage	67	17
High cost of airtime/data	91	23
Low literacy/language barriers	84	21
Generic/irrelevant information	61	15
Gender/social restrictions	15	4
Weak integration with extension services	82	20
Total	400	100

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Farmers face high airtime/data costs (23%), low literacy and language barriers (21%), incomplete integration with extension services (20%), and network coverage (17%) and generic information (15%) also hinder usage. Gender and social barriers carry less significance (4%).

DISCUSSION OF FINDINGS

The first research question sought to examine how mobile phones are used to educate farmers in Akwa Ibom State. Mobile phones are highly used to access farm information by 70% of respondents. This is supported by research stating that mobile phones are used for more than casual communication, and have become critical for agile decision making in agriculture [1,2]. Mobile technology is integrated in farming when farmers use mobile phones to consult extension workers, and coordinate activities with other farmers. The 8% of farmers who rarely use mobile phones are most likely to be economically and technically excluded as other research studies have shown [4]. The findings support Rogers' [10] theory of Diffusion of Innovations, which states that if mobile phones are embedded in farmers' communication activities, then they are easy to use in farming, and they meet the farmers' communication needs.

The second research question looked at the different kinds of agricultural data accessed via mobile phones. The study shows that the most accessed type was financial and institutional information, with 51% of respondents reporting access, while the other three types reported lower percentages: market prices (22%), input availability/services (18%), and weather updates (5%), livestock and crop advisory (4%) guidance. This shows that farmers most likely access information that concerns financing, government, or other supportive programs rather than information that helps with daily production guidance. This might also mean that farmers get information that is technical and weather related through other means like the radio, community meetings, or traditional knowledge. The information gap is compliant with the Uses and Gratification Theory (U&G Theory) of active/passive information seekers. This describes farmers as active information seekers and as such describes the farmer as an active information seeker and emphasizes the purpose of the communication channel as fully informative, relevant and practical [11,12]. Lack of information on production and climatic factors creates an information gap that also describes mobile advisory services as lacking. This shows that in order to increase uptake, content needs to be relevant to the farmers, and their operational realities.

The third research question looks at what challenges farmers experience when using mobile phones for info pertaining to their farming. Most challenges include the cost of airtime and data (23%), low literacy and language (21%), and integration with extension services (20%) and then poor network (17%) and irrelevant info (15%). Less of an issue were gender and social restrictions (4%). These challenges are structural, economical, and social and literature support this [3,8]. With farmers relying on only voice data services and only using communication where the content is relevant shows that mobile intervention services need to be designed for the actual user. To improve access to mobile phones useful for agriculture, providing more data and more calls, more relevant info, and mobile banking is most important.

CONCLUSION

This research assessed mobile phone usage for providing farmers in Akwa Ibom State with agricultural information. The study identified the level of mobile phone use, the type of information accessed, and the challenges users encountered. The study found that farmers extensively use mobile phones in order to obtain financial, institutional, and market-based information. This demonstrates, amongst other things, that farmers consider mobile phone information access as more valuable for their own self-sustaining resource access, and income-generating programme activities. In contrast, information such as technical production, weather information, and crop management advisors are hardly accessed. This indicates that mobile-based advisory services are not relevant or inadequately provided. In addition to these information access challenges; farmers also encounter a multitude of other challenges. They may have limited airtime, data or poor network coverage. They may also encounter low literacy and linguistic challenges, limited access to integrated extension services, and/or other social or economic changes. The study found that mobile phones have the potential to communicate agricultural information more effectively, but the challenges of structural, social, economic, and informational contextual tailoring to farmers' needs to mitigate these challenges must be met. Failure to do this may result in mobile technologies deepening the existing challenges of providing timely, actionable agricultural information to farmers.

Recommendations

Considering the study's results, the following strategies are suggested:

1. More mobile adoption for agri purpose can be achieved through training and awareness campaigns aimed at demonstrating the practical role of mobile communication in farm decision making.
2. Farm advisory services should include relevant production and weather info using voice messages in the vernacular for easy and practical reference.
3. Extension service providers, policy makers, and network service providers should work together on reducing costs for airtime, data, and extending coverage to rural areas. Use

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mobile technology to link users to extension officers. And for those with low education, illiteracy, and social barriers, use simple voice interactions to overcome barriers to participation.

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