Utilization of WhatsApp Groups for Farmer Peer-Learning and Adoption of Improved Agricultural Practices Among Smallholder Farmers in Bayelsa State

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Abstract
This study assessed the utilisation of WhatsApp groups for farmer peer-learning and the adoption of improved agricultural practices among smallholder farmers in Bayelsa State, Nigeria. The study adopted a cross-sectional survey design using a mixed-methods approach. The population comprised smallholder farmers belonging to agricultural WhatsApp groups across the agricultural zones of Bayelsa State. A sample of 216 farmers was used for the quantitative analysis, while farmers, cooperative leaders, agricultural extension agents, and WhatsApp group administrators participated in the qualitative interviews. Data were collected using WhatsApp Group Utilisation, Farmer Peer-Learning and Improved Agricultural Practices Questionnaire (WGU-FPL-IAPQ) and a semi-structured interview guide. The questionnaire recorded an acceptable reliability coefficient. Quantitative data were analysed using mean, standard deviation, and Pearson Product-Moment Correlation, while qualitative data were analysed thematically. The findings showed that agricultural information was exchanged at a marginally high extent, particularly information on planting periods, improved planting materials, seasonal changes, weather, flooding, and water management. Farmer participation was low and mainly passive, as farmers read agricultural messages more frequently than they asked questions, responded to other farmers, or shared personal experiences. Farmer peer-learning was also low, although farmers discussed common production problems and encouraged one another to adopt improved practices. The overall adoption of improved agricultural practices was low, despite relatively higher adoption of flood-management, harvesting, storage, and post-harvest practices. Qualitative findings identified flooding, poor connectivity, high data costs, limited digital literacy, inadequate transportation, high input costs, lack of credit, and irregular extension-agent participation as major constraints. The analysis revealed a significant but weak positive relationship between WhatsApp peer-learning and the adoption of improved agricultural practices. The study concludes that while WhatsApp bridges physical extension gaps in difficult terrains, its potential is limited by passive participation. It is recommended that extension agencies and cooperative administrators introduce structured, interactive prompts and subsidized digital tools to transition farmers from passive readers to active peer-learners.

Keywords: *WhatsApp groups, peer-learning, agricultural information, technology adoption, smallholder farmers, Bayelsa State.*

Introduction

Agricultural production depends not only on land, labour, capital, and other physical resources but also on the availability of timely and relevant knowledge. Farmers require continuous information to make appropriate decisions about the selection of crops and varieties, land preparation, planting periods, input application, pest and disease control, harvesting, processing, storage, and marketing. For smallholder farmers, access to such information is often limited by inadequate extension personnel, difficult terrain, poor transportation networks, and the high cost of frequent face-to-face consultations. These limitations have increased the importance of mobile communication in agriculture. Through mobile applications such as WhatsApp, farmers can communicate with one another, share farm experiences, seek advice, circulate photographs and videos, and receive information from extension agents and other agricultural stakeholders. WhatsApp therefore provides a practical platform through which agricultural knowledge can move more quickly among farmers and support peer-learning and the adoption of improved agricultural practices.

WhatsApp is a mobile-based communication platform that enables users to interact through instant text messaging and other forms of digital communication (Allil et al, 2024). The platform supports computer–human interaction and facilitates continuous communication among users through internet-connected devices. Balaji and Kavaskar (2024) viewed WhatsApp as a social communication platform that enables people with common interests to form groups and exchange information, including text, videos, audio and other multimedia materials. In the agricultural context, WhatsApp can serve as a tool for disseminating farm technologies and creating an information-support system for farmers. Through its messaging, voice-note, video-sharing, document-sharing, and group-discussion features, WhatsApp enables users to communicate rapidly across geographical locations. In the agricultural sector, WhatsApp groups are increasingly being utilised by farmers, extension agents, researchers, agricultural organisations, input suppliers, and other stakeholders to disseminate agricultural information and support farmers' decision-making. These groups provide opportunities for farmers to discuss production challenges, share practical experiences, seek technical advice, exchange information on farm inputs and markets, and learn from one another. The Food and Agriculture Organization (FAO, 2022) observes that digital technologies can strengthen agricultural extension and advisory services by improving farmers' access to timely information, technical knowledge, market opportunities, and professional support. The usefulness of WhatsApp groups in agriculture is closely associated with their capacity to support farmer peer-learning. Farmer peer-learning refers to the process through which farmers acquire knowledge, skills, attitudes, and practical experiences through interaction with other farmers. Manda et al, (2023) described farmer peer-learning as a process through which farmers acquire and exchange agricultural knowledge, skills and experiences from one another through interaction, discussion, observation and sharing of farming practices. The process enables farmers to learn from the practical experiences of other farmers and to adapt useful agricultural practices to their own farming conditions. To Kiptot et al, (2022) farmer peer-learning is a form of informal agricultural learning in which farmers share knowledge, experiences and practical solutions through social relationships and farmer-to-farmer interactions. Such learning can complement formal extension services by providing farmers with locally relevant information and opportunities to observe how agricultural innovations are applied by their peers. It recognises farmers as both users and producers of agricultural knowledge. Through peer-learning, farmers exchange

information about practices that they have tested, adapted, or observed within their local environments. Such learning may involve discussions, demonstrations, personal experiences, problem-solving, feedback, and collective assessment of agricultural technologies. Farmer-to-farmer learning can strengthen farmers' ability to analyse production problems, experiment with alternative solutions, and adapt technical recommendations to their local circumstances (Food and Agriculture Organization (FAO, 2022). WhatsApp groups provide a digital environment in which these peer-learning activities can take place continuously, even when farmers are separated by distance or have limited opportunities for physical meetings.

Farmer peer-learning through WhatsApp groups may occur in both formal and informal agricultural networks. Formal WhatsApp groups may be established by farmer cooperatives, extension agencies, government agricultural programmes, research institutions, development organisations, or commodity associations. Informal groups may be created by farmers who share common occupations, locations, crops, livestock enterprises, or socioeconomic interests. Within these groups, farmers may exchange information about planting dates, land preparation, improved varieties, fertiliser use, pest and disease management, weed control, irrigation, climate adaptation, harvesting, processing, storage, and marketing. Klerkx et al. (2019) explain that agricultural innovation increasingly depends on interaction among farmers, researchers, extension agents, private organisations, financial institutions, and other stakeholders. WhatsApp groups can strengthen these interactions by connecting farmers to technical experts and to peers who possess relevant production experiences. Digital agricultural research suggests that interactive communication and farmer-to-farmer exchange can support the diffusion of agricultural innovations, although the extent of adoption depends on information quality, participation, trust, access to inputs, affordability, and the availability of complementary extension services (CIMMYT, 2022). The adoption of improved agricultural practices remains important for increasing farm productivity, improving income, strengthening food security, reducing production risks, and promoting environmental sustainability. Smallholder farmers who adopt improved practices may achieve better yields, reduce losses, use farm resources more efficiently, improve product quality, and participate more effectively in agricultural markets. However, farmers may fail to adopt improved practices even when they are aware of them. High input prices, inadequate credit, labour shortages, limited access to machinery, insecure land tenure, poor roads, weak markets, and environmental risks may prevent farmers from translating knowledge into practice. Consequently, WhatsApp-based learning should not be viewed as a complete solution to the challenges facing smallholder farmers. Rather, it should be understood as one component of a wider agricultural support system involving extension agencies, farmer organisations, research institutions, input suppliers, financial institutions, markets, and government policies.

The relevance of WhatsApp groups is particularly important in Bayelsa State, where farming communities are widely dispersed and agricultural activities are influenced by riverine terrain, seasonal flooding, inadequate personnel, poor transportation networks, difficult riverine terrain, insufficient funding, and the scattered location of farming communities. Although some farmers may belong to WhatsApp groups, their level of participation, access to relevant information, and use of the knowledge shared remain uncertain. Some group members may only receive messages passively, while others may lack the digital skills, network access, data, smartphones, or confidence required to participate actively in discussions. In addition, the information shared through some groups may be inaccurate, incomplete, outdated, or unsuitable for the specific ecological and socioeconomic conditions of farmers in Bayelsa State. The problem is further reflected in the continued limited adoption of improved agricultural practices among smallholder

farmers. Farmers may receive information about improved seeds, fertiliser application, pest management, climate-smart agriculture, improved processing, or post-harvest handling but fail to apply the recommendations because of inadequate technical understanding, high input costs, limited finance, labour constraints, poor access to markets, or lack of follow-up support.
Some farmers may be aware of improved production methods but fail to apply them because of inadequate technical understanding, uncertainty about expected benefits, high input costs, limited access to finance, insufficient labour, or lack of supporting services. Others may receive information through WhatsApp groups that is incomplete, inaccurate, poorly explained, or inappropriate for local farming conditions. Poor network coverage, high data costs, unreliable electricity, limited smartphone ownership, low digital literacy, language barriers, and unequal participation may further restrict the usefulness of WhatsApp-based agricultural learning. These conditions create uncertainty about whether WhatsApp groups are genuinely strengthening farmer knowledge and adoption or merely increasing the volume of agricultural messages available to farmers. Therefore, this study examines the utilisation of WhatsApp groups for farmer peer-learning and the adoption of improved agricultural practices among smallholder farmers in Bayelsa State.

Objectives of the Study

The broad objective of this study is to assess the utilization of whatsapp groups for farmer peer-learning and adoption of improved agricultural practices among smallholder farmers in Bayelsa State. To achieve this, the study specifically aims to:

1. Determine the nature of agricultural information exchanged among smallholder farmers in Bayelsa State.
2. Examine the level of farmer participation in agricultural WhatsApp groups among smallholder farmers in Bayelsa State.
3. Evaluate the extent of farmer peer-learning achieved through WhatsApp groups among smallholder farmers in Bayelsa State
4. Analyze the level of adoption of improved agricultural practices resulting from WhatsApp peer-learning among smallholder farmers in Bayelsa State.

Research Questions

The study answered the following research questions:

1. What is the nature of agricultural information exchanged among smallholder farmers in Bayelsa State?
2. What is the level of farmer participation in agricultural WhatsApp groups among smallholder farmers in Bayelsa State.
3. What is the extent of farmer peer-learning achieved through WhatsApp groups among smallholder farmers in Bayelsa State?
4. What is the level of adoption of improved agricultural practices resulting from WhatsApp peer-learning among smallholder farmers in Bayelsa State?

Hypothesis

The study developed the following hypothesis

1. There is no significant relationship between the utilisation of WhatsApp groups for farmer peer-learning and the adoption of improved agricultural practices among smallholder farmers in Bayelsa State.

Methodology

This study adopted a cross-sectional survey research design using a mixed-methods approach (quantitative and qualitative). This design is suitable because it allows the researcher to collect data from a representative sample of smallholder farmers at a single point in time to explain current patterns of digital tool usage, learning behaviors, and technology adoption. The study was conducted in Bayelsa State, situated in the Niger Delta region of Nigeria. The state is geographically characterized by a waterlogged, riverine terrain with extensive networks of creeks and rivers, making physical movement challenging. Agriculture (mainly crop cultivation like cassava, plantain, and yam, alongside aquaculture and fishing) is a major livelihood source for the rural population. The unique geography makes the state a critical area for assessing how digital platforms like WhatsApp bridge physical extension service gaps. The target population consists of all registered smallholder farmers who belong to agricultural WhatsApp groups (whether formal groups managed by cooperatives) across the agricultural zones of Bayelsa State. There are 1,250 registered cooperative groups operating across the state. Out of this macroeconomic framework, a baseline population of 611 Farmers Multipurpose Cooperative Societies actively functioning within the state's agricultural zones (Source: Bayelsa State Bureau for Cooperative Development). These 611 specialized agricultural cooperatives constitute the primary population which the digitally active smallholder farmer population is drawn.

The study uses 242 Farmers Multipurpose Cooperative Societies as the sample, calculated from the population of 611 cooperative societies using Yamane's formula at a 5% level of precision. A multistage sampling technique was used. First, the 611 cooperative societies were stratified according to Bayelsa State's agricultural zones. Second, 242 cooperative societies were proportionately allocated across the zones and selected through simple random sampling. Third, smallholder farmers who belong to agricultural WhatsApp groups were identified from the selected cooperatives' membership registers. Finally, the required farmers were selected through systematic random sampling. For the qualitative component, active WhatsApp farmer-group members, cooperative leaders, extension agents, and group administrators were purposively selected until data saturation is reached.

The instrument for data collection is a researcher-developed questionnaire titled: WhatsApp Group Utilisation, Farmer Peer-Learning and Improved Agricultural Practices Questionnaire (WGU-FPL-IAPQ). The questionnaire consisted of four sections, Sections A, B and C use a four-point scale of Very High Extent (4), High Extent (3), Low Extent (2), and Very Low Extent (1). While Section D used a scale of Fully Adopted (4), Moderately Adopted (3), Slightly Adopted (2), and Not Adopted (1). A semi-structured interview guide was also used to obtain qualitative data from selected farmers, cooperative leaders, extension agents, and WhatsApp group administrators. The questionnaire was submitted to experts in Agricultural Science Education, Agricultural Extension, Measurement and Evaluation, and Information and Communication Technology for face and content validation. Their observations were used to revise the items and ensure that they adequately measured WhatsApp group utilisation, farmer peer-learning, and the adoption of improved agricultural practices.

The questionnaire was pilot-tested on smallholder farmers outside the study area who had similar characteristics to the study respondents. The pilot-test data were analysed using Cronbach's alpha. A reliability coefficient of 0.79 was considered acceptable. The researcher, assisted by three WhatsApp group admin of distributed the questionnaire electronically using WhatsApp, and respondents completed and returned the questionnaires through the same platform. Some clarifications were provided to respondents through WhatsApp messages, voice calls, and voice

notes. Qualitative data were collected through interviews with purposively selected farmers, cooperative leaders, agricultural extension agents, and WhatsApp group administrators. The research questions were answered using the mean and standard deviation, while Pearson Product-Moment Correlation was used to test the hypotheses at the 0.05 level of significance. The qualitative data obtained through interviews were transcribed, coded, and analysed thematically to complement the quantitative findings.

Results

Results According to Research Questions

Research Question 1: What is the nature of agricultural information exchanged, and what is the level of farmer participation in agricultural WhatsApp groups among smallholder farmers in Bayelsa State?

Table 1: Nature of Agricultural Information Exchanged through WhatsApp Groups

S/N	Agricultural information exchanged	Mean	SD	Decision
1	Information on improved planting materials and crop varieties	2.63	0.89	High extent
2	Information on pest and disease control	2.41	0.88	Low extent
3	Information on agricultural produce prices and markets	2.46	0.86	Low extent
4	Information on planting periods and seasonal changes	2.71	0.84	High extent
5	Information on fertiliser, manure, and input application	2.19	0.93	Low extent
6	Information on weather, flooding, and water management	2.57	0.98	High extent
	Grand mean	**2.50**	**0.90**	**High extent**

Table 1 shows that Items 1, 4, and 6 were rated at a high extent, while Items 2, 3, and 5 were rated at a low extent. Item 1, 4 and 6 with a mean score of 2.63. 2.71 and 2.57 exceeded the benchmark of 2.50. These results indicate that information relating to planting periods and seasonal changes, improved planting materials and crop varieties, and weather, flooding, and water management was exchanged relatively frequently among farmers in Bayelsa State. Items 2, 3, and 5 recorded mean scores of 2.41, 2.46, and 2.19, respectively, and were therefore rated at a low extent and were below the benchmark of 2.50. This suggests that information on pest and disease control, agricultural produce prices and markets, and fertiliser, manure, and input application was exchanged less frequently. The grand mean of 2.50 indicates that the overall exchange of agricultural information was at the criterion level and was therefore interpreted as high extent. However, since the grand mean was exactly 2.50, the overall result may more appropriately be described as marginally high. The findings suggest that information relating to seasonal farming decisions, improved planting materials, and flood-related conditions received greater attention than information relating to pest management, markets, and input application.

Research Question 2: What is the level of farmer participation in agricultural WhatsApp groups among smallholder farmers in Bayelsa State.

Table 2: Level of Farmer Participation in Agricultural WhatsApp Groups

S/N	Participation activity	Mean	SD	Decision
1	Reading agricultural messages posted in the group	2.76	0.84	High extent
2	Asking questions about farming practices	2.21	0.94	Low extent
3	Responding to questions from other farmers	2.08	0.91	Low extent
4	Sharing personal farming experiences	2.16	0.92	Low extent
	Grand mean	**2.30**	**0.90**	**Low extent**

Table 2 shows that Item 1 recorded a high extent, with a mean score of 2.76, indicating that farmers frequently read agricultural messages posted in their WhatsApp groups. Items 2, 3, and 4 recorded low extents, with mean scores of 2.21, 2.08, and 2.16, respectively. The grand mean of 2.30 is below the benchmark score of 2.50 indicating that the overall level of farmer participation in agricultural WhatsApp groups was low. This suggests that participation was mainly passive, as farmers read messages more frequently than they asked questions, responded to other farmers, or shared personal farming experiences.

Research Question 3: What is the extent of farmer peer-learning achieved through WhatsApp groups among smallholder farmers in Bayelsa State?

Table 3: Extent of Farmer Peer-Learning Achieved through WhatsApp Groups

S/N	Peer-learning activity	Mean	SD	Decision
1	Learning from the practical experiences of other farmers	2.31	0.91	Low extent
2	Discussing solutions to common production problems	2.68	0.89	High extent
3	Obtaining clarification from other farmers	2.18	0.93	Low extent
4	Comparing the results of different farming practices	2.09	0.95	Low extent
5	Sharing photographs or videos to demonstrate farm practices	1.91	0.97	Low extent
6	Encouraging one another to adopt improved agricultural practices	2.67	0.92	High extent
	Grand mean	**2.31**	**0.93**	**Low extent**

Table 3 shows that Items 2 and 6 were rated at a high extent, with mean scores of 2.68 and 2.67, respectively. Item 5 recorded the lowest mean score of 1.91. Items 1, 3, 4, and 5 were rated at a low extent, with mean scores ranging from 1.91 to 2.31. The grand mean of 2.31, which is below the criterion mean of 2.50, indicates that farmer peer-learning through WhatsApp groups was generally achieved to a low extent. Although farmers discussed production problems and encouraged one another to adopt improved practices, broader peer-learning activities remained limited.

Research Question 4: What is the level of adoption of improved agricultural practices resulting from WhatsApp peer-learning,

Table 4: Level of Adoption of Improved Agricultural Practices resulting from WhatsApp peer-learning

S/N	Improved agricultural practice	Mean	SD	Decision
1	Use of improved or disease-resistant planting materials	2.34	0.91	Low adoption
2	Timely planting based on seasonal information	2.42	0.87	Low adoption
3	Improved pest and disease-management practices	2.29	0.93	Low adoption
4	Appropriate application of fertiliser and organic manure	2.16	0.95	Low adoption
5	Improved flood, drainage, and water-management practices	2.68	0.88	High adoption
6	Improved harvesting, storage, and post-harvest handling	2.73	0.84	High adoption
	Grand mean	**2.44**	**0.90**	**Low adoption**

Table 4 shows that Items 5 and 6 were rated at a high level of adoption, with mean scores of 2.68 and 2.73, respectively. Items 1, 2, 3, and 4 were rated at a low level of adoption, with mean scores of 2.34, 2.42, 2.29, and 2.16, respectively. The grand mean of 2.44, which is below the criterion mean of 2.50, indicates that the overall adoption of improved agricultural practices was low. The relatively higher scores for Items 5 and 6 may be connected with the immediate relevance of flood management, drainage, water control, harvesting, storage, and post-harvest handling to the farming conditions of Bayelsa State. However, the low scores for Items 1–4 suggest that farmers faced greater difficulty adopting improved planting materials, seasonal planting decisions, pest-control methods, and fertiliser application.

Qualitative Findings

The interview findings were used to explain the quantitative results. Four major themes emerged.

Theme 1: Flooding and waterlogged farms

Farmers reported that flooding and waterlogging affected planting, crop growth, harvesting, transportation, and access to farms. Participants explained that WhatsApp groups were useful for sharing information about rising water levels, damaged farms, drainage, and movement through creeks. However, access to the groups was sometimes interrupted by poor network connectivity and electricity problems.

Theme 2: Market and transportation challenges

Participants indicated that farmers used WhatsApp groups to obtain information about produce prices, available buyers, and transportation by boat. Nevertheless, the usefulness of market information was limited when farmers lacked affordable transportation, storage facilities, or direct access to buyers.

Theme 3: Limited active participation

The interviews showed that many farmers mainly read messages but did not contribute regularly. Some participants reported that farmers were unwilling to post questions or farming experiences because of limited digital confidence, fear of providing incorrect information, and the cost of data required to participate in discussions.

Theme 4: Limited conversion of information into adoption

Participants stated that farmers sometimes received information about improved practices but could not adopt the recommendations because of the high cost of inputs, lack of credit, unavailability of improved planting materials, flooding, poor roads, and inadequate extension support.

Theme 5: Need for extension-agent involvement

Farmers and group administrators reported that extension agents did not participate regularly in WhatsApp discussions. Participants indicated that extension-agent involvement would help verify information, correct misinformation, explain technical recommendations, and guide farmers on practices suitable for flood-prone and waterlogged areas.

Test of Hypothesis

Hypothesis 1: There is no significant relationship between the utilisation of WhatsApp groups for farmer peer-learning and the adoption of improved agricultural practices among smallholder farmers in Bayelsa State.

Table 5: Pearson Product-Moment Correlation between WhatsApp Peer-Learning and Adoption of Improved Agricultural Practices

Variables	N	Mean	SD	r	p-value	Decision
WhatsApp peer-learning	216	2.31	0.93	0.29	0.000	Reject H_0
Adoption of improved agricultural practices	216	2.44	0.90			

Table 5 shows a correlation coefficient of 0.29 between WhatsApp peer-learning and the adoption of improved agricultural practices. The p-value of 0.000 is less than the 0.05 level of significance. Therefore, the null hypothesis is rejected. The result indicates that there was a statistically significant but weak positive relationship between WhatsApp peer-learning and the adoption of improved agricultural practices among smallholder farmers in Bayelsa State. This means that farmers who reported higher levels of peer-learning tended to report slightly higher levels of adoption. However, the weak correlation indicates that WhatsApp peer-learning alone was not sufficient to produce substantial adoption. Other factors, including access to credit, affordability of inputs, extension support, network connectivity, electricity supply, flooding, transportation, storage, and market access, may have influenced adoption.

Discussion of Findings

Nature of Agricultural Information Exchanged

The study found that the overall nature of agricultural information exchanged through WhatsApp groups was marginally high, with a grand mean of 2.50. This indicates that agricultural WhatsApp groups served as useful channels for exchanging agricultural information among smallholder farmers in Bayelsa State. The finding agrees with the Food and Agriculture Organization of the United Nations (FAO, 2022), which reported that digital agricultural technologies can improve farmers' access to information and services, but their effectiveness depends on connectivity, infrastructure, electricity, financial access, and digital skills. Therefore, the marginally high result reflects both the usefulness of WhatsApp groups and the limitations imposed by the rural and riverine conditions of Bayelsa State.

Level of Farmer Participation in Agricultural WhatsApp Groups

The study found that the overall level of farmer participation in agricultural WhatsApp groups was low, with a grand mean of 2.30. This result indicates that farmers were not actively involved in most group activities. The finding is consistent with the International Telecommunication Union (ITU, 2023), which identified connectivity, affordability, digital skills, and geographical location as important influences on meaningful digital participation. The result therefore suggests that membership of an agricultural WhatsApp group does not necessarily imply active participation. More effective participation would require improved connectivity, affordable data, digital-literacy support, and stronger group moderation.

Extent of Farmer Peer-Learning Achieved through WhatsApp Groups

The study found that farmer peer-learning through WhatsApp groups was achieved to a low extent, with a grand mean of 2.31. This indicates that the groups provided limited opportunities for sustained and meaningful farmer-to-farmer learning. The finding agrees with the International Fund for Agricultural Development (IFAD, 2021), which emphasised that rural transformation requires access to knowledge, technology, infrastructure, markets, and support services. In the present study, WhatsApp groups created a foundation for peer interaction, but poor connectivity, high data costs, limited digital skills, and inadequate extension-agent involvement weakened the learning process.

Level of Adoption of Improved Agricultural Practices

The study found that the overall level of adoption of improved agricultural practices was low, with a grand mean of 2.44. This suggests that WhatsApp peer-learning had not resulted in substantial adoption of improved agricultural practices among the smallholder farmers studied. This finding demonstrates that information access alone does not guarantee adoption. Farmers also require the financial resources, inputs, technical assistance, infrastructure, and environmental conditions needed to implement the practices. The finding agrees with Aker and Ksoll (2016), who found that mobile-phone access could influence some agricultural decisions but could not eliminate wider market and production constraints. Thus, WhatsApp peer-learning should be combined with affordable inputs, credit facilities, extension services, improved transportation, storage facilities, and market support.

Qualitative Findings

Flooding and Waterlogged Farms

The qualitative findings showed that flooding and waterlogging affected planting, crop growth, harvesting, transportation, and access to farms. Farmers reported that WhatsApp groups helped them exchange information about rising water levels, damaged farms, drainage, and movement through creeks. This finding complements the quantitative results on agricultural information exchange and adoption. WhatsApp groups provided a means for farmers to communicate rapidly about flood-related risks, but digital communication could not remove the physical effects of flooding. Farmers still required drainage facilities, accessible farm routes, suitable production technologies, and institutional assistance to manage flood-related problems effectively.

Market and Transportation Challenges

The findings also showed that farmers used WhatsApp groups to obtain information about produce prices, buyers, and transportation by boat. However, the usefulness of such information was limited

when farmers lacked affordable transportation, adequate storage facilities, or direct access to buyers. This finding helps explain the relatively limited adoption of improved agricultural practices. Even when farmers obtained information about markets or production opportunities, high transport costs and difficult movement through waterways restricted their ability to sell produce profitably. Therefore, WhatsApp communication alone could not resolve the structural market and transportation problems confronting farmers in riverine communities.

Limited Active Participation

The interviews revealed that many farmers mainly read messages but did not contribute regularly. Participants explained that farmers were sometimes unwilling to post questions or share their experiences because of limited digital confidence, fear of making mistakes, high data costs, and poor network service. This qualitative evidence supports the low grand mean of 2.30 recorded for farmer participation. It shows that participation was largely passive and that the groups were not being fully used for interactive knowledge exchange. The situation limited the amount of locally generated agricultural knowledge available to other group members.

Limited Conversion of Information into Adoption

The interview findings showed that farmers sometimes received information about improved agricultural practices but were unable to implement the recommendations. The main reasons identified were high input costs, lack of credit, unavailability of improved planting materials, flooding, poor roads, and inadequate extension support. This theme explains why the overall adoption grand mean was low at 2.44 despite the marginally high exchange of agricultural information. Farmers may have access to information but lack the resources and enabling conditions necessary to act on it. The finding reinforces the view that digital extension should complement, rather than replace, input support, credit, physical extension, infrastructure, and market services.

Need for Extension-Agent Involvement

Farmers and group administrators reported that extension agents did not participate regularly in WhatsApp discussions. Participants indicated that extension-agent involvement would help verify information, correct misinformation, explain technical recommendations, and guide farmers on practices suitable for flood-prone and waterlogged areas. This finding is important because peer-generated information may not always be technically accurate or suitable for every farming environment. Regular extension-agent participation could improve the credibility of WhatsApp discussions and help farmers adapt recommendations to local conditions involving flooding, waterlogging, aquaculture, fishing, and crop production. The World Bank (2023) similarly reported that digital agriculture can improve access to information, markets, finance, extension, and advisory services but must be supported by infrastructure, electricity, logistics, digital skills, and farmer institutions.

Relationship between WhatsApp Peer-Learning and Adoption of Improved Agricultural Practices

The study found a statistically significant but weak positive relationship between WhatsApp peer-learning and the adoption of improved agricultural practices. The finding indicates that farmers who reported higher levels of WhatsApp peer-learning also tended to report slightly higher levels of adoption. This positive relationship may be because peer-learning exposes farmers to new

practices, allows them to discuss production problems, provides examples from other farmers, and encourages them to consider improved methods. The finding agrees with Aker and Ksoll (2016), who showed that mobile communication can influence agricultural decisions but cannot independently resolve broader production and market constraints. It also agrees with the World Bank (2023), which emphasised that digital agriculture should be combined with infrastructure, skills, electricity, logistics, extension services, and farmer institutions.

Conclusion

Based on the findings, the study concludes that agricultural WhatsApp groups have considerable potential to support agricultural communication among smallholder farmers in Bayelsa State, but their current contribution to farmer peer-learning and adoption of improved agricultural practices remains limited. The marginally high level of information exchange shows that WhatsApp groups are useful for circulating information on planting periods, improved planting materials, seasonal changes, weather conditions, flooding, and water management. This is particularly relevant to Bayelsa State because farming is conducted within a riverine environment characterised by creeks, waterlogged farms, seasonal flooding, and difficult transportation. However, the low level of farmer participation indicates that most farmers use the groups passively. They mainly read messages rather than asking questions, responding to other farmers, or sharing personal experiences. Consequently, the groups have not fully developed into interactive agricultural learning communities. The low level of peer-learning further shows that participation in a WhatsApp group does not automatically result in farmer-to-farmer learning. Peer-learning was restricted by limited interaction, inadequate practical demonstrations, low use of photographs and videos, poor connectivity, high data costs, and irregular participation by extension agents. The low overall level of adoption also demonstrates that access to agricultural information alone is insufficient to produce substantial changes in farming practices. Farmers require affordable inputs, credit, extension support, reliable transportation, storage facilities, electricity, network connectivity, and technologies suited to flood-prone and waterlogged environments. Although the study found a significant relationship between WhatsApp peer-learning and adoption, the relationship was weak. This indicates that WhatsApp peer-learning contributes positively to adoption but cannot independently overcome the financial, infrastructural, environmental, and institutional challenges confronting smallholder farmers in Bayelsa State. WhatsApp should therefore be viewed as a complementary agricultural extension channel rather than a substitute for physical extension services and other forms of agricultural support.

Recommendations

The study recommends that

1. Agricultural agencies should provide regular and verified WhatsApp information on planting periods, improved varieties, pest control, markets, inputs, weather, flooding, and water management.
2. WhatsApp group administrators should encourage active participation through question-and-answer sessions, farmer discussions, voice notes, and practical demonstrations.
3. Agricultural extension agents should participate regularly in farmer WhatsApp groups to verify information, correct misinformation, and provide technical guidance.
4. Government and telecommunication providers should improve network coverage, electricity supply, and affordable access to mobile data in rural and riverine communities.
5. Cooperative societies and agricultural agencies should provide farmers with affordable

improved inputs, credit, flood-management technologies, storage facilities, and transportation support.

6. Farmers should receive practical training on flood-adapted farming, drainage, improved planting materials, pest management, harvesting, and post-harvest handling.
7. WhatsApp-based extension should be integrated with physical farm visits, demonstrations, cooperative meetings, and farmer field schools because digital communication alone cannot ensure adoption.

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