# UTILISATION OF MOBILE PHONE APPLICATIONS FOR COMMUNICATION AMONG MAIZE POST-HARVEST ACTORS IN OYO STATE, NIGERIA

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## ABSTRACT

*Information and Communication Technologies (ICTs), especially mobile phone applications, are increasingly shaping communication and information exchange in agricultural value chains, including post-harvest activities. Despite these potentials, the extent of use among maize post-harvest actors (MPHAs) in Nigeria is not well studied. This study, therefore, investigated the utilization of mobile phone applications for communication among MPHAs in Oyo State, Nigeria. Specifically, it identified the types of applications used, assessed the level of usage, and examined the benefits derived from their usage. A multi-stage sampling technique was used to select 300 respondents, and data were collected through a structured interview schedule.* Data was analysed using both *descriptive and inferential statistics. The results showed that all respondents (100%) relied on phone calls and SMS for communication, with phone calls being the most frequently used ($\bar{x}$ = 2.72), followed by SMS ($\bar{x}$ = 2.36). Overall, the use of mobile applications was moderate, as reported by 61.3% of the respondents. The major benefits reported included improved dissemination and access to information on reducing post-harvest losses (100%) and increased profit (99.4%). Furthermore, years of formal education (r = 0.148) and income (r = 0.152) had significant relationships with the use of mobile phone applications. The study concluded that the MPHAs were making use of mobile phone applications at a moderate level. It is recommended that capacity-building programmes be implemented to enhance digital skills and promote effective utilization of mobile applications.*

**Keywords:** ***applications, dissemination, mobile phone post-harvest activities***

## INTRODUCTION

Almost every facet of life is impacted by information and communication technology (ICT), including education, the economy, governmental and private services, and even lifestyles. For persons and nations to flourish sustainably, it is therefore regarded as an essential component. According to the National Institute of Food and Agriculture (NIFA), ICT advancements can improve farm management practices and agricultural decision-making (National Institute of Food and Agriculture (NIFA). (2026). However, through specialized education programmes, it is crucial to keep farmers up to date with the newest agricultural technologies and techniques (Al-Ammary and Ghanem, 2023).

The evolution of ICT from a simple radio programme to machine learning and advanced analytics of agricultural data has demonstrated the power of ICT to agricultural business processes in many countries. Training and educating people are the keys to change. ICT extension services are significant factors in improving the socio-economic life of farmers in rural areas (Al-Ammary and Ghanem, 2023). Ravindra *et al*. (2020) stated that ICT, such as TVs and smartphones, has proven essential in providing farmers with valuable information about agricultural activities. Also, according

to Aldosari *et al*. (2019), farmers believe that utilizing ICT, such as mobile applications, will provide better information flow that directly connects them with agriculture extension services providers.

Mobile applications have revolutionized the way farmers interact with information and technology, empowering them with a wealth of data at their fingertips (Albarakati *et al.*, 2022). By harnessing the power of smartphones and the internet, these apps have transcended traditional agricultural practices, enabling farmers to make more informed decisions that directly impact their yields and profitability (Kamal and Bablu, 2023). Moreover, farmers can make well-informed decisions about when and where to sell their produce, guaranteeing the highest returns, by obtaining current crop prices. Additionally, mobile applications can give farmers useful information about the nutrient levels and health of the local soil, allowing them to adjust their irrigation and fertilization plans. By lowering the need for dangerous pesticides and encouraging sustainable farming methods, customized pest management strategies further protect crops from possible threats. Mobile applications are revolutionary in leveling the playing field in areas with limited access to traditional agricultural extension services (Ahmad *et al*., 2021).

In addition to facilitating direct communication between farmers and consumers, mobile applications are essential for exchanging best practices and expertise. With the help of these applications, farmers can make well-informed decisions and maximize their output by receiving information on market demands, weather forecasts that help them prepare for approaching storms or droughts by taking precautions to protect crops and livestock, and professional guidance. Farmers receive a fair portion of the earnings when middlemen are eliminated, and customers may purchase fresh fruit at competitive costs. These apps also encourage sustainable farming methods, which lessen their negative effects on the environment and build a more robust ecosystem. In the end, this digital revolution boosts smallholders, rural economies, and global food security (Chakraborty *et al.*, 2022; Nguyen *et al*., 2020).

The emergence of mobile applications has made it possible for farmers to access financial services, which has long been a barrier to their development. Farmers all over the world now have more opportunities thanks to these creative solutions, which include digital payment systems, mobile banking, and access to credit and insurance services. Farmers can now effectively manage risks and obtain capital for investments in resources that increase productivity by embracing these technological advancements. Additionally, increased financial inclusion gives farmers the information they need to make wise choices, embrace sustainable practices, and engage more fully in markets. The agricultural sector is positioned for previously unheard-of growth and resilience as this positive transformation picks up steam (Kamal and Bablu, 2023).

For farmers, extension services have become a lifeline, connecting rural communities with state-of-the-art farming methods. Experts are now even more able to assist outside of geographical boundaries thanks to the development of mobile applications. Farmers can obtain information, professional guidance, and customized solutions for their unique problems through interactive platforms. These apps also make it easier for farmers to share best practices, creating a vibrant network of farmer-to-farmer learning. This digital strategy encourages sustainable practices, resource conservation, and increased agricultural productivity. The

cooperation between mobile applications and extension services will surely be crucial in advancing global agricultural development as technology develops (Magomadov, 2019; Ren *et al*., 2020).

Although Information and Communication Technologies (ICTs) and mobile phone applications have been widely acknowledged as transformative tools in agricultural production and extension services, their specific utilization among maize post-harvest actors (MPHAs) in Nigeria remains largely underexplored. Most existing studies emphasize farmers at the production stage, overlooking the critical role of post-harvest actors who are central to reducing losses, improving market efficiency, and enhancing profitability within the maize value chain. Hence, this study assessed the utilisation of mobile phone applications for communication among maize post-harvest actors in Oyo State, Nigeria.

The specific objectives of this study were to (i) identify the types of mobile phone applications used for communication by maize postharvest actors; (ii) examine the level of usage of mobile phone applications for communication by the respondents; and (iii) examine the benefits of using mobile phone applications by the respondents.

***Statement of Hypothesis:***

$H_{o1}$: There is no significant relationship between the socioeconomic characteristics of the respondents and their usage of mobile phone applications for communication.

## METHODOLOGY

***Area of study***

The study was carried out in Oyo State, Nigeria, which is located at latitude 8°00'N of the equator and longitude 4°00'E of the Greenwich meridian (Adewuyi et al., 2018). The Republic of Benin, Kwara State, Osun State, and Ogun State encircle it on the west, north, east, and south. The state's tropical climate causes it to have distinct rainy and dry seasons. The temperature is 21°C on average every year. Between 230 and 260 days a year are considered the wet season. Oyo State's climate supports the cultivation of many crops, including staple grains, fruits, vegetables, cereals, roots, and tubers, which supply raw materials to both small and large companies.

***Sampling procedure and sample size***

The respondents for the study were those involved in maize processing and marketing. Oyo State is divided into four Agricultural Zones by the Oyo State Agricultural Development Programme (OYSADEP), which are Ibadan/Ibarapa (14 Local Government Areas (LGAs)), Saki (10 LGAs), Ogbomosho zones (5 LGAs), and Oyo (4 LGAs). A multi-stage systematic sampling procedure was used to select respondents for the study. At the first stage, 30% of the LGAs in each agricultural zone were randomly selected, resulting in four LGAs from the Ibadan/Ibarapa zone, three LGAs from the Saki zone, two LGAs from the Ogbomosho zone, and one LGA from the Oyo zone, giving a total of 10 LGAs.

Three communities with the highest involvement in maize processing and marketing were purposively selected at the second stage from each of the 10 LGAs to give a total of thirty communities. At the third stage, the snowball sampling technique was used to select 5 processors and 5 marketers from each community to give 150 processors and 150 marketers. In all, 300 respondents were selected for the study. A well-structured interview schedule was used to collect quantitative data, while a Focus Group Discussion guide was used to collect qualitative data in achieving the objectives.

***Measurement of variables***

Usage of mobile phone applications by post-harvest actors of maize was operationalized

using the extent of utilizing 15 apps for communication and the forms of using the applications by post-harvest actors of maize. The extent of utilizing the mobile phone applications was measured using 4 points scale ranging from never (0), rarely (1), occasionally (2), and always (3). The mobile phone applications investigated were Facebook, WhatsApp, X formerly "Twitter", LinkedIn, Instagram, YouTube, Skype, Google Meet, Zoom, Mixlr, Free Conference, Messenger, Telegram, phone calls, and SMS. The forms of getting information through the media were listed as text (1), audio (1), picture (1), and video (1), and the respondents selected the forms of using each of the applications. The total score of each respondent was used as the mobile phone application utilization score. The minimum score was zero (0), and the maximum was 630. The respondents were categorized into three groups - low, moderate, and high using composite mean and standard deviation. The fifteen mobile phone applications were listed, and the respondents were asked if they use them (Yes=1) or not (No=0) to achieve the types of applications they use. The respondents were also asked to indicate the benefits they derived from using the applications by selecting no (0) or yes (1). Means, frequency counts, percentages, and standard deviation were used to summarize and describe the data.

## RESULTS AND DISCUSSION

### *Socio-economic characteristics*

The result in Table 1 shows that the mean age for (MPHAs) was 41±8. This result concurs with Agbongiarhuoyi *et al.* (2020) finding that the mean age of respondents using ICT for marketing agricultural produce was 41 years. This is an indication that active, youthful, and productive people dominate the agriculture industry. Therefore, it is expected that young people's natural curiosity will increase their usage of mobile phone applications (apps). This assertion aligns with the characterization of Nigerian youth by Akinyemi et al. (2024) as technology-inclined and heavy users of smartphones, which suggests a natural propensity to engage with digital agricultural tools.

The mean household size for MPHAs was 6±2 persons. This indicates that MPHAs had a fairly small household size. The size of a household is also a determinant of the extent of involvement in diverse maize post-harvest activities. This finding is similar to the submission of Akinwale *et. al.* (2019), who reported that maize farmers had a mean household size of 5 persons in Ondo State.

The mean year of formal education for the MPHAs was 13.7±1.7 years. This denotes that MPHAs ' high literacy rates have an impact on how well they utilize mobile phone functions and applications. The implication of this is that the educational level of MPHAs will enhance their knowledge of post-harvest activities as well as make well-informed decisions towards averting post-harvest losses. This finding is consistent with the studies of Aldosari et al. (2019) and Alabi et al., 2025 that have established a positive relationship between educational level and technology adoption among agricultural actors in Nigeria.

All the respondents had access to social media, though with differences in frequency of usage, with 52.3 percent of the MPHAs using social media daily, 47.0 percent using it once in a while, and just 0.7 percent using it weekly.

**Table 1: Socio-economic characteristics**

| Variables | Total (n=300) | | |
|---|---|---|---|
| | **Freq.** | **%** | **Mean ± SD** |
| **Age (years)** | | | |
| 15-24 | 7 | 2.3 | |
| 25-34 | 47 | 15.7 | |
| 35-44 | 149 | 49.7 | 41±8 |
| 45-54 | 89 | 29.7 | |
| 55+ | 8 | 2.7 | |
| **Household size (persons)** | | | |
| 1-3 | 25 | 8.3 | |
| 4-5 | 98 | 32.7 | |
| 6+ | 177 | 59.0 | 6±2 |
| **Formal education (years)** | | | |
| 5-9 | 4 | 1.3 | |
| 10-14 | 173 | 57.7 | |
| 15+ | 123 | 41.0 | 13.725±1.693 |
| **Access to social media** | | | |
| Yes | 300 | 100 | |
| **Usage of social media** | | | |
| Once in a while | 141 | 47.0 | |
| Weekly | 2 | 0.7 | |
| Daily | 157 | 52.3 | |

*Source: Field survey, 2022*

***Types of mobile phone applications***

The result in Table 2 reveals that all (100%) MPHAs utilized the app for making calls and sending SMS. Additionally, respondents used Facebook (98.7%), WhatsApp (72.7%), X (Twitter) (60.0%), and LinkedIn (54.7%). They also used Telegram (44.3%), Telegram (44.3%), Instagram (49.0%), and Messenger (35.7%), among others. This result indicates that phone calls, SMS, Facebook, and WhatsApp were the main mobile phone applications utilized by the MPHAs. This suggests that MPHAs are progressively integrating social media into their post-harvest operations. The ease of operation of these apps may be attributed to their low data requirements, widespread network coverage in rural Nigeria, and how simple they are to use. The findings also supported Ajayi et al.'s (2021) assertion that Facebook is the most popular social media platform globally, with over 1.87 billion monthly active users. This indicates a significant opportunity for extension specialists.

**Table 2: Types of mobile phone applications**

| Mobile phone application | Total (n=300) | |
|---|---|---|
| | Frequency | % |
| SMS | 300 | 100 |
| Phone call | 300 | 100 |
| Facebook | 296 | 98.7 |
| WhatsApp | 218 | 72.7 |
| X (Twitter) | 180 | 60.0 |
| LinkedIn | 164 | 54.7 |
| Instagram | 147 | 49.0 |
| YouTube | 139 | 46.3 |
| Telegram | 133 | 44.3 |
| Messenger | 107 | 35.7 |
| Skype | 81 | 27.0 |
| Mixlr | 63 | 21.0 |
| Free conference | 62 | 20.7 |
| Zoom | 29 | 9.7 |
| Google meet | 19 | 6.3 |

*Source: Field survey, 2022*

***Level of usage of mobile phone applications***

***Extent of using mobile phone applications for communication***

The result in Table 3 shows the extent of using the application to receive general information on post-harvest activities from respondents. Phone call ranked as the most used app by the maize post-harvest actors ($\bar{x}$ = 2.72), which could be a result of the way the application is designed and is simple to use. SMS ranked second ($\bar{x}$ = 2.36), which meant that it was used for sending and receiving information on post-harvest activities. SMS is another application that is built into all phones. Its frequent use may be a result of the minimal time required to send a message, because the fact that it does not require a sophisticated mobile phone or a very strong internet connection. Facebook ranked third among the applications used for obtaining information on maize post-harvest activities ($\bar{x}$ = 2.24). This could be because the application is a social media platform which is open to a wide range of people, where groups of different agricultural commodities stakeholders can be created, allowing members from any part of the world to share and receive information. WhatsApp was occasionally used ($\bar{x}$ = 2.10). Furthermore, X (Twitter) ($\bar{x}$ = 1.74) and YouTube ($\bar{x}$ = 1.64) was occasionally used. This could be because the application is basically used to obtain information in video format. This finding aligns with Afolabi et al. (2025), who reported that text messaging, Facebook, and WhatsApp were highly accessible to maize farmers in Nigeria

**Table 3: Extent of use of mobile phone applications to get information on post-harvest activities**

| Applications | Capital | Storage | Transportation | Processing | Market | Price | Overall |
|---|---|---|---|---|---|---|---|
| | Mean | Mean | Mean | Mean | Mean | Mean | Mean |
| Phone call | 2.56 | 2.26 | 2.63 | 2.53 | 2.48 | 2.81 | 2.72 |
| SMS | 2.29 | 2.20 | 2.18 | 2.31 | 2.24 | 2.31 | 2,36 |

| Applications | Capital | Storage | Transportation | Processing | Market | Price | Overall |
|---|---|---|---|---|---|---|---|
| | Mean | Mean | Mean | Mean | Mean | Mean | Mean |
| Facebook | 2.09 | 1.82 | 1.63 | 2.43 | 1.91 | 2.08 | 2.24 |
| WhatsApp | 1.98 | 1.68 | 1.50 | 2.43 | 1.96 | 2.15 | 2.10 |
| X (Twitter) | 1.50 | 1.36 | 1.27 | 1.90 | 1.47 | 1.51 | 1.74 |
| YouTube | 1.25 | 0.98 | 0.87 | 1.41 | 1.12 | 1.26 | 1.64 |
| Instagram | 1.20 | 0.96 | 0.89 | 1,17 | 1.11 | 1.23 | 1.61 |
| LinkedIn | 1.05 | 1,00 | 0.95 | 0.97 | 0.98 | 0.86 | 1.43 |
| Messenger | 0.48 | 0.36 | - | 0.01 | 0.43 | - | 1.21 |
| Zoom | 0.47 | 0.47 | 0.47 | 0.93 | 0.47 | 0.47 | 1.20 |
| Free conference | 0.37 | 0.37 | 0.37 | 0.73 | 0.37 | 0.37 | 1.16 |
| Mixlr | 0.36 | 0.27 | 0.36 | 0.71 | 0.36 | 0.36 | 1.15 |
| Skype | 0.41 | 0.41 | 0.41 | 0.62 | 0.41 | 0.41 | 1.13 |
| Telegram | 0.09 | 0.08 | 0.01 | 0.12 | 0.02 | 0.11 | 1.03 |
| Google meet | 0.07 | 0.05 | - | - | - | - | 1.00 |

Never=0: Rarely=1: Occasionally=2: Always=3
Source: Field survey 2022

***Forms of using mobile phone applications for communication***

Results in Table 4 show that the majority (98.7%) of the MPHAs used Facebook to send and receive information in the form of text, 60 percent in the form of pictures, 31.7 percent in the form of video, and 10 percent in the form of audio. Information through WhatsApp was received and sent in the form of text by 72.7 percent of the respondents, 60 percent in the form of video, 57 percent in the form of audio, and 50.7 percent in the form of a picture. The phone call app was used by all (100%) of the respondents in the form of audio because that is the only means by which the application can be used. SMS was also used by all (100%) of the respondents in the form of text. X (Twitter)was used in the form of text (60.0%), picture (38.3%), audio (29.7%), and video (27.7%). Instagram was used in the form of text (49.0%) and audio (29.7%). YouTube was used in the form of video (44.0%), picture (19.3%), text (14.0%), and audio (7.3%).

The result of getting information through text would be as a result of the ease with which information can be sent and received through it. Phone calls were used by all the respondents in the form of audio because it is the only means by which the application can be used. SMS was also used by all the respondents in the form of text because it is the main means of getting information. The extent of getting information in the form of audio on WhatsApp is probably due to the ease of getting information through audio, especially when the user is not in a convenient position to send text, and because the sender's intention could be easily communicated in the form of audio rather than text. Video format is also high due to short clips of video that can be easily sent on WhatsApp and personal status at a low rate of data consumption. YouTube was used in the form of video because it is an application that projects information mainly in the form of video. The majority of the respondents used X (Twitter) in the form of text because most tweets are sent and received in the form of text. Instagram is usually used to send and receive information in the form of videos and pictures, combined with text to provide more information about the pictures or videos.

**Table 4: Forms of using mobile phone applications**

| Mobile phone applications | Text | Audio | Picture | Video |
|---|---|---|---|---|
| *Facebook | 98.7 | 10.0 | 60.0 | 31.7 |
| *WhatsApp | 72.7 | 57.0 | 50.7 | 60.0 |
| *Phone call App | - | 100.0 | - | - |
| *SMS | 100.0 | - | - | - |
| * X (Twitter) | 60.0 | 29.7 | 38.3 | 27.7 |
| *Instagram | 49.0 | 14.3 | | |
| *YouTube | 14.0 | 7.3 | 19.3 | 44.0 |
| *Messenger | 35.7 | 17.3 | 23.3 | 12.7 |
| *LinkedIn | 54.7 | 22.0 | 21.0 | 33.0 |
| *Zoom | 8.0 | 9.0 | 5.3 | 9.7 |
| *Telegram | 44.3 | 39.7 | 32.0 | 24.7 |
| *Free conference | 10.0 | 12.0 | 8.3 | 20.0 |
| *Mixlr | 16.0 | 21.0 | 2.0 | - |
| *Google Meet | 1.3 | 6.3 | 0.7 | 1.0 |
| *Skype | 4.0 | 7.0 | 2.0 | 27.0 |

* Multiple responses
Source**:** Field survey, 2022

***Level of usage***

The results in Table 5 show that 61.3 percent of the MPHAs were using the application at a moderate level, 23.7 percent were using it at a low level, while 15 percent at a high level. This shows that the majority of the respondents used the applications at a moderate level. The implication of this moderate level of usage of the applications among respondents could be that the understanding of their usage for agricultural information dissemination is low and needs more improvement. Better knowledge and a positive attitude towards these tools could influence their level of usage. Therefore, more advocacy programmes aimed at boosting the level of usage of the applications could be introduced.

**Table 5: Level of usage of mobile phone applications for communication among maize post-harvest actors**

| Level of usage | Post-harvest Actors | |
|---|---|---|
| | Frequency | Percentage |
| Low (insert the value) | 71 | 23.7 |
| Moderate (insert the value) | 184 | 61.3 |
| High (insert the value) | 45 | 15.0 |

Source**:** Field survey, 2022

***Benefits derived from using mobile phone applications***

The findings in Table 6 show that respondents enjoyed several benefits from using mobile phone applications. All (100%) of the MPHAs reported that the apps helped them share and receive information on reducing post-harvest losses. Nearly all (99.4%) of the respondents also indicated that the apps enabled direct contact with

producers without relying on middlemen and contributed to increased profits. In addition, 99.4 percent of the MPHAs indicated the apps were useful for accessing information on new post-harvest technologies. Mobile phone applications provide business owners with access to current and pertinent business data. Younger agricultural entrepreneurs will have more opportunities to build their own networks and websites, independent of location or time. As a result, they could use e-advertisements to market their goods in both domestic and foreign markets. This result agrees with Ajayi *et al.* (2021) that the use of mobile phones facilitated access to needed information about new agricultural techniques, increased income and profit, gained access to weather forecast information and enabled connectivity with consumers and traders.

**Table 6: Distribution of respondents based on the benefits derived from using mobile phone applications, n=300**

| Benefits | Frequency | Percentage (%) |
|---|---|---|
| Disseminate and receive information on reducing post-harvest loss | 300 | 100.0 |
| Direct contact with the producer | 298 | 99.4 |
| Increase in profit | 298 | 99.4 |
| Received information on new maize post-harvest technologies | 298 | 99.4 |
| Information on improving the product | 296 | 98.7 |
| Easy access to information on the weather in different markets | 296 | 98.7 |
| Connection to maize buyers | 296 | 98.7 |
| Information on the latest price | 294 | 98.0 |
| Information to loan | 294 | 98.0 |
| Information from agro-allied industries | 294 | 98.0 |
| Contact with other maize post-harvest stakeholders | 292 | 97.4 |
| Getting feedback from customers | 292 | 97.3 |
| Ability to display products | 290 | 96.7 |
| Getting information on the market day | 288 | 96.0 |
| Track input supply industries | 288 | 96.0 |
| Connecting to trusted transporters | 288 | 96.0 |

Source**:** Field survey, 2022

***Test of Hypothesis***

$H_{01}$: There is no significant relationship between the socioeconomic characteristics of the respondents and their usage of mobile phone applications for communication.

Results in Table 7 show that years of formal education ($r = 0.148$, $p<0.05$) and estimated annual income ($r = 0.152$, $p<0.05$) had positive and significant relationships with the usage of mobile phone applications for communication among maize post-harvest actors (MPHAs). This implies that as respondents' educational attainment and income levels increased, their utilization of mobile applications for communication for maize post-harvest activities also increased. Education possibly exposed the respondent's awareness of the benefits of mobile applications for enterprise improvement or

information access, while higher income may have facilitated access to smartphones and data services, reinforcing continued usage. This agrees with the submission of Akinwale *et al*. (2019), who found a significant correlation between educational level and mobile phone utilization among maize entrepreneurs in Ondo State.

**Table 7: Results of the correlation between socioeconomic variables of Maize Postharvest Actors' usage of mobile phone applications for communication**

| Variables | r-value | p-value |
|---|---|---|
| Age | 0.048 | 0.563 |
| Household size | 0.038 | 0.643 |
| Years in formal education | 0.148* | 0.000 |
| Annual nnual income | 0.152* | 0.000 |

*Significant at P≤ 0.05; r = correlation coefficient: p = probability value
Source: Field survey, 2022

## CONCLUSION AND RECOMMENDATIONS

The study concludes that there was a universal reliance on basic voice (phone calls), text functions (SMS), and social media messaging apps (Facebook and WhatsApp) by the MPHAs. The benefits derived from the usage of mobile phone apps by the respondents were substantial, as the majority of the respondents reported improved dissemination and receipt of information on reducing post-harvest losses, as well as having direct contact with the producers, bypassing the middlemen. As a result, they used mobile phone applications meaningfully, though at a moderate level. The study, therefore, recommends that extension agencies and relevant stakeholders should implement targeted digital literacy training workshops, seminars, and other means to enhance the MPHAs digital skills in using WhatsApp, Facebook groups, and emerging apps for agricultural information and networking. Also, dissemination efforts should prioritize low-bandwidth tools such as phone calls, SMS, and WhatsApp tools for timely, location-specific post-harvest advice, given their high acceptance and accessibility.

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