

## Exploring Mobile Phone Usage for Agricultural Inputs Access among Smallholder Farmers in Mpwapwa District, Tanzania: Demographic Factors, Access Methods, and Challenges

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### ABSTRACT

*This study investigates how smallholder farmers in Mpwapwa District, Tanzania, utilize mobile phones to access crucial agricultural input information. The study was grounded on theory of reasoned action (TRA) and gratification theory (UGT). Utilizing a case study design with a quantitative approach, data were collected from 384 participants through structured surveys. The data collected were analyzed using the Statistical Package for Social Sciences (SPSS). The findings reveal significant demographic influences on mobile phone usage, particularly highlighting the active participation of the 19–39 age groups in seeking agricultural information. Various methods employed by farmers to access farm input information were assessed, demonstrating a reliance on mobile technology despite existing challenges. These challenges include knowledge gaps, financial constraints, and limited technical skills, which impede effective usage. The study emphasizes the importance of targeted interventions to enhance mobile technology adoption among farmers. Recommendations are provided to optimize mobile phone use, aiming to improve farmers' access to essential agricultural inputs and ultimately enhance productivity.*

**Keywords:** Input Information, ICT Interventions, Mobile Phone Usage, Technology Adoption, Smallholder Farmers

### I. INTRODUCTION

At the heart of Sub-Saharan Africa, where agriculture remains the cornerstone of the economy and livelihoods of millions, the integration of modern technologies has become a vital catalyst for agricultural development (Garzón et al., 2020). Smallholder farmers constitute a substantial proportion of the agricultural workforce in many African nations including Tanzania (Mgendi, et al., 2021). Their success is integral not only for national food security but also for the economic well-being of rural communities (Mupambwa et al., 2022).

The fourth industrial revolution, mobile phones, has emerged as a powerful tool for transforming various aspects of life, including agriculture (Campa, 2020). The pervasive penetration of mobile telecommunication infrastructure in sub-Saharan Africa has enabled remote communities to connect with the world, access information, and leverage services once beyond their reach (Nan et al., 2020). For smallholder farmers, mobile communication presents a unique opportunity to overcome barriers related to access to critical agriculture information, knowledge, and resources (Ireru et al., 2021).

Mobile phones have significantly transformed agriculture in Tanzania, making it easier for stallholder farmers, particularly younger ones, to access crucial market information and enhance product quality and quantity (Quandt et al., 2020). Frequent mobile phone use by horticultural farmers in Mwanza has demonstrated economic benefits, particularly in terms of information transfer (Krone & Dannenber, 2018). However, the use of mobile phones to acquire information about farm inputs remains limited owing to challenges such as network connectivity issues and lack of technical knowledge (Misaki et al., 2018). Farmers rely mainly on face-to face communication for knowledge (Skaalsveen et al., 2020). With the proliferation and ubiquity of ICTs especially mobile phones and internet, there has been an exponential increase in ICT based agricultural information services (Muhanguzi & Ngubiri, 2022). To promote mobile phone usage for agricultural information and overcome existing limitations, additional efforts are needed (Emeana et al., 2020).

Given these dynamics, the main goal of this study is to evaluate the role of mobile phones in improving smallholder farmers' access to vital agricultural information in Tanzania's Mpwapwa district. Specifically, this study aims to investigate the relationship between farmers' demographics and their use of mobile phones to learn about farm inputs, assess the methods used to access farm input information, and identify the obstacles faced when using mobile phones for this purpose.

## II. THEORETICAL FRAMEWORK

The theoretical framework guiding this study is based on two key theories: the theory of reasoned action (TRA) and gratification theory (UGT). The Theory of Reasoned Action (TRA), proposed by Ajzen and Fishbein (1980), explains how a person's attitude, which is shaped by their beliefs about the outcomes of a behavior, influences their behavioral intentions. In this study, TRA helps explain how farmers' attitudes and social norms affect their use of mobile phones to access agricultural input information. The Uses and Gratifications Theory (UGT), introduced by Katz et al. (1973), explores how individuals actively choose media to satisfy specific needs. UGT is relevant to this study because it highlights how smallholder farmers intentionally use mobile phones to meet their agricultural information needs, providing insight into user behavior. Both theories contribute to understanding the variables influencing farmers' adoption and usage of mobile phones for accessing farm input information in this study.

## III. METHODOLOGY

### 3.1 Research Design

The study employed a quantitative research approach. Specifically, a case study design guided the research. The study was conducted in Mpwapwa District, Tanzania, focusing on smallholder farmers to explore their usage of mobile phones for accessing agricultural input information. This design allowed for an in-depth examination of the relationship between demographic factors and mobile phone usage, as well as the methods employed for accessing farm input information and the challenges faced by farmers in the district, ensuring the collection of relevant and high-quality data.

### 3.2 Population and Sampling

The population for this study comprises all smallholder farmers residing in different villages in Mpwapwa district. This population includes farmers engaged in crop farming, animal husbandry, and those involved in both activities. The sample size for this study was determined using Cochran's sample size formula. The calculated sample size was 384 respondents. A multistage sampling technique was applied, starting with the purposive selection of Mpwapwa Mji division due to its large number of smallholder farmers and good mobile phone coverage. One ward, Matomondo, was selected, and from this ward, three villages (Tambi, Mlembule, and Mwenzele) were chosen.

The sample size for each village was determined based on the population distribution, with 145 respondents from Tambi, 138 from Mlembule, and 101 from Mwenzele. The final selection of respondents was carried out through systematic random sampling, with every second smallholder farmer selected from a list provided by the Village Agricultural Extension Officer (VAEO).

### 3.3 Validity and Reliability

In this study, validity was established through expert reviews, where experienced lecturers and statisticians evaluated the research instruments to ensure alignment with the study objectives and relevance to the problem being investigated. Content validity was further strengthened by refining the questionnaire based on expert feedback. Criterion and concurrent validity tests were conducted to ensure that the instrument accurately predicted the relevant outcomes and produced results consistent with established measures. Reliability was established by piloting the questionnaires, ensuring that responses were consistent and making necessary adjustments to improve clarity and precision.

### 3.4 Instruments

The instrument used for data collection in this study was a semi-structured questionnaire. The questionnaire was designed to gather data on respondents' demographics, mobile phone ownership, and their use of mobile phones to access agricultural information. The items were constructed based on the study's objectives to ensure relevance and clarity in addressing the research problem. The questionnaire was refined through consultations with experts to enhance its validity and accuracy.

### 3.5 Data Analysis

The data collected for this study were verified for accuracy, coded, and analyzed using the Statistical Package for Social Sciences (SPSS) to align with the study's objectives. To investigate the relationship between farmers' demographics and their use of mobile phones to learn about farm inputs, a Chi-square test was conducted. This analysis explored associations between mobile phone access and demographic characteristics such as age, gender, education, and marital status, assessing how these factors influenced farmers' usage of mobile phones in accessing farm input information.

Descriptive analysis was employed to assess the methods used to access farm input information. Key questions analyzed included the respondents' primary sources of information regarding agricultural inputs. To identify the

obstacles that smallholder farmers encounter when using mobile phones to access farm inputs, descriptive analysis was again employed.

### 3.6 Ethical Considerations

Ethical concerns were prioritized throughout the research process to ensure participant integrity and trust. The researcher introduced themselves, clearly explained the study's goals, and obtained informed consent from all participants. Emphasizing the academic nature of the data use, participants were assured of their right to withdraw at any time without negative consequences. This transparency allowed respondents to make informed decisions about their involvement.

To protect participants' privacy, strict measures were implemented to ensure data confidentiality. All collected data were anonymized, with personal identifiers removed to prevent identification. The researcher maintained open communication, encouraging participants to ask questions or express any concerns during data collection. These ethical considerations aimed to uphold the dignity and rights of all participants, fostering an environment of trust and respect.

## IV. FINDINGS & DISCUSSION

This section presents the analysis of smallholder farmers' use of mobile phones to access farm input information in Mpwapwa district. The findings address three key research questions: First, how do farmers' demographics (age, gender, education, and marital status) affect their use of mobile phones to learn about farm inputs? Second, what are the methods used to access farm input information? Lastly, what obstacles do they face in accessing this information by using mobile phones? These findings align with the study's objectives of investigating the relationship between demographics and mobile phone use, assessing the methods used to access farm input information, and to identify the challenges facing smallholder farmers in the usage of mobile phones for accessing farm inputs information.

### 4.1 Response Rate

A total of 91% of the 384 participants in the study in Mpwapwa District responded, which according to Munda and Legrand (2014), is deemed sufficient for credible results.

#### 4.1.1 Impact of Farmers' Demographics on Mobile Phone Use for Farm Inputs

Table 1 shows a nearly balanced gender distribution, with 43.4% male and 56.6% female respondents indicating equal involvement in farming activities. According to the survey, both male and female respondents used mobile phones for farming, with female respondents potentially using them less frequently because of household responsibilities. These results are in line with Levi (2015) who argues that both males and females are equally participating in production because of the increase in responsibilities to both parties.

Also, table 1 presents an overview of the age distribution of smallholder farmers in the Mpwapwa district. According to table 1, most respondents in the Mpwapwa district were between the ages of 19 and 29 and 30 and 39 respectively. The result ties with that of Krone et al. (2014) who found that the age group between 21 to 40 years as the most dominant among farmers due to the responsibilities they have to feed the families. This age group of farmers can easily adopt and use mobile phone technologies in accessing farm input information and consequently maximize efficiency as to increase farm production. Furthermore, Nwokoye et al. (2019) established that the degree of awareness, farmers' perceptions, educational attainment, income level, age, training, and cost of ICT devices are significant determinants of farmers' ICT adoption.

In addition, table 1 shows that, most respondents in the three communities in the Mpwapwa district had completed secondary school (44.3%), followed by vocational training (39.7%), with only 16% having completed primary school. Low literacy levels remain a barrier, affecting the ability to utilize mobile technology. This finding supports the opinion of Raza et al. (2020) who emphasized that the majority of farmers in rural areas have not gone for higher-level education and that farmers' low literacy levels hinder their ability to read, write, and understand technical concepts, which has a detrimental impact on their ability to adapt to technology.

Furthermore, table 1 provides a thorough picture of the research population by summarizing respondents' marital status in the three villages in the Mpwapwa area. According to table 1 54% of respondents were married while 23% were single at the time of the survey. Other marital situations included being separated (3%), widowed/widowed (5%), divorced (4%), and relationships (11%). These finding denotes that married people dominate the farming activities in the district than the other categories. These findings support those of Astatike and Gazuma (2020), who found that marital status, affects mobile phone ownership, indicating the dominance of married people in farming activities in the district.

According to table 1, 44.3% of the respondents owned farms as personal property, 42.9% owned family farms, 8% owned rental farms, and 4.9% owned cooperative farms. These results support the research of Wordofa et al. (2021),

who agree that there is a relationship between family economic status and the adoption of new technology. Farm ownership denotes the economic level of the respondent and plays a significant role in both technology acceptance and use.

**Table 1**

*Demographic Characteristics of Respondents (n=350)*

Demographic Variable	Category	Frequency	Percentage
Gender	Male	198	43.4
	Female	152	56.6
Age	>18 years	12	3.4
	19-29	117	33.4
	30-39	192	54.9
	40-49	29	8.3
Educational level	Primary	56	16.0
	Secondary	155	44.3
	Vocational training	139	39.7
Marital status	Married	189	54.0
	Unmarried	79	23.0
	Divorced	14	4.0
	Widow/widower	18	5.0
	Separated	11	3.0
	In a relationship	39	11.0
Type of farm ownership	Personal property	155	44.3
	Family farm	150	42.9
	Rented farm	28	8.0
	Cooperative farm	17	4.9

#### 4.1.2 Methods used to Access Farm Input Information

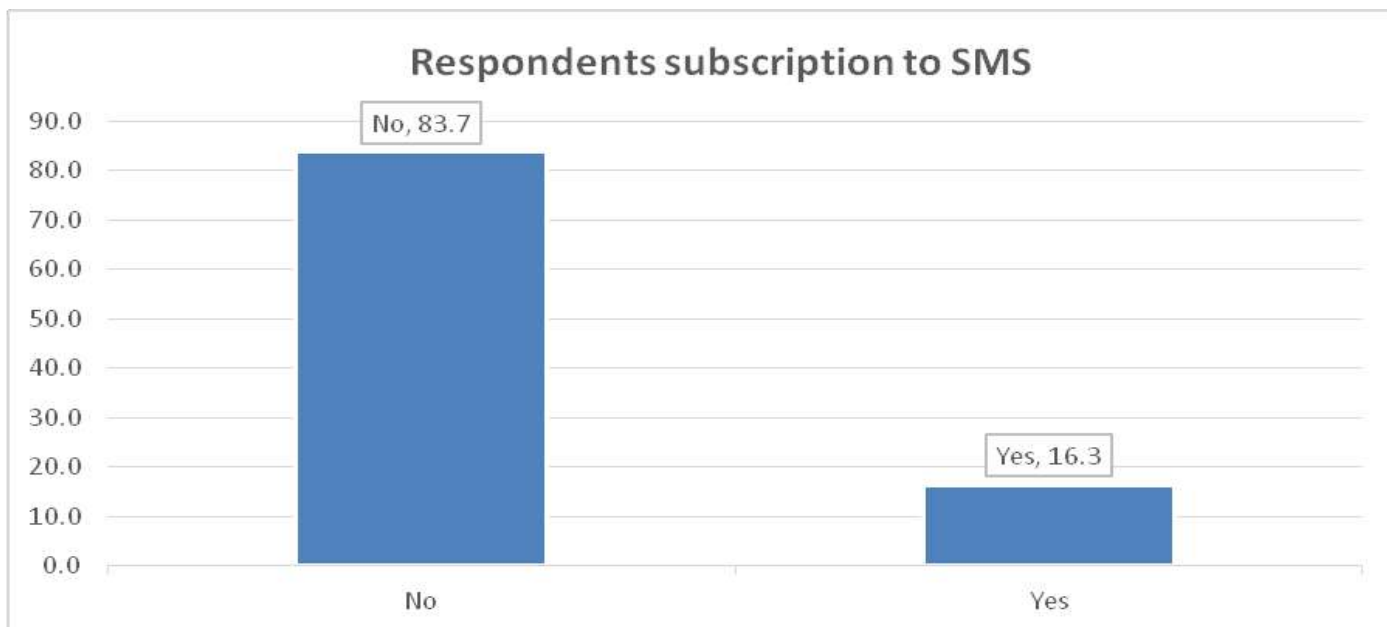
This study examined how respondents acquired information on farm inputs (table 2). The findings indicated that 59.4% of the respondents relied on conversations with other smallholder farmers for information about agricultural inputs, while 2.6% cited newspapers, 6% noted radio, and 1.7% mentioned television. The predominance of peer discussions as the primary source of farm input information aligns with Nassanga et al. (2013), who observed that in areas with limited access to electricity, farmers often prefer informal peer conversations for information access due to the high costs and unreliability of solar-powered devices.

**Table 2**

*Methods used to Access Farm Input Information (n=350)*

Response	Frequency	Total
Discussion with farmers	208	59.4
Newspapers	9	2.6
Radio	2	0.6
Television	6	1.7
<b>Total</b>	<b>350</b>	<b>100</b>

Figure 1 illustrates that 63% of the respondents' owned smartphones, while 37% owned feature phones during the data collection period. Most respondents fell into two youth-oriented age groups: 33.4% were between the ages of 19 and 29, and 54.9% were between the ages of 30 and 39, suggesting a greater likelihood of embracing technology. These findings echo Balkrishna and Deshmukh (2017), who noted that the majority of farmers are increasingly using mobile phones equipped with Internet and social media applications.



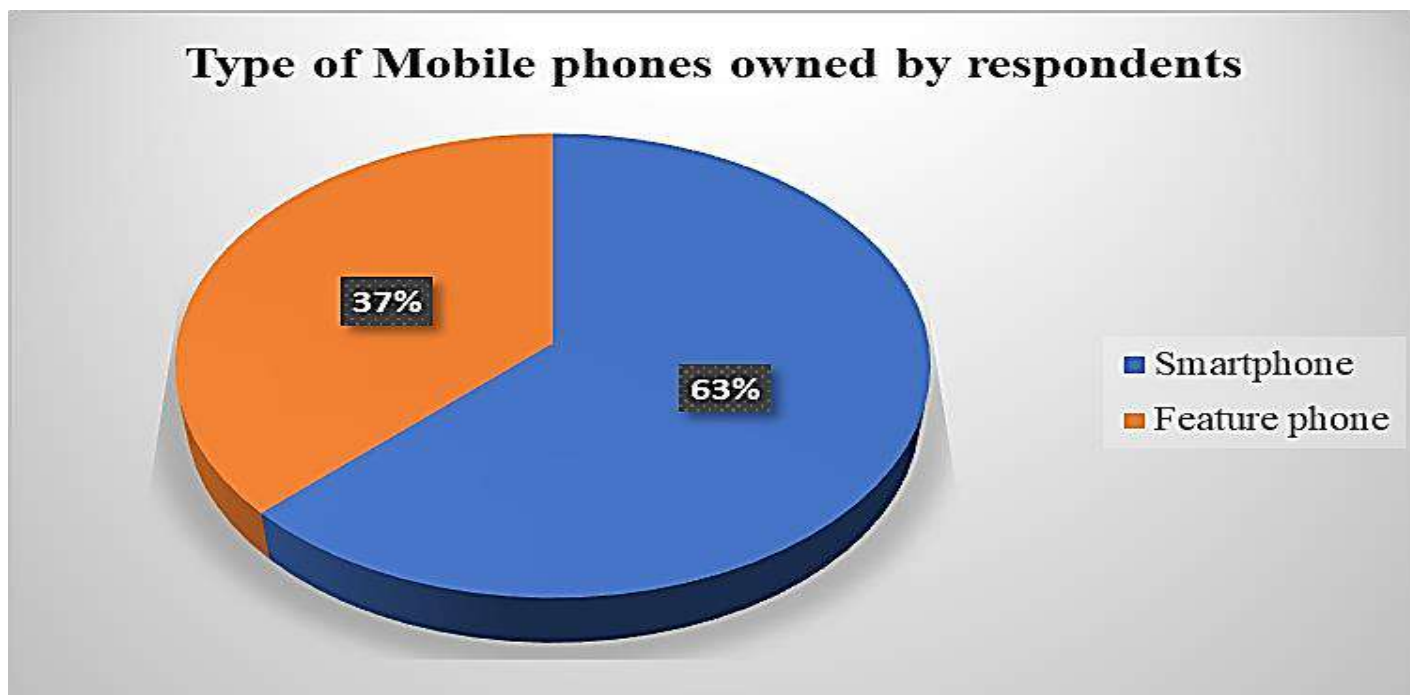
**Figure 1**  
*Type of Mobile Phones Owned by Respondents*

According to table 3 77% of the respondents indicated they used their mobile phones to access information about farm inputs, while 23% reported they had not done so. Specifically, 33.7% accessed information from family members, 24.2% spoke to progressive farmers, and 15% consulted agricultural officers. Another 2% interacted with entrepreneurs and smallholder farmers' NGOs, supporting the findings by Nyamba (2017) who found that mobile phones facilitate information exchanges. Also, these results are consistent with Ben Yishay and Williams (2018), who observed that farmers often rely on personal observations and peer conversations for information.

**Table 3**  
*Information Received Against Source of Information (n=350)*

Source of farm input information	Agriculture officers	Businessmen	Experienced farmers	Relatives	NGO	TOTAL
No	4	4	12	62	0	82
Yes	51	7	85	118	7	268
<b>Total</b>	<b>55</b>	<b>11</b>	<b>97</b>	<b>180</b>	<b>7</b>	<b>350</b>

Figure 2 summarizes subscription of the respondents into Short Message Service (SMS). The researcher's intention was to know respondents' familiarity with the use of SMS as one of the services available in mobile phones and they can be used to access farm input information. Most of respondents relied on discussions with fellow farmers; the data indicate a broader dependence on informal networks of friends, neighbors, and formal contacts with input suppliers and extension officers, rather than on explicit sources of knowledge. This observation aligns with Klärner and Knabe (2019), who emphasized the importance of informal networks as major information sources in rural areas.



**Figure 2**  
*Respondents' Subscription to SMS*

The preferences of respondents for receiving SMS as a method of accessing farm input information on their mobile phones are summarized in Table 4. A significant majority (86.3%) preferred subscribing to SMS to receive information about farm inputs, while only 13.7% did not. This finding aligns with Krell et al. (2021), who highlighted the valuable features of mobile phones for agricultural use, including the ability to track market prices and receive information through SMS.

**Table 4**  
*Preference on Receiving SMS (n=350)*

Response	Frequency n=350	Total (%)
No	48	13.7
Yes	302	86.3
<b>Total</b>	<b>350</b>	<b>100</b>

Majority of the respondents 302 (86.3) % claim that they prefer to subscribe to SMS as a method to access farm input information while about 48 respondents (13.7) % say they do not prefer SMS subscription. These findings correspond to the study by Martin & Abbott (2011) who cites examples of unique features of mobile phones as: storing agricultural information in the mobile phone such as storing market prices in the mobile phone, using the speakerphone function for group conferencing and receiving market prices through SMS (Martin & Abbott, 2011). Karanja et al. (2020) highlights a number of benefits to farmers from the SMS-based market including timely access to market price information at the time of harvest helps farmers decide where to sell, it also enables them to negotiate a better price with traders.

This study sought to assess respondents' awareness of social media as a platform for accessing farm input information. Results indicated that a significant majority (85.4%) of respondents were unaware of social media's potential in this regard, while only 14.6% claimed to have some understanding of its utility for agricultural information (table 5).

**Table 5**  
*Social Media and Access to Farm Input Information*

Response	Frequency n=350	Total (%)
Yes	51	14.6
No	299	85.4
<b>Total</b>	<b>350</b>	<b>100</b>

This study has revealed that farmers in the Mpwapwa district primarily rely on peer discussions for farm input information, with a smaller proportion using formal media sources like newspapers, radio, and television. Mobile phones, particularly through SMS, have emerged as a valuable tool, with a significant number of respondents expressing a preference for SMS subscriptions to receive agricultural information.

#### 4.1.3 Challenges in Using Mobile Phones to Access Farm Inputs Information

The findings show that while mobile phones are widely used for accessing farm inputs information, several challenges hinder their effective usage. As presented in table 3, a significant 77% of respondents indicated that they had accessed farm input information via mobile phones at some point, while 23% had never done so. Despite the use of mobile phone to access farm inputs, SMS usage not fully embraced. There are significant barriers to adopting SMS services. In table 6, 65.1% of respondents reported encountering challenges with SMS, such as the cost of subscription and lack of awareness of mobile applications. A similar study by Masuki et al. (2007) has identified that barriers to SMS usage are compounded by factors such as language barriers, illiteracy, and the complex nature of SMS technology, which reduce its effectiveness as a tool for disseminating farm input information.

**Table 6**

*Challenges in using SMS for Farm Input Information (n=350)*

Response	Frequency n=350	Total (%)
No	122	34.9
Yes	228	65.1
<b>Total</b>	<b>350</b>	<b>100</b>

Furthermore, the study highlights the lack of awareness about social media as a platform for accessing farm input information. As shown in Table 5, 85.4% of respondents were unaware of the potential of social media for this purpose, while only 14.6% claimed to have knowledge of it. Studies suggest that this is due to factors such as poor internet connectivity, data costs, limited electricity supply, and low digital literacy (Barau & Afrad, 2017; Balkrishna & Deshmukh 2017). Mobile phones offer significant potential for accessing farm input information; smallholder farmers in Mpwapwa District face several challenges, including reliance on informal networks, barriers to SMS usage, and limited awareness of social media platforms.

## V. CONCLUSIONS & RECOMMENDATIONS

### 5.1 Conclusions

This study has explored smallholder farmers' use of mobile phones for accessing farm input information in Mpwapwa District, addressing the impact of demographics, methods of information access, and the challenges faced. Significant majority of respondents use mobile phones to gather agricultural information, with peer discussions being the primary source of information, followed by conversations with experienced farmers and relatives. Despite a high preference for receiving updates via SMS, challenges such as subscription costs, limited awareness of mobile applications, and low digital literacy impede effective usage.

Demographics such as age, gender, and educational level play a crucial role in influencing mobile phone usage among farmers. The majority of respondents fall within the 19 to 39 age range, suggesting a willingness to adopt mobile technologies for agricultural purposes. However, low literacy levels and the predominance of married farmers indicate that marital status and education significantly affect mobile phone ownership and usage. Furthermore, the limited awareness of social media platforms for agricultural information highlights a gap in utilizing modern communication tools that could enhance access to crucial farm input information.

### 5.2 Recommendations

This study recommends that agricultural extension services implement community-based programs to enhance farmers' awareness of mobile applications that provide vital agricultural information. Increasing outreach through workshops and training can help improve digital literacy among farmers, enabling them to utilize mobile technology more effectively for accessing farm input information. Telecommunication companies should consider offering subsidized or tailored data plans specifically for farmers to address the challenges posed by subscription costs. Collaborating with agricultural organizations can help in creating affordable packages that facilitate better access to agricultural information via mobile phones.

Local agricultural groups should be established to foster knowledge sharing among farmers, recognizing the significance of peer discussions and experienced farmers as information sources. This will create networks for informal

learning, enhancing the overall information access experience. Targeted educational campaigns should focus on married farmers and those with lower educational levels. These campaigns can provide practical guidance on mobile technology use tailored to the specific needs of these groups.

Finally, the local agricultural extension services should take the lead in organizing training sessions, collaborating with non-governmental organizations (NGOs) and community-based organizations focused on agriculture to promote the use of social media platforms for disseminating agricultural information. These sessions can emphasize the advantages of these platforms, thereby increasing farmers' awareness and encouraging them to adopt modern communication tools. This initiative will ultimately enhance their access to crucial farm input information.

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