Information Services & Use 43 (2023) 27–37
DOI 10.3233/ISU-230179
IOS Press

Mobile phone use for farm-related activities by ethnic minority farmers during the Covid-19 pandemic in Quang Tri Province, Central Vietnam

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Abstract. This study explores the use of mobile phones for farm-related activities of ethnic minority farmers in Quang Tri province, Central Vietnam, in the context of the COVID-19 pandemic. A random sampling strategy was used to select 180 ethnic farmers, different by gender, age, and education level, to interview using a semi-structured questionnaire. Results indicate ethnic minority farmers used mobile phones for various purposes related to agriculture through phone calls and social media platforms (Facebook, Zalo, YouTube, etc.). Mobile phones have become essential for farmers to access and exchange market information, receive weather information, get extension advisories, learn new farming practices and technologies, contact and buy farm inputs, etc. There was a statistically significant association between gender, age, and education level with the purposes of mobile phone usage. Young and highly educated farmers should be prioritized in digital service development strategies since they are the pioneers who will be the leading groups of farmers in terms of using mobile phones for farm-related activities. Furthermore, the significance of female farmers' mobile phone use should not be overlooked, as when women have access to these devices, they can use them for various farming tasks to improve their agricultural production.

Keywords: Covid-19 pandemic, minority farmer, mobile phone, Vietnam

1. Introduction

Mobile phones are becoming an important device in Vietnam and the developing world. According to statistical data from the Ministry of Information and Communications, the number of mobile phone subscribers (as of the third quarter of 2021) in Vietnam reached 123 million, an increase of 0.88% over the same period last year. Vietnam is one of the top ten countries with the most smartphones, with 71.54 million smartphones in use by Vietnamese people [1]. According to Burra et al. [2], 90% of Vietnamese farmers own a mobile phone, and 42% of mobile phone users have 3G or 4G connections. An MMA [3] report indicated that 68% of mobile phone users in rural Vietnam own a smartphone, and those users spend

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three hours connected to the internet. In addition, the report also showed that users in rural areas spend 40% of their online time chatting with others using chat apps. Rural Vietnamese use instant messaging apps 6 to 7 times daily, for 20 minutes per time. Rural people's rising use of mobile phones is seen as a key premise for the agricultural digital transformation in Vietnam [4].

Ethnic minorities occupy 14.7% of Vietnam's population. Ethnic groups live mainly in mountainous areas with a high poverty rate, low educational attainment, and low infrastructure conditions [5]. Ethnic minority communities are often known as one of the most vulnerable groups under adverse external impacts because of their low livelihood resilience. Under the effects of the COVID-19 pandemic, the lives of ethnic minorities are facing more difficulty than the majority group (the Kinh group). According to UN Women [6], ethnic minorities witnessed a greater drop in income as a result of COVID-19 than the Kinh group, with 70.3% of their households experiencing a decrease in income compared with 65.5% of Kinh households. More importantly, the income recovery of ethnic minority households was slower than that of Kinh households [7]. In agricultural production, commodity production networks are disrupted by travel restrictions, making agricultural products difficult to consume. Ethnic minority households, especially female-headed households, faced more difficulties due to lack of means of transportation, driving licenses, or even the fact that they could not drive to transport their agricultural products to central areas for sale, while wholesalers were unable to collect agricultural products from communities [8]. In addition, agricultural extension services and input supply services were disrupted, causing a slew of problems for ethnic minority farmers.

After the Covid-19 outbreak, the Vietnamese government has prioritized digital transformation in agriculture. The Ministry of Agriculture and Rural Development (MARD) established a Digital Transformation Steering Committee in 2021 to guide the implementation of the digital transformation task, which is focused into three pillars: the digital MARD, the digital agriculture economy, and digital farmers. Digital farmers targeted the raise of digital device adoption in farm related activities such as smartphone, autonomous devices, drone. The main purpose is to make it easier for farmers to interact, connect with value chain actors, and boost productivity and efficiency through automation.

However, until currently, there are very few studies on the use of mobile phones in farm-related activities by ethnic minority farmers in Vietnam, so there is little scope to explore the role of this digital device in their farming needs. Simultaneously, no research has been identified to examine the relationship between farmer characteristics such as gender, age, and educational status and their agricultural-related mobile phone usage. Therefore, this research, with the aim of exploring the use of mobile phones for farm-related activities of ethnic minority farmers, will be helpful to policymakers, extension agencies, and other stakeholders as they work to develop and provide digital services for specific groups of ethnic minority farmers in Central Vietnam.

2. The role of mobile phone usage in smallholder farming

In fact, the role of mobile phone usage for farmers in the context of the COVID-19 pandemic is widely found in the literature. With their functions, mobile phones provide digital solutions to smallholder farmers, allowing them to seize opportunities and increase their resilience to the pandemic's disruptions [9]. Smallholders can use mobile phones to access information on technologies and good practices when access to formal education institutions and printing materials is limited [10]. Mobile phones can promote farmers' trading [11], allowing farmers and other parties in remote areas to communicate more easily [12].

Digital agricultural extension and digital trading solutions through using mobile phones, therefore, have been deployed in many countries to adapt to COVID-19, including Vietnam.

Mobile phones are increasingly popular in developing countries, becoming an important tool for smallholder farmers adopting farm-related activities. Aside from standard calling and texting functions, mobile phones allow farmers to use and communicate with one another via various applications. Evidence suggests that mobile phone use has enormous potential for improving agricultural production [13–18]. The benefits of mobile phones used in farm-related tasks have been documented in many studies [19–23].

Many scholars have admitted that mobile phones have strengthened farmers' communication, interactions, and linkages. This point of view was confirmed by Deichmann [20] and earlier by Razaque and Hassa [19], who found that mobile phones increased the cohesion and social interactions between farmers and other actors in the value chain [19,20]. Mobile phones enable farmers to communicate over considerable distances [21,24]. By using mobile phones, farmers could communicate directly with the traders to sell their products and negotiate prices themselves [25], contributing to an increase in farm-gate prices from improvements in bargaining power with intermediaries [16,26]. Mobile phones also shorten the distance between food chain actors involved in producing, processing, transporting, and marketing food [23]. In addition, with a mobile phone, farmers can approach larger intermediaries directly and sell a larger volume of products at a higher price [16,20].

Mobile phone usage provides farmers with information to make better decisions in agriculture production. Aker [27] recognized a wide range of uses for mobile phones, one of which was assisting farmers in getting information. Mobile phones have improved access to information from both private and public sectors, such as extension services, research systems, etc. According to GSMA [22], farmers can benefit from mobile advisory services like weather forecasts and extreme weather advisories, which can help them make better decisions and mitigate risks. Meanwhile, Treinen and Elstraeten [28] revealed that mobile phones could assist farmers in accessing or sharing information and receiving non-face-to-face training. The role of mobile phones in providing extension advice and weather information as well as in exchanging information between farmers, was also confirmed by Ramatu et al. [29] and Aldosary et al. [25]. In addition, mobile phones improve access to market information for smallholder farmers [16].

Farmers can also use mobile phones to access financial services [21,22], agricultural inputs [30,31], insurance [22], and to share or rent tractors, labor, and other resources with others [20]. More importantly, mobile phones significantly lower farmers' costs [29,32].

3. Research method

This research selected Quang Tri province, located in Central Vietnam as the study site to collect the data. According to the General Statistics Office of Vietnam [33], the province has a population of 633,400 people, living in 168,495 households with an average of 4.4 people per household. The province has a rural population of 436,962 people (accounting for 68.97%), and the local people's lives depend heavily on agricultural production.

The residence territory of ethnic minorities in Quang Tri province is primarily western mountainous areas, with a natural area of 313,675 hectares, accounting for 68% of the province's natural area. Currently, ethnic minorities live in 38 communes and towns (mainly distributed in 2 districts, including Dakrong and Huong Hoa), primarily in the Van Kieu and Pa Ko groups, with a population of over 85,000 people. Almost 100% of ethnic minority households in Quang Tri have their livelihoods mainly based on agriculture, of

which 11,806 are poor households, accounting for 28.32% of the whole province (the poverty rate of the whole province is 7.03%) [34].

This study randomly selected 180 ethnic smallholder households in the Dakrong and Huong Hoa districts of Quang Tri province who use mobile phones (either basic mobile phones or smartphones). The household survey was undertaken in March 2022, after the longest outbreak of the COVID-19 pandemic in Quang Tri province (starting in April 2021). The respondents were the key farmers in households who played a key role in agricultural production and decision-making in the households. A structured questionnaire was designed to collect data related to the adoption of mobile phone applications and functions and the purposes of mobile phone use.

Data were coded and analyzed using IBM-SPSS statistical package. Count and percentage were used to describe the response of smallholder farmers to the use of mobile phones. With the null hypothesis of whether gender, age group and education level, and the usage of mobile phone applications and functions are independent, the Fisher's Exact Test was applied. This type of test is commonly used in the examination of small samples, however, it is valid for all sample sizes [35]. Thus, this kind of test was chosen to ensure that, in some situations, low expected frequencies could guarantee the accuracy of the test findings.

4. Results

4.1. Ethnic minority farmers' characteristics and their mobile phone ownership

Table 1 summarizes the characteristics of ethnic minority farmers based on gender, age, education, and mobile phone ownership. Overall, male, middle-aged, and lower-educated farmers accounted for the majority of respondents, and there was a difference in mobile phone ownership between farmer groups. The majority of farmers (74.44%) were male, with 71.64% and 41.04% owning a basic phone and a smartphone, respectively. Meanwhile, the figures for female farmers were 78.26% and 39.96%, respectively. The middle-aged (30 to 50-year-old) group dominated not only in terms of the percentage of respondents (60.00%) but also in smartphone ownership (47.22%). The elderly farmer group mainly used basic phones (84.21% of users) instead of smartphones (only 18.42% of users). Around 87.22 percent of farmers had a junior high school education or less, and they used more basic phones (over 74.00%) and fewer smartphones (under 40.00%) than the higher education level farmer group (56.52% using basic phones and 52.17% using smartphones).

4.2. Smallholder farmers' usage of mobile phone applications and functions

Table 2 shows the mobile phone applications and functions used by male and female farmers in agricultural-related activities and the relationships between gender and mobile phone use. Overall, phone calls, Zalo, SMS, Facebook, and YouTube are the most commonly used applications and functions among ethnic minorities, with higher usage by male farmers. The Fisher's Exact Test results in Table 2 report that gender was statistically associated with almost all mobile phone applications and functions usage. In particular, the use of Zalo was statistically associated with gender at less than 10% ($p < 0.1$); phone calls, Facebook, YouTube, and Google search use were statistically associated with gender at less than 5% ($p < 0.05$); and SMS usage was statistically significant at less than 1% ($p < 0.01$).

Table 3 reveals the use of mobile phone applications and functions by age groups of ethnic minority farmers and their relationships. Generally, elderly farmers mainly used phone calls, while young farmers

Table 1
Farmers' demographics and their mobile phone ownership (n = 180)

Characteristic	Interviewed case		Mobile phone ownership	
	Count	%	Basic phone (%)	Smartphone (%)
Gender				
Male	134	74.44	71.64	41.04
Female	46	25.56	78.26	36.96
Age				
<30 years old	34	18.89	67.65	41.18
30–50 years old	108	60.00	71.30	47.22
>50 years old	38	21.11	84.21	18.42
Education level				
Primary school	87	48.33	74.71	39.08
Junior high school	70	38.89	77.14	37.14
Senior high school	23	12.78	56.52	52.17

Table 2
Mobile phone applications and functions adopted by gender (%)

Application/function	Male	Female	Fisher's Exact Test (2-sided)
Phone call	73.13	54.35	0.027**
SMS	58.21	34.78	0.007***
Zalo	61.82	35.29	0.092*
Facebook	45.45	11.76	0.020**
YouTube	40.00	11.76	0.040**
Weather App	31.34	28.26	0.853ns
Google search	21.82	0.00	0.057**

*$p \leq 0.1$, **$p \leq 0.05$, ***$p \leq 0.01$.

were more likely to use SMS, Zalo, Facebook, YouTube, Weather App, and Google search. Table 3 also indicates that the age group was statistically associated with the use of Facebook and YouTube at less than 5% ($p < 0.05$), and SMS and Zalo at less than 1% ($p < 0.01$). However, it must be affirmed that the significance found in these tests represents differences in data between the independent variable level but does not necessarily indicate a trend across all three levels of the independent variable.

Table 4 indicates the use of mobile applications and functions by education level and the relationships between such mobile phone uses and the farmer's education. Farmers adopted more mobile phone applications and functions as their education level increased. Over 73% of senior high school farmers use phone calls, SMS, and Zalo, significantly higher than the junior high school or less group. Similarly, the highest educated group dominated the adoption of Facebook, YouTube, and weather apps (from 52%–59%). The Fisher's Exact Test results in Table 4 reveal that the education level of ethnic minority farmers was statistically associated with their usage of Facebook at a significance level of less than 10% ($p < 0.1$); the Weather App at a significance level of less than 5% ($p < 0.05$); and SMS and YouTube at a significance level of less than 1% ($p < 0.01$).

Table 3
Mobile phone applications and functions adopted by age groups (%)

Application/function	<30 years old	30–50 years old	>50 years old	Fisher's Exact Test (2-sided)
Phone call	64.71	66.67	76.32	0.496^{ns}
SMS	73.53	55.56	23.68	0.000***
Zalo	71.43	58.82	0.00	0.004***
Facebook	64.29	35.29	0.00	0.010**
YouTube	57.14	31.37	0.00	0.027**
Weather App	38.24	32.41	18.42	0.146^{ns}
Google search	14.29	19.61	0.00	0.608^{ns}

$^{**}p \leq 0.05$, $^{***}p \leq 0.01$.

Table 4
Mobile phone applications and functions adopted by education levels (%)

Application/function	Primary school	Junior high school	Senior high school	Fisher's Exact Test (2-sided)
Phone calls	73.56	60.00	73.91	0.168^{ns}
SMS	40.23	60.00	73.91	0.004***
Zalo	47.06	57.69	75.00	0.273^{ns}
Facebook	23.53	46.15	58.33	0.056*
YouTube	14.71	46.15	58.33	0.004***
Weather App	31.03	22.86	52.17	0.030**
Google search	17.65	15.38	16.67	1.000^{ns}

$^{*}p \leq 0.1$, $^{**}p \leq 0.05$, $^{***}p \leq 0.01$.

4.3. Mobile phone usage in farm-related activities of ethnic minority farmers

Table 5 presents the purposes of mobile phone usage by the farmer's gender in the study area. Overall, male and female farmers used mobile phones in various activities, and the Fisher's Exact Test results showed gender was statistically associated with several such activities. In particular, male farmers were more likely to use mobile in getting extension advisory (36.57% of users compared to 19.57%, $p < 0.1$); contacting and purchasing farm inputs (32.09% compared to 17.39%, $p < 0.1$), and learning new farming practices and technologies (23.88% compared to 8.7%, $p < 0.05$). Meanwhile, female farmers used mobile phones more to market farm products in comparison with the male group (30.43% compared to 17.91%, $p < 0.1$) and to access other services for farming (41.30% compared to 27.61%, $p < 0.1$).

Table 6 outlines how mobile phones are used in various activities by age group. In general, younger farmers used their mobile phones more for farm-related activities, and there were statistically significant relationships between age and several mobile phone-adopted activities of ethnic farmers. Over 40% of young farmers (those under the age of 30) used their mobile phones for every activity, including exchanging market information, receiving weather information, and communicating with retailers or consumers. In contrast, accepting the activity of contacting and purchasing farm inputs was adopted by 47.37% of old farmers (>50 years old). In comparison, other activities were almost adopted by less than

Table 5
Farmers' mobile phone use in farm-related activities by gender (%)

Purposes of mobile phone use	Male	Female	Fisher's Exact Test (2-sided)
Marketing farm products	17.91	30.43	0.093*
Exchanging market information	23.13	34.78	0.125ns
Receiving weather information	34.33	23.91	0.205ns
Getting extension advisories	36.57	19.57	0.044*
Learning about new farming practices and technologies	23.88	8.70	0.032**
Getting advice to solve farming problems from other farmers	21.64	26.09	0.545ns
Communicating to retailers or consumers	24.63	34.78	0.185ns
Contacting and purchasing farm inputs (seeds, fertilizers, chemicals, etc.)	32.09	17.39	0.060*
Contacting to rent or exchange farming labor	27.61	30.43	0.708ns
Accessing other services for farming (land preparation, irrigation, financial, etc.)	27.61	41.30	0.098*

*$p \leq 0.1$, **$p \leq 0.05$.

Table 6
Ethnic minority farmers' mobile usage purposes by age groups (%)

Purposes of mobile phone use	<30 years old	30–50 years old	>50 years old	Fisher's Exact Test (2-sided)
Marketing farm products	26.47	22.22	13.16	0.363ns
Exchanging market information	41.18	22.22	23.68	0.095*
Receiving weather information	41.18	30.56	26.32	0.379ns
Getting extension advisories	38.24	33.33	23.68	0.384ns
Learning about new farming practices and technologies	32.35	23.15	0.00	0.000***
Getting advice to solve farming problems from other farmers	23.53	24.07	18.42	0.827ns
Communicating to retailers or consumers	47.06	21.30	26.32	0.017**
Contacting and purchasing farm inputs (seeds, fertilizers, chemicals, etc.)	35.29	19.44	47.37	0.003***
Contacting to rent or exchange farming labor	38.24	26.85	23.68	0.357ns
Accessing other services for farming (land preparation, irrigation, financial, etc.)	35.29	30.56	28.95	0.833ns

*$p \leq 0.1$, **$p \leq 0.05$, ***$p \leq 0.01$.

35% of users over the age of 30. Fisher's Exact Test results in Table 6 show the statistically significant association between age and the use of mobile phones in learning new farming practices and technologies and contacting and purchasing farm inputs at less than 1% ($p < 0.01$); communicating to retailers or consumers at less than 5% ($p < 0.05$); and exchanging market information at less than 10% ($p < 0.1$).

Table 7
Ethnic minority farmers' mobile usage purposes by education level (%)

Purposes of mobile phone use	Primary school	Junior high school	Senior high school	Fisher's Exact Test (2-sided)
Marketing farm products	8.05	22.86	65.22	0.000***
Accessing and exchanging market information	17.24	30.00	47.83	0.008***
Receiving weather information	32.18	24.29	52.17	0.049**
Getting extension advisories	24.14	37.14	47.83	0.050*
Learning about new farming practices and technologies	18.39	18.57	30.43	0.909ns
Getting advice to solve farming problems from other farmers	21.84	22.86	26.09	0.150ns
Communicating to retailers or consumers	20.69	32.86	34.78	0.824ns
Contacting and purchasing farm inputs (seeds, fertilizers, chemicals, etc.)	29.89	28.57	21.74	0.824ns
Contacting to rent or exchange farming labor	25.29	31.43	30.43	0.642ns
Accessing other services for farming (land preparation, irrigation, financial, etc.)	32.18	35.71	13.04	0.114ns

*$p \leq 0.1$, **$p \leq 0.05$, ***$p \leq 0.01$.

Table 7 reveals the farm-related works adopted mobile phones of ethnic farmers by education level. Overall, farmers with a high level of education are more likely to use mobile phones for agricultural-related activities than the other groups. About 65.22% of graduated senior high school farmers used mobile phones to marketing farm products, 52.17% to receive weather information, and 47.84% to exchange market information and get extension advisories. Meanwhile, the figures for the other age groups were almost under 40% for all activities. Fisher's Exact Test results in Table 7 indicate that farmers' education levels are statistically associated with the use of mobile phones in marketing farm products and exchanging market information at less than 1% ($p < 0.01$); receiving weather information at less than 5% ($p < 0.05$); and getting extension advisories at less than 10% ($p < 0.1$).

5. Discussion and conclusion

In the context of the COVID-19 pandemic influence, mobile phone use plays an important role in farmers' communication. However, the use of mobile phones is not exactly the same among farmers. Our empirical findings indicate that farmer characteristics have statistically significant relationships with the use of mobile phone applications and functions. Calling is a primary function of a mobile phone, so most farmers can easily use it for agricultural-related purposes. However, with applications and functions that required knowledge and skills in digital technology, such as Zalo, Facebook, YouTube, Google search, etc., male, young, and higher-educated farmers were more likely to adopt. These findings corroborated the conclusions of Treinen [28] and GSMA [22], which stated that their digital literacy influenced farmers' use of digital devices. This digital access disparity must be addressed in the future digitization programs of the government (e.g., digital extension services).

Ethnic minorities in Quang Tri province used mobile phones for various farm-related activities when face-to-face communication was limited due to COVID-19. Mobile phones have become essential devices for farmers to access and exchange market information, receive weather information, get extension advisories, learn about new farming practices and technologies, contact and buy farm inputs, etc. Obviously, mobile phone use has grown in popularity and has progressed beyond simple communication, as mentioned by Henze and Ulrichs [36]. This finding is very meaningful because ethnic minority farmers in Vietnam are notorious for having poor knowledge, skills, and a low capacity to access digital technologies. In the context of digital technology being considered as a strategy to "take a shortcut" in agricultural development in Vietnam and other developing countries, disadvantaged farmers' access to mobile phones or digital devices has created a foundation for accelerating the digitization of agriculture. This finding partly helps to assuage worries raised by Trendov et al. [37], who found that digitalization has caused a divide between early adopters and skeptics, small-scale and large-scale farmers, gender, and urbanization level.

Logically, a higher percentage of younger and better-educated farmers use mobile phones for farm-related activities than the other farmer groups. This highlights the importance of these farmer groups in using mobile phones in agriculture, as Poushter and Oates [38] and Trendov et al. [37] have noted. Young and highly educated farmers are the pioneers who will be the leading groups of farmers in terms of using digital technologies. They can serve as models for a wide range of digital technology solutions the Vietnamese government supports, such as digital extension services, e-commerce, agricultural applications, etc. Furthermore, female farmers are frequently referred to as the most disadvantaged group, with low capacity and technological access [16,28,39]. However, ethnic minority women in the research area were more active than men in utilizing mobile phones for various tasks, including marketing farm products, contacting and purchasing farm inputs, and accessing various farming-related services. This finding implies that when women have access to digital devices like mobile phones, they can use them to improve their agricultural production. Mobile phone adoption among women, thus, has the potential to boost agricultural productivity improvements and develop women's livelihoods, as concluded by Deichmann [20], Treinen [28], and Quandt et al. [17].

Acknowledgements

The authors of this research would like to thank Hue University for its financial support in conducting this research.

The authors also acknowledge the partial support of the University of Agriculture and Forestry, Hue University, under the Strategic Research Group Program, Grant No. NCM.DHNL.2021.05.

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