THE IMPACT OF MOBILE PHONE OWNERSHIP ON FARMERS' INCOME: EVIDENCE FROM MICRODATA IN INDONESIA

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Abstract

Farmers in Indonesia play a crucial role in providing staple foods for the community. However, the welfare of farmers remains an unresolved issue to date. With the advancement of technology, collaboration between agricultural activities and the utilization of technology such as mobile phones should be possible, which can increase farmers' income. This study aims to analyze how mobile phone ownership among farmers can improve the welfare of farmers in Indonesia. Using microdata sourced from the World Bank's Global Financial Inclusion Index, this research employs Ordered Logistic Regression to analyze the data. The results of the data analysis indicate a significant tendency of variables such as gender, age, farmers' residential location, and savings behavior towards increasing farmers' income associated with farmers' mobile phone ownership. With the significance generated from these variables, this study can serve as a basis for agricultural stakeholders and policymakers to determine more beneficial agricultural strategies and strengthen policies that can improve farmers' welfare in the current digital era.

Keywords: Mobile Phone Ownership, Farmers, Farmer Income

INTRODUCTION

In the past five years, Indonesia has experienced rapid digitalization. Evidence shows a drastic increase in household internet access from 57% in 2017 to 82% in 2021 (Central Statistics Agency, 2022). However, there are significant differences in the digitalization process between urban and rural areas. In this regard, the development of internet access in rural areas has been slower compared to urban areas. In 2021, only 49% of rural communities had internet access. In comparison, 72% accessed the internet in urban areas during the same year.

The low level of digitalization in rural areas is synonymous with the low digitalization of the agricultural sector. Additionally, as part of the digitalization process, mobile phone ownership by farmers can be crucial for the advancement of the agricultural sector. According to Labonne and Chase (2009), mobile phone ownership can significantly impact the welfare of farmers. Farmers' bargaining power can be enhanced by owning a mobile phone, and they can more easily obtain market price information. Lastly, mobile phone ownership can encourage farmers to consume more.

Previous empirical research has found evidence that mobile phone ownership positively impacts farmers' welfare (Labonne & Chase, 2009; Muto & Yamano, 2009; Aker, 2010; Mittal & Mehar, 2012; Haile et al., 2019). However, previous studies have used various measures of welfare, such as consumption expenditure and agricultural product prices. Additionally, previous research rarely reveals how the mechanism of mobile phone ownership can affect farmers' welfare.

Based on this background, this research aims to use microdata to

examine the impact of mobile phone ownership on farmers' income in Indonesia. Our study differs from previous research in three ways. First, we examine the impact of mobile phone ownership by dividing farmers' income into five quintiles, using the Ordered Logistic Regression (OLR) model. This study provides a more in-depth division of income groups compared to previous research such as Siaw et al. (2020), which only uses the Probit Model. With a more detailed division of farmers' income groups, policymakers will be facilitated in evaluating which income group benefits the most from mobile phone ownership.

Second, we look at various potential pathways (age, gender, location, education, and financial access) as mechanisms through which mobile phone ownership affects farmers' income. Recent research by Khan et al. (2022), for example, only evaluates the role of mobile phone ownership in farmers' income through marketing pathways. Therefore, this research will be more accurate in providing an analysis of the mechanisms through which mobile phone ownership influences increased farmers' income.

Third, to our knowledge, we are the first to investigate this issue using microdata in Indonesia. The use of micro-level dataset has its advantages, where estimation results can more accurately explain research issues. In this case, estimation results can be used to evaluate the extent to which mobile phone ownership impacts the increase in farmers' income.

LITERATURE REVEW

Digital Economy: Concepts and Roles

According to Goldfarb & Tucker (2019); Körner et al. (2018), the digital economy is an economy that utilizes information and communication technology. Similar views are also expressed by Zhang & Chen (2019), stating that the digital economy can be defined as the utilization of technology based on the ICT sector. This ICT sector includes the internet, IT services, hardware, software, and telecommunications. Furthermore, the digital economy is also defined as economic activities that use digital information and knowledge as efficient production factors.

The development of the digital economy has been ongoing for a long time and has provided significant benefits to economic growth and development within societies, such as streamlining economic transactions (Ilham, 2019), expanding economic networks (Soemarwoto, 2020), and increasing people's income (Mardia et al., 2021). Additionally, according to Abdurakhmanova et al. (2020); Song et al. (2022), the digital economy can enhance efficiency in the supply chain of goods and services and increase the level of knowledge in society (intellectual capital).

The digital economy is interconnected with many aspects due to the complexity of the systems built within it. Therefore, there are several other terms for the digital economy that reflect the systems it operates, such as the internet economy—due to its dependence on the internet as its main driver, including the network economy because of the extensive networks created, and the platform economy because of the concentration of various economic activities in one container, such as the accumulation of various data on one server or various economic interactions carried out with just a handheld device (Bukht & Heeks, 2017).

As discussed earlier, digital economic activities can be conducted through handheld devices, and indeed, the digital economy makes communication tools the primary 'weapons' in various mechanisms. Some of the most significant communication tools used as primary tools today are mobile phones or smartphones, computers or laptops, and tablets (Dahlman et al., 2016). These three devices have proven to be the most significant and powerful technologies used in digital economic activities, especially mobile phones, as stated by Ahmedov (2020). This is evidenced by the continuous increase in mobile phone sales, indicating that the use of mobile phones as the primary tool for transactions

will continue to increase (Teece, 2017). In the research by Budiarta et al. (2020), mobile phones were found to be the most widely used tool and had a strong influence on the development of the digital economy. Purnomo (2019) also found that the digital economy would be highly effective if implemented through features available on mobile phones, especially to optimize marketing processes in MSMEs on Madura Island. Therefore, the role of mobile phones in the development of the digital economy is crucial, especially in fostering community economic growth by creating more extensive job opportunities, thus increasing people's income.

The phenomenon of increasing income due to the high number of mobile phone users has been found by Teece (2018) in his research. This is also supported by Asongu (2015), who found that the increasing use of mobile phones correlates significantly with the increase in people's income in Africa.

Digital Economy and Low-Income Communities

In its development, the digital economy is believed to empower communities by shortening the information chain and reducing asymmetric information, which leads to inefficiencies in economic activities. That is the reason given by Bach et al. (2018) that the digital divide must be minimized to reduce the burden of poverty in an area caused by information disparities. The digital economy is also considered as a new pro-poor economic movement. This is evidenced in several low-income countries, where the digital economy has been able to drive their economies. It was also found by Dahlman et al. (2016) that digital infrastructure is proven to reduce production costs, increase trade, reduce market entry barriers, increase market access through e-commerce, and increase the added value of products in the agricultural and service sectors.

Furthermore, if the digital economy can increase the added value of products in the agricultural sector, then according to Mahfud & Fatoni (2022), the digital economy indirectly increases farmers' income. In Indonesia, farmers are believed to be a vulnerable group with unstable incomes (Kustiningsih, 2017; Prihatin et al., 2012). It is also stated that farmer households are one of the vulnerable households not only due to the uncertain climate in Indonesia but also because Indonesian farmers are still unable to sell their agricultural products during the harvest season due to oversupply (Kustiningsih, 2017).

The increase in household income through the digital economy, according to Sibarani (2021), is through the implementation of online product marketing. Thus, farmers' marketing is not limited to local markets, which leads to oversupply and low agricultural product prices. Through online marketing, farmers are believed to reach a wider market with competitive product prices. However, besides the wide marketing of agricultural products, Elian et al. (2014) also found that through the internet, farmers will be able to obtain information regarding up-to-date agricultural processes, thus creating agricultural innovations that can drive the added value of agricultural products.

Research Hypotheses Development

Based on the research results of Thamrin et al. (2012) that age significantly affects the income level of Pinang farmers, and also the research of Ariska & Prayitno (2019), who found that age affects the income of fishermen, the research hypothesis is formulated as follows:
H1: Age significantly affects income.

Putri & Setiawina (2013) found that the type of occupation positively affects the income level of poor families in Bebandem Village, Karangasem. This study is also supported by the research conducted by Kapisa et al. (2021), which found that the type of occupation significantly impacts the income of household heads in Manbesak Village. Therefore, based on previous research, the research hypothesis is formulated as follows:
H2: Occupation type significantly affects income.

Gender was found to have a significant positive effect on income in bamboo craftsmen in Belega Village, Gianyar Regency (Sasmitha & Ayuningsasi, 2017). Similar findings were also found by Akbariandhini & Prakoso (2020), who researched the effect of gender on income levels in Indonesia and found that gender has a positive and significant influence on income levels in Indonesia. Therefore, based on previous research, the research hypothesis is formulated as follows:
H3: Gender significantly affects income.

In the research by Prihatminingtyas (2019), it was found that the location of the business affects the income of traders in Landungsari, and the results of the research by Aji & Listyaningrum (2021) stated that the location of the business affects the income of MSMEs in Bantul Regency. Therefore, based on previous research, the research hypothesis is formulated as follows:
H4: Location significantly affects income.

Akbariandhini & Prakoso (2020) stated in their research that education level affects income levels in Indonesia. This result is consistent with the research results of Hasanah et al. (2020) and Julianto & Utari (2019), which state that education level has a significant influence on SMEs' income, including individuals. Therefore, based on previous research, the research hypothesis is formulated as follows:
H5: Education significantly affects income.

Pinem & Mardiatmi (2021) found in their research that financial inclusion, including financial access, has a significant positive effect on the income of MSMEs in Depok, West Java. Paloma et al. (2020) also found in their research conducted on coffee farmers in Solok Regency that financial access, including financing, affects the income of coffee farmers. Therefore, based on previous research, the research hypothesis is formulated as follows:
H6: Financial access significantly affects income.

RESEARCH METHODS

The type of research used in this study is quantitative method. Quantitative research is a method for testing specific theories by examining the relationships between variables (Creswell, 2012). The analysis tool used to achieve the objectives of this research is descriptive and inferential statistics, namely using the Ordered Logistic Regression (OLR) model.

OLR is almost similar to multinomial logistic regression (MLR), but in the MLR model, the response of the dependent variable emphasizes more than two choices, and these responses are not treated as a specific order. In estimation, the OLR model uses maximum likelihood calculations, so a sufficient amount of data samples is required (University of California, n.d.).

The OLR model is a model with a dependent variable that is a graded choice, where one choice will have a better or worse level than another choice. For example, a person's income level can be ranked based on their quartiles. A person's position in each category (quartile) can be categorized as graded choices (ordered).

In general, the OLR model can be written in the following equation:

$$y^* = X^T\beta + \varepsilon \quad (1)$$

where y* is the dependent variable with responses in categories, XT is the vector of independent variables, and ε is the error term following a standard logistic distribution pattern, while β represents the vector of regression coefficients to be estimated. Furthermore, in the Ordered Logistic Regression (OLR) analysis, several assumptions need to be met, namely: 1) the dependent variable is

measured on an ordinal scale; 2) there are one or more independent variables with continuous, categorical, or ordinal scales; 3) there is no multicollinearity, which can be assessed using the Variance Inflated Factor (VIF); and 4) Proportional Odds, which can be tested using the Brant Test.

To answer the research question of whether mobile phone ownership increases farmers' income, this study employs OLR analysis with an empirical model specification adapted from the model developed by Labonne & Chase (2009) as follows:

$$y_i^* = \beta_1 Mobilephone_i + x_i'\beta + e_i \quad (2)$$

$$y_i^* = \begin{cases} 5\,(household\ income\ quintile\ 5)\ if\ y_i^* > \mu_4 \\ 4\,(household\ income\ quintile\ 4)\ if\ \mu_3 < y_i^* \le \mu_4 \\ 3\,(household\ income\ quintile\ 3)\ if\ \mu_2 < y_i^* \le \mu_3 \\ 2\,(household\ income\ quintile\ 2)\ if\ \mu_1 < y_i^* \le \mu_2 \\ 1\,(household\ income\ quintile\ 1)\ if\ y_i^* \le \mu_1 \end{cases}$$

Where mobile phone = 1 if the respondent owns a mobile phone, and handphone = 0 otherwise, x = explanatory variable vector (age, education), where age = respondent's age (in years), education = respondent's level of education, where 1 if the respondent completed primary school or less, 2 if the respondent completed junior high school, 3 if the respondent completed higher education or more. Meanwhile, we also try to examine the interaction between mobile phone usage and livelihood as a farmer in equation (2) and involve potential channels used by the population in equation (3), which are written as follows:

$$y_i^* = \beta_1 Mobilephone_i\ x\ \beta_2 Farmer_i + x_i'\beta + e_i \quad (3)$$

Where farmers (farmer) = 1 if the respondent's household is engaged in farming or animal husbandry, and farmers = 0 if otherwise.

$$y_i^* = \beta_1 Mobilephone_i\ x\ \beta_2 Farmer_i\ x\ \beta_3 Potential\ channels_i + x_i'\beta + e_i \quad (4)$$

Next, to answer the research question, to what extent does mobile phone ownership affect farmers' income (potential mechanisms), we define potential channels using several variables as follows:

Table 1. Variabel Penelitian dan Skala Pengukurannya

No.	Variable	Information	Units
1.	Income	Respondents' income categorized into 5 quintiles, where the lowest quintile (1) represents the poorest income group and conversely, the highest quintile (5) represents the highest income group.	• Quintile 1 = 1 • Quintile 2 = 2 • Quintile 3 = 3 • Quintile 4 = 4 • Quintile 5 = 5
2.	Mobile phone	Ownership status of mobile phones	Owns a mobile phone = 1 and 0 = others

No.	Variable	Information	Units
3.	Farmer	Respondents' status as farmers	Engaged in farming = 1 and 0 = others
4.	Age	Respondents' age	Years
5.	Farmer	Respondents' livelihood categorized as farmers and others	Farmer = 1 and 0 = others
6.	Gender	Gender of surveyed respondents	Male = 1 and 0 = female
7.	Location	Place of residence of respondents at the time of the survey	Urban = 1 and 0 = rural
8.	Education	Respondents' highest level of education	Up to elementary school = 1, Junior high school = 2, Senior high school and above = 3
9.	Financial access	Consists of several types of financial services accessible to respondents, including: loans, savings, money transfers, and debit cards	
	- Loans	Respondents, individually or jointly with others, borrowing money in the past year, including from banks or similar financial institutions, through mobile money accounts, from family or friends, or from informal savings groups, or for other reasons	Borrowing = 1 and 0 = others
	- Savings	Respondents personally saving or setting aside money in the past year, including using accounts at financial institutions, through mobile money accounts, savings, or with people outside the family, or for any reason	Saving = 1 and 0 = others
	- Money transfer	Making or receiving domestic money transfer payments	Yes = 1 and 0 = others
	- Debit cards	Respondents who have debit cards	Have = 1 and 0 = others

Source: Researcher (2023)

All the necessary data for the research will be obtained from microdata originating from individual surveys on the Global Financial Inclusion (Global Findex) Database from the World Bank. This dataset is derived from a survey conducted on a total of 1,062 individuals in Indonesia.

RESULT

Results of Ordered Logistic Regression Estimation

Table 2 presents the descriptive statistics of the variables used in this study.

Tabel 2. Descriptive Statistics

Variable	Label	Obs	Mean	Std. Dev.	Min	Max
Income	Income	1062	3.201	1.435	1	5
Mobile phone	Owns a mobile phone =1, Others=0	1062	.758	.428	0	1
Age	Age	1062	38.391	14.447	15	85
Education	SD=1, SMP=2, SMA=3	1062	1.735	.525	1	3
Farmer	Farmeri=1, Others=0	202	.911	.286	0	1
Gender	Man=1, Woman=0	1062	.433	.496	0	1
Location	City=1, Village=0	1062	.637	.481	0	1
Loans	Borrowing=1, Others=0	1062	.425	.495	0	1
Savinf	Saving=1, Others=0	1062	.536	.499	0	1
Money transfer	Money transfer=1, Lain=0	1062	.299	.458	0	1
Debit cards	Debit card=1, Lain=0	1062	.389	.488	0	1

Source: Processed data (2023)

As seen in Table 2, variables such as mobile phone ownership, age, and level of education have a significant relationship with farmers' income. When considering the interaction with farmers' livelihoods, only the education variable is detected to have a significant association with farmers' income, while the variables of education and age are not detected to be significant.

Tabel 3. The Effect of Mobile Phone Ownership on Farmers' Income

	Without Interaction	With Interaction
Income		
Mobile phone=1, Others=0	0.45**	0.09
	(3.26)	(0.10)
Age	0.02***	0.01
	(3.92)	(0.78)
SD=1, SMP=2, SMA=3	1.02***	1.01***
	(7.93)	(3.69)
Farmer=1, Others=0		0.14
		(0.23)
Farmer Interaction x Mobile phone		0.32
		(0.34)
/		
cut1	1.12**	0.75
	(3.24)	(0.80)
cut2	2.12***	1.81
	(6.14)	(1.91)
cut3	2.98***	2.57**
	(8.47)	(2.68)
cut4	3.91***	3.66***
	(10.91)	(3.77)
Observations	1062	202
chi2	96.02	21.80
r2_p	0.03	0.03

z statistics in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001
Source: Estimated data (2023)

Next, in table 3, the effect of mobile phone ownership on farmers' income is explained through the interaction of farmers' livelihoods with potential variables. Significance was found at the 0.001 level in the gender and education variables. Furthermore, significance was found at the 0.01 level in the savings variable. Location

variable significance was also found at the 0.05 level.

Table 3. The Effect of Mobile Phone Ownership on Farmers' Income: Variable Interaction (Potential Channels)

	Gender	Location	Education	Loans	Savings	Remiten	Debit card
Income							
Farmer x Phone x Gender Interaction	1.00*** (3.31)						
Farmer x Phone x Location Interaction		0.77* (2.36)					
Farmer x Phone x Education Interaction			0.53*** (3.98)				
Farmer x Phone x Loan Interaction				-0.39 (-1.28)			
Farmer x Phone x Savings Interaction					0.86** (3.13)		
Farmer x Phone x Money Transfer Interaction						0.32 (1.00)	
Farmer x Phone x Debit Card Interaction							0.56 (1.64)
/							
cut1	-1.27*** (-6.59)	-1.39*** (-7.29)	-1.05*** (-4.94)	-1.65*** (-8.37)	-1.23*** (-6.22)	-1.46*** (-7.62)	-1.41*** (-7.57)
cut2	-0.25 (-1.59)	-0.38* (-2.40)	-0.02 (-0.10)	-0.64*** (-3.95)	-0.22 (-1.31)	-0.46** (-2.97)	-0.41** (-2.68)
cut3	0.48** (3.05)	0.34* (2.17)	0.72*** (3.79)	0.08 (0.49)	0.50** (3.12)	0.25 (1.62)	0.30* (2.01)
cut4	1.57*** (8.27)	1.38*** (7.67)	1.80*** (8.73)	1.09*** (6.29)	1.57*** (8.91)	1.27*** (6.99)	1.34*** (7.63)
Observations	202	202	202	202	202	202	202
chi2	10.93	5.55	15.88	1.65	9.82	0.99	2.69
r2_p	0.02	0.01	0.02	0.00	0.02	0.00	0.01

z statistics in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001
Source: Estimated data (2023)

DISCUSSION

Based on the general analysis results, mobile phone ownership tends to influence farmers' income levels. Similarly, age also plays a role, as the analysis indicates that higher age correlates with higher farmer incomes. Education follows a similar pattern; individuals with higher levels of education tend to earn more.

Mobile phone ownership provides access to information and communication technology. Farmers with phones may access real-time market information, acquire advanced agricultural knowledge through applications, and communicate with traders or buyers. This can enhance efficiency in agricultural decision-making and marketing. Phones can also serve as a platform for online agricultural product marketing or partnerships with companies providing agricultural services. This opens up new opportunities for farmers to increase their income through diversification of their business or gaining access to broader markets. Therefore, farmers' income can indeed increase with the presence of mobile phones (Luo et al., 2023).

Regarding older farmers, they may have years of experience in agriculture. They can rely on knowledge gained from field experience, understand weather dynamics, planting patterns, and how to address common agricultural issues. This experience can help them manage agriculture more effectively. As they age, farmers may also have built networks and relationships within the agricultural industry. These relationships can be valuable assets for obtaining support, information, or business opportunities that can contribute to their income.

Higher levels of education can bring the technical knowledge needed to adopt modern and efficient farming methods. Formal education can provide a deeper understanding of agricultural science, resource management, and technological innovation. Higher education can also enhance farmers' managerial abilities in planning, organizing, and decision-making, leading to optimized resource use and increased productivity. Although the highest education level among farmers may only be high school, it still distinguishes those who have only completed primary or secondary education in terms of understanding and problem-solving skills in agricultural work.

Gender Role in Mobile Phone Ownership and Farmers' Income

In many places, women may face barriers in accessing mobile phones. This could be related to economic, cultural, or social factors. In some cases, women may be less able to purchase or have access to phones compared to men. Gender roles in mobile phone ownership are also linked to control over assets and decisions. If women have lower control over resources and decision-making at the household or agricultural level, they may also have limited access to phones and their benefits (Montfaucon, 2020). Men as household heads may indeed have more power over household assets, including phone ownership. Although the results of this data analysis indicate a tendency for men owning phones to increase income, to maximize the positive role of mobile phone ownership in farmers' income, an approach that considers gender inequality and promotes inclusivity needs to be adopted. This could involve technology skills training, policy support for women's empowerment in agriculture, and efforts to change social norms that hinder women's roles in this sector.

The Role of Farmers' Residential Location in Mobile Phone Ownership and Farmers' Income

The analysis results indicate that farmers living in urban areas tend to be more able to leverage their mobile phone ownership to increase income. Urban farmers may be more likely to have better access to technology, including phones, because they live in digitally connected areas. This can give them greater access to agricultural information, market prices, and the latest farming techniques. Phones also enable farmers to engage in online marketing activities and build networks with buyers or consumers. Urban farmers can more easily utilize digital platforms to promote and sell their agricultural products, which can have a positive impact on income.

Furthermore, mobile phone ownership can open up access for urban farmers to online education and training resources. They can access tutorials, webinars, or e-learning platforms to enhance their knowledge of more efficient farming techniques or the latest innovations, which can impact productivity and income. Phones also enable urban farmers to access financial services and e-commerce platforms. This can facilitate business transactions, enable farmers to purchase agricultural inputs online, and support better financial management, all of which can contribute to farmers' income.

The Role of Farmers' Education in Mobile Phone Ownership and Farmers' Income

The education level of farmers tends to play a significant role in their mobile phone ownership and its impact on their income. Higher levels of education can contribute to a better understanding of technology, including phones. Educated farmers may be better able to use phone features effectively to support their

agricultural activities, such as accessing market information, managing inventory, or utilizing agricultural apps (Luo et al., 2023). Higher education can also enhance farmers' abilities to engage in marketing activities and business management. With a better understanding of management concepts, farmers can use phones to market their products, manage inventory, and make better business decisions. This can contribute to increased income.

With better understanding due to higher levels of farmer education, this can motivate farmers to engage in agricultural innovation. Educated farmers may be more open to adopting advanced technology in agriculture, such as agricultural sensors or automated monitoring systems. Phones can be a tool to manage and utilize these innovations, which can improve agricultural efficiency and productivity. Through a better understanding of the role of farmers' education levels in mobile phone ownership, more effective training programs and educational initiatives can be developed. Additionally, policy support to increase farmers' access to technology and educational resources can help create an environment supportive of growth and income improvement in the agricultural sector.

The Role of Farmers' Saving Behavior in Mobile Phone Ownership and Farmers' Income

Farmers who have savings tend to play a significant role in mobile phone ownership and its impact on their income. Mobile phone ownership may require initial investment. Farmers with savings may find it easier to purchase or upgrade their phone devices, opening up opportunities to access technology and information that can enhance agricultural productivity. Savings can be used for investment in agricultural technology that interacts with phones (Oluwatayo, 2013). Farmers with savings may be more willing to invest in digital marketing strategies or e-commerce applications that leverage phones. This can help them reach a wider market and increase sales opportunities, ultimately increasing income. Mobile phone ownership can help farmers manage their finances better. Phones can be used to monitor financial transactions, access banking information, or even conduct financial transactions. With savings, farmers can feel more financially secure and better prepared to take risks associated with technology investment.

Farmers with savings may be better prepared to face economic risks or agricultural failures. This financial readiness can give farmers confidence to try new technology or phone-based farming strategies, knowing that they have financial reserves to overcome various challenges in agricultural activities. Policies and development programs can be designed to encourage better savings and investment in agricultural technology. Initiatives to improve financial literacy and access to financial services can support farmers in harnessing the potential of mobile phone technology to increase their income.

CONCLUSION

This research aims to examine the impact of mobile phone ownership on farmers' income in Indonesia. We used micro survey data from the "Global Financial Inclusion (Global Findex) Database" conducted by the World Bank in 2021. Using the Ordered Logistic Regression approach, we found that overall, mobile phone ownership has a direct impact on income improvement. However, specifically, there is no indirect effect of mobile phone ownership on farmers' income. Furthermore, the impact of mobile phone ownership on farmers' income is indirect.

This indirect influence can be traced through several potential pathways in explaining the impact of mobile phone ownership on farmers' income improvement. We identified four potential pathways in explaining how the mechanism of mobile phone ownership affects farmers' income. These four pathways are gender, location, education, and savings. Other pathways that cannot explain the mechanism of how mobile phone ownership affects farmers' income include: loans, money transfers, and debit cards.

From the results of this research, policymakers should pay attention to optimizing mobile phone utilization to encourage increased income among farmers with characteristics such as female gender and rural location with low levels of education and low savings. Additionally, it is crucial for the government to encourage farmers to become more familiar with digital technology, especially in the use of mobile phones for transactions such as mobile money transfers and access to banking services to enhance income.

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