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The Antecedents of Digital Payment Acceptance among Indonesian Farmers: Moderating Role of Education

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Abstract

This study investigates the role of social capital and the level of education in the acceptance of digital payment systems among farmers in Indonesia, utilizing the Technology Acceptance Model (TAM) and incorporating social capital theory. We surveyed 316 farmers with experience using digital payments, analyzing data through Structural Equation Modeling (SEM) with SmartPLS. The findings confirm that perceived usefulness (PU) and perceived ease of use (PEOU) significantly influence farmers' behavioural intentions to adopt digital payment systems, supporting the original TAM framework. Social capital, particularly social trust, positively affects PU and PEOU, while social interaction shows no significant impact on PU and PEOU. Contrary to expectations, education level did not moderate the relationships within the TAM model, suggesting that digital literacy and digital payment technology adoption can be effectively promoted across all educational levels within the context of Indonesian farmers.

Keywords: Digital Payment, Acceptance, Education Level, Social Capital, Farmers

Introduction

Digital payment systems are developing rapidly across the globe, transforming how transactions are conducted in various sectors (World bank, 2022). In Indonesia, the digital payment ecosystem has shown significant growth and development, supported by government initiatives, technological advancements, and increasing internet penetration (Kumar *et al.*, 2023). This ecosystem provides an opportunity for various sectors, including agriculture, to enhance their operational efficiency and overall productivity. APEC (2017)

suggested that the use and adoption of digital payment in agriculture is crucial to improve the sector's productivity.

Despite being one of the greatest emerging economies, agriculture remains a cornerstone of the Indonesian economy, employing 30% of the national workforce while contributing approximately 13% to the country's annual GDP (World Bank, 2023). However, the sector is also characterized by high levels of poverty, with many farmers struggling to achieve financial stability. BPS (2023) highlighted that almost 50% of the national poverty cases are linked directly to the agricultural population. This is caused by the lack of productivity and efficiency in the sector (Susilastuti, 2017). Encouraging the adoption of digital payment by farmers is believed to be able to address this challenge as it can increase transaction efficiency, productivity, and boost global trade (APEC, 2017; Sawadogo and Wandaogo, 2021; Dzogbenuku *et al.*, 2022).

Most studies on digital payment adoption revealed that the main determinants for digital payment adoption include perceived usefulness, perceived ease of use, social influence, trust, subjective norms, and compatibility (Malaquias and Hwang, 2016; Munoz-Leiva *et al.*, 2019; Najib and Fahma, 2020; Balakrishnan and Shuib, 2021; Daragmeh *et al.*, 2021; Moghavvemi *et al.*, 2021; Widyanto *et al.*, 2021; Khan *et al.*, 2023). Research also found that gender and age were moderating the effect of those variables on digital payment adoption (Akinyemi and Mushunje, 2020; Zhu *et al.*, 2021; Dzogbenuku *et al.*, 2022). İn addition, Akinyemi and Mushunje (2020) and Zhu *et al.* (2021) also suggested that people with better education attainment had more possibility in adopting digital payment technology.

Education is widely recognized as a powerful tool for breaking the cycle of poverty (Majumder and Biswas, 2017; Paraschiv, 2017; Eryong and Xiuping, 2018). It equips individuals with the knowledge and skills necessary to adapt to changing economic landscapes and leverage new technologies (Weir and Knight, 2004). In the context of agriculture, education can play a crucial role in enabling farmers to adopt modern practices and technologies, including digital payment systems. Therefore, it is important to investigate the role of education on digital payment adoption among farmers in Indonesia to better understand how to improve digital payment adoption among those agricultural society.

In the context of rural communities, social capital, which encompasses the networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit, plays a crucial role in its development (Wiesinger, 2007; Xu *et al.*, 2021). Rivera *et al.* (2019) concluded that rural populations often rely on strong community ties and social networks to share information, resources, and support. In agricultural settings, social capital can influence the dissemination and adoption of new technologies, including digital payment systems (Nugraha *et al.*, 2021). Farmers in rural areas are more likely to adopt innovations that are endorsed and utilized by their social networks. Moreover, individuals' perceptions and acceptance of new technologies are significantly shaped by their relationships and interactions within their social networks (Hamre, 2008). Social trust and social interaction can enhance the perceived ease of use and usefulness of digital payment systems (Zolotov *et al.*, 2019). For instance, if farmers observe their peers successfully using digital payments and receiving benefits, they are more likely to perceive the technology as useful and easy to use. Zolotov *et al.* (2019) also suggested that social identification and reciprocity further reinforce these perceptions, as

individuals tend to align their behaviours with those of their community members and reciprocate trust and support.

This research is based on the Technology Acceptance Model (TAM), which provides a robust framework for understanding how users come to accept and use a technology. According to TAM, perceived usefulness and perceived ease of use are primary factors influencing an individual's decision to adopt a new technology (Kwesi and Opoku, 2020). In this study, level of education is considered a moderating variable that may influence the relationship between these factors and the acceptance of digital payment systems among farmers. Additionally, social capital theory will be used as antecedents for the TAM constructs, incorporating social trust, social identification, social interaction, and social reciprocity as variables that might impact perceived usefulness and perceived ease of use. By incorporating social capital as antecedents in this study, we can better understand the collective influence of social networks on technology adoption. This approach allows for a more comprehensive analysis of the factors driving digital payment acceptance among farmers, beyond individual perceptions and education levels.

The aims of this research is to investigate factors affecting digital payment adoption among farmers in Indonesia based on TAM model. Moreover, the moderating role of education on the model's relationship will also be examined. In addition, the effect of social capital constructs such as social trust, social identification, social interaction and social reciprocity will be investigated as antecedent variables for perceived usefulness and perceived ease of use.

Literature Review

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a foundational framework for predicting and explaining user behaviours regarding technology adoption (Kwesi and Opoku, 2020). Initially introduced by Davis (1989), TAM was designed to understand user acceptance of computer-based technologies in professional settings. Since its inception, TAM has been extensively applied and adapted across various technological contexts, including financial technology adoption (Daragmeh *et al.*, 2021) and agricultural technology adoption (Shang *et al.*, 2021). According to Davis (1989), TAM suggests that perceived usefulness (PU) and perceived ease of use (PEOU) are crucial determinants of technology acceptance and adoption. PU is defined as the degree to which an individual believes that using a particular technology will enhance their job performance, while PEOU refers to the degree to which an individual believes that the technology is user-friendly. Numerous studies have consistently demonstrated that these two constructs significantly influence user attitudes and intentions toward adopting new technologies across diverse domains and cultural settings (Marangunić and Granić, 2015).

Perceived Usefulness (PU)

Previous studies have consistently demonstrated that PU had significant influences on the Behavioural Intention (BI) to adopt digital payment systems across various contexts (Munoz-Leiva *et al.*, 2019; Flavian *et al.*, 2020; Najib and Fahma, 2020; Balakrishnan and Shuib, 2021). This significant influence of PU on BI of using digital payment also found in the rural context of Brazil (Malaquias and Silva, 2020). PU encompasses an individual's assessment of the advantages, benefits, and overall utility of a particular technology. When individuals recognize

that using a specific technology will be beneficial, they are more likely to be motivated to adopt it (Davis, 1989). Consequently, it is hypothesized that PU exerts a significant impact on the BI to adopt digital payment systems among stakeholders in the agricultural sector.
H1. Perceived Usefulness has a positive effect on the behavioral intention to adopt digital payment by farmers.

Perceived Ease of Use (PEOU)
Flavian *et al.* (2020) identified PEOU as a key determinant of BI to adopt mobile payment systems in both the United States and Spain. This finding aligns with an earlier study by Giovanis *et al.* (2012), which reported that PEOU had both a direct and indirect impact on internet banking adoption behavior. Similar conclusions were drawn by Firman & Nurjihadi (2023), Saputra & Nurjihadi (2023), and Daragmeh *et al.* (2021), who found that PEOU plays a significant role in digital payment adoption across various contexts. Malaquias and Silva (2020) also confirmed the significant impact of PEOU on BI of mobile payment adoption in rural Brazil. Based on these studies, this research hypothesizes that PEOU significantly influences BI to use digital payment systems by farmers in Indonesia.
H2. Perceived Ease of Use has a positive effect on the behavioral intention to adopt digital payment by farmers.

Behavioral Intention (BI) of Digital Payment Adoption
As individuals form a positive intention towards adopting digital payment systems, they are more likely to proceed with using these systems for financial transactions. Numerous studies, including those by Khan et al. (2023), Ong et al. (2023), Malaquias & Silva (2020), and Sivathanu (2017), have confirmed that behavioural intention significantly and positively impacts the actual and behavioural usage (AU) of digital payment systems. Drawing from this evidence, we hypothesize that behavioural intention positively and significantly affects the actual usage of digital payment systems among farmers.
H3. behavioral intention to adopt digital payment has a positive effect on the actual usage of digital payment by farmers.

Social Capital Theory
Social capital theory has gained considerable attention in technology adoption research, especially within the agricultural sector, as a means to understand the uptake of agricultural innovations (Rivera *et al.*, 2019). This theory highlights the crucial role of social relationships, networks, and trust in influencing individuals' behaviour towards adopting new technologies. Social capital refers to the resources accessible to individuals and groups through their social connections and networks, including information, trust, and social support (Ghrootaert and Bastelaer, 2002). In the realm of digital technology adoption, social capital has been employed as predictors in various studies such as Zolotov *et al.* (2019), in the context of online citizen participation, Lee (2015), in tourism technology context, Barton (2013), in the e-learning adoption setting, and Yang *et al.* (2009), in a broader Information Communication Technology (ICT) context. However, the use of social capital theory in the context of digital payment adoption is still missing in the literatures, making this study to be the first to discuss its integration in to TAM model within the context of digital payment. In addition, as this study focuses on agricultural society setting, the integration of social capital in to the model is even more important as social capital has always been considered to be the main capital owned by rural and agricultural population (Hunecke *et al.*, 2017; Rivera *et al.*, 2019). Constructs of

social capital in this study is following the constructs developed by Zolotov *et al.* (2019) as it provides more comprehensive view on social capital that include social trust, social identification, social interaction, and social reciprocity.

Social Trust (ST)

Trust in social relationships has been found to have a positive impact on people's behaviour that facilitate collective action (Nugraha *et al.*, 2021). Defined as the willingness to rely on or have confidence in others' actions, intentions, and behaviours, social trust is a critical factor in social dynamics (Ghrootaert and Bastelaer, 2002). In rural communities, farmers often rely on their social networks for information and support (Mendes *et al.*, 2023). Farmers are more inclined to believe in the benefits of a technology when it is endorsed by trusted figures (Castillo *et al.*, 2021). When community members who are often seen as knowledgeable and experienced, advocate for digital payment systems, farmers are more likely to perceive these systems as beneficial for their agricultural practices and financial transactions. Furthermore, when trusted community members endorse and demonstrate the use of digital payment systems, it can reduce perceived complexity and technological anxiety among farmers (Hamre, 2008). This trust-based support network can facilitate informal training and troubleshooting, making the technology appear more user-friendly and accessible. Thus, we proposed hypothesis that ST has positive effects on perceived usefulness and perceived ease of use.

H4. Social trust has a positive effect on perceived usefulness of digital payment by farmers.

H5. Social trust has a positive effect on perceived ease of use of digital payment by farmers.

Social Identification (SID)

SID refers to the extent to which individuals see themselves as part of a group and derive their identity from group membership (Zolotov *et al.*, 2019). In rural farming communities, social identification can play a significant role in shaping perceptions towards new technologies (Hunecke *et al.*, 2017). When farmers strongly identify with their community, they will be more confident in using technology as they value practices that are seen as beneficial to the group (Castillo *et al.*, 2021). If the community collectively recognizes and endorses the benefits of digital payment systems, individual members are more likely to perceive these systems as useful. Moreover, SID can enhance PEOU by creating a supportive environment where knowledge and experiences are shared among group members, making members of community to become more confident (Castillo *et al.*, 2021). When farmers identify closely with their community, they are more likely to engage in collective learning and mutual assistance. This can demystify the technology, making it seem more accessible and user-friendly. Thus, we propose hypothesis that SID is positively affect PU and PEOU.

H6. Social identification has a positive effect on perceived usefulness of digital payment by farmers.

H7. Social identification has a positive effect on perceived ease of use of digital payment by farmers.

Social Interaction (SIT)

Social interaction refers to the exchange of information, experiences, and support among individuals within a community (Ghrootaert and Bastelaer, 2002). Hamre (2008) explained that frequent social interactions can significantly influence perceptions and attitudes toward new technologies, especially in rural farming communities. In the context of digital payment

adoption, when farmers engage in regular interactions, they share their experiences and insights about how the technology can improve efficiency, security, and convenience in their financial transactions. Frequent social interactions among farmers also provides opportunities for collective learning and problem-solving. Therefore, through regular discussions and shared experiences, farmers can learn from each other's successes and challenges in using digital payment systems, which can make the technology seem more intuitive and user-friendly. This leads to the following hypotheses:

H8. Social interaction has a positive effect on perceived usefulness of digital payment by farmers.

H9. Social interaction has a positive effect on perceived ease of use of digital payment by farmers.

Social Reciprocity (SR)

Zolotov *et al.* (2019) explained that SR refers to the mutual exchange of resources, support, and services within a community. It is a foundational aspect of social capital, fostering cooperation and trust among community members (Claridge, 2018). Zolotov *et al.* (2019) found that SR had a significant effect on use behaviour of online citizen participation, indicating that the same influence can also happen in the context of digital payment adoption. In the context of agricultural society, farmers participation in reciprocal relationships would share their positive experiences and the tangible benefits they have gained from using digital payment technology, which can enhance the perceived value of the technology among peers. In addition, when farmers are engaged in reciprocal relationships, they are more likely to share their knowledge, provide demonstrations, and offer help when others encounter difficulties with the technology. Thus, we hypothesize that:

H10. Social reciprocity has a positive effect on perceived usefulness of digital payment by farmers.

H11. Social reciprocity has a positive effect on perceived ease of use of digital payment by farmers.

Moderating Role of Education

PU is a critical factor in determining BI to adopt digital payment technologies (Liébana-Cabanillas *et al.*, 2020; Najib and Fahma, 2020; Daragmeh *et al.*, 2021; Khan *et al.*, 2023). However, as suggested by Akinyemi and Mushunje (2020) and Zhu *et al.* (2021), the strength of this relationship can vary depending on an individual's level of education. Higher education enhances cognitive abilities, critical thinking, and the capacity to understand and evaluate the benefits of new technologies. In the context of this research, farmers with higher levels of education are likely to more accurately assess and appreciate the advantages of digital payment systems, leading to a stronger intention to use them. In contrast, farmers with lower levels of education might not fully comprehend or appreciate the usefulness of the technology, resulting in a weaker behavioural intention.

Moreover, the influences of PEOU on BI of digital payment adoption that had been confirmed by many studies (de Luna *et al.*, 2019; Jung *et al.*, 2020; Moghavvemi *et al.*, 2021), its effect was also moderated by years of education (Akinyemi and Mushunje, 2020; Zhu *et al.*, 2021). Education enhances learning capabilities and the ability to navigate technological tools, thereby making the technology seem more accessible (Weir and Knight, 2004). Farmers with higher levels of education are likely to find digital payment systems easier to use, and this

perception of ease will strongly influence their intention to adopt the technology. Conversely, for farmers with lower education levels, even if they perceive the technology as easy to use, their limited familiarity with digital tools might still impede their behavioural intention.

Sivathanu (2017), and Migliore *et al.* (2022), proved that BI of digital payment system is a strong predictor of the actual usage of these technology, but those studies did not examine the role of education in the relationship. Higher education levels equip individuals with better problem-solving skills and technical knowledge (Eryong and Xiuping, 2018) that can increase the confidence to overcome barriers to AU. For this study context, farmers with higher education levels are more likely to follow through on their intentions to use digital payment systems, translating intention into actual usage. On the other hand, farmers with lower education levels might face practical challenges in executing their intentions, such as difficulty in understanding the technology or lack of access to necessary resources, leading to a weaker link between intention and actual usage.

H12a. The relationship between perceived usefulness and behavioural intention of digital payment adoption is stronger for farmers with higher levels of education.

H12b. The relationship between ease of use and behavioural intention of digital payment adoption is stronger for farmers with higher levels of education.

H12c. The relationship between behavioural intention of digital payment adoption and actual usage is stronger for farmers with higher levels of education.

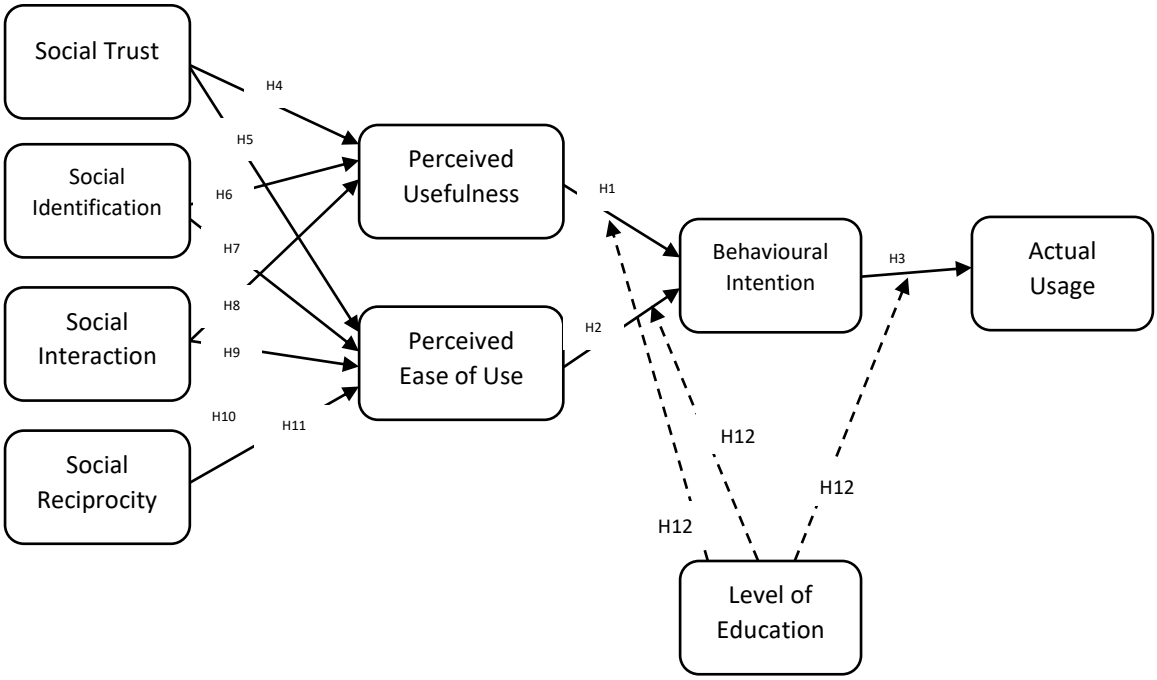

Figure 1. Research Model

Method

This research employs a survey-based methodology targeting farmers who have experience using digital payment systems. The population for this study consists of farmers from various regions in Indonesia, ensuring a diverse and representative sample. To recruit respondents, a self-registration sampling method was utilized, inviting farmers to participate through various channels. In total, 396 farmers from different regions of Indonesia participated in the survey.

However, only 316 responses were eligible to be included in data analysis as some responses were not completed or the respondents did not met the eligibility criteria of this study. Saunders *et al.* (2019), argued that 300 samples are adequate for large population.

The survey instrument was meticulously developed based on a comprehensive review of relevant literature, ensuring it effectively captures the constructs of interest, such as perceived usefulness, perceived ease of use, education level, and social capital variables. The main references for this instrument development include Malaquias and Silva (2020) and Najib and Fahma (2020), for PU and PEOU, Sivathanu (2017) for the constructs of BI and AU, and Zolotov *et al.* (2019), for social capital variables. To guarantee the instrument's content validity and reliability, it was validated by a panel of experts. The results of instrument development used in this study is displayed in table 1. The survey was distributed online using Allcounted.com, a platform that facilitates data collection and management. Additionally, enumerators were employed in certain regions to assist with data collection, ensuring that farmers with limited internet access or digital literacy could also participate.

For data analysis, Structural Equation Modelling (SEM) was employed using the SmartPLS application. SEM is well-suited for examining predictive analysis of complex relationships between variables and assessing the moderating effects of higher education on digital payment acceptance (Hair Jr. *et al.*, 2017). The analysis focused on testing the hypothesized relationships derived from the Technology Acceptance Model (TAM), and assessing the impact of social capital variables, including social trust, social identification, social interaction, and social reciprocity as antecedents of PU and PEOU. Moreover, this study is also designed to evaluate the moderating role of education using Multigroup Analysis (MGA) as suggested by Cheah *et al.* (2020).

Table 1
Research Instrument Development

No	Variable	Questionnaire items		References
		No	Items	
1	Perceived Usefulness	1	Digital payment would improve the quality of transactions in my agricultural business.	• Malaquias and Silva (2020) • Najib and Fahma (2020)
		2	Digital payment would improve the accuracy of transactions in my agricultural business.	
		3	Digital payment reduces the time of transactions in my agricultural business.	
		4	Using digital payment for my agricultural business would increase my productivity.	
		5	Digital payment makes transactions more flexible for my agricultural business.	

2	Perceived Ease of Use	1	Learning to use digital payment transactions to support my agricultural business would not be very difficult.	• Malaquias and Silva (2020) • Najib and Fahma (2020)
		2	I can perform digital payments easily for transactions to support my agricultural business.	
		3	Using digital payment for my agricultural business is clear and understandable.	
3	Behavioural Intention of Digital Payment Adoption	1	I prefer to use digital payment systems to handle payments for my agricultural activities.	Sivathanu (2017)
		2	I choose to conduct all financial transactions for my agricultural activities using digital payment systems.	
		3	I am interested in using digital payment for transactions in my agricultural business.	
		4	I'm willing to manage my accounts with the help of digital payment systems to support my agricultural business.	
		5	I want to learn how digital payment systems can be leveraged to improve my agricultural business.	
4	Actual Usage	1	I use digital payment systems for agricultural businesses.	Sivathanu (2017)
		2	I utilize digital payment systems to manage my accounts.	
		3	I use digital payment systems to conduct transactions in agricultural activities.	
		4	I sign up for financial services that are specially designed for digital payment systems.	
5	Social Trust	1	I believe I can trust the members of my agricultural community who are actively using digital payment systems for their agricultural businesses.	Zolotov *et al.* (2019)
		2	I believe that agricultural community members who utilize digital payment systems	

			for their transactions are more professional and trustworthy.	
		3	I believe I can establish better business collaborations with members of the agricultural community who use digital payment methods.	
		4	I trust that agricultural community members who use digital payment methods can offer valuable insights into reliable transaction methods for my agricultural business.	
6	Social Identification	1	I feel a sense of belonging to the agricultural community that uses digital payment for transactions in agriculture.	Zolotov *et al.* (2019)
		2	I feel a strong sense of connection with the agricultural community that utilizes digital payment for agricultural transactions.	
		3	I take pride in being a member of the agricultural community that utilizes digital payment for agricultural transactions.	
7	Social Interaction	1	I maintain close social relationships with some members of the agricultural community that use digital payment for their agricultural business.	Zolotov *et al.* (2019)
		2	I spend a lot of time interacting with some members of the agricultural community that use digital payment for their agricultural business.	
		3	I regularly engage in communication with certain members of the agricultural community who employ digital payment methods for their agricultural business.	
		4	I know some members of the agricultural community that use digital payment for their	

			agricultural business on a personal level.	
8	Social Reciprocity	1	It is equitable to support one another within the agricultural community members who utilize digital payment for agricultural transactions.	Zolotov *et al.* (2019)
		2	I believe that members of the agricultural community who use digital payment for agricultural transactions will help me if I need it.	
		3	I trust that fellow members of the agricultural community who utilize digital payment for transactions will assist me when needed, so reciprocating assistance is only fair.	

Results

Respondents Description

Table 2

Description of Respondents

Measure	Item	Absolute	%
Gender	Male	202	64%
	Female	114	36%
Age	Gen Z (<25 y.o)	84	27%
	Millenials (>25 – 45 y.0)	143	45%
	Gen X (>45 – 60 y.o)	82	26%
	Baby boomers (> 60 y.o)	7	2%
Education	No School	3	1%
	Elementary School	33	10%
	Junior High School	39	12%
	Senior High School	116	37%
	Bachelor	112	35%
	Post Graduate	13	4%
Ethnicity by Region	Sumatra	46	15%
	Java	88	28%
	Nusa Tenggara	140	44%
	Borneo-Sulawesi	37	12%
	Maluku-Papua	5	2%
Frequency of Using Mobile phone	everyday	280	89%
	2-3 times a week	24	8%
	once a week	1	0%
	rarely	11	3%

Measure	Item	Absolute	%
Farming Experience	Less than 5 years	94	30%
	5-10 years	74	23%
	more than 10 years	148	47%
Farming Size	Less than 0,5 ha	100	32%
	0,5 - 1 ha	117	37%
	more than 1 ha	99	31%

Reliability, Convergent Validity and Goodness of Fit

As suggested by Hair *et al.* (2019), the first assessment conducted using SmartPLS was the PLS Algorithm calculation to measure the validity, reliability, and goodness of fit of the proposed model. At first, the outer loading value of all items in the research instrument was measured, in which each item was required to have above 0.7 value. Cronbach's Alpha (CA) and Composite Reliability (CR) of the constructs were used to measure the model internal consistency and measurement reliability which required a value of more than 0.7 to ensure the reliability of the model. Furthermore, the model's validity was measured using Average Variance Extracted (AVE) value to ensure its convergent validity and Forner-Larcker Criterion matrix to ensure the discriminant validity. The AVE value needs to be above 0.5 while the discriminant validity is met when the value of the square root of the AVE for each construct are greater than the highest correlation of that construct with any other construct (Hamid *et al.*, 2017). The result is displayed in table 3 and table 4.

Table 3
Model's Reliability and Convergent Validity

	Outer Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
PU1	0.929			
PU2	0.929			
PU3	0.879	0.946	0.959	0.824
PU4	0.869			
PU5	0.930			
PEOU1	0.899			
PEOU2	0.949	0.926	0.953	0.871
PEOU3	0.951			
BI1	0.911			
BI2	0.906			
BI3	0.920	0.943	0.957	0.815
BI4	0.911			
BI5	0.864			
AU1	0.907			
AU2	0.917	0.909	0.937	0.787
AU3	0.888			
AU4	0.834			
ST1	0.885			
ST2	0.920	0.935	0.954	0.837
ST3	0.933			

ST4	0.921			
SID1	0.936			
SID2	0.924	0.922	0.950	0.865
SID3	0.930			
SIT1	0.889			
SIT2	0.912	0.918	0.942	0.802
SIT3	0.906			
SIT4	0.875			
SR1	0.895			
SR2	0.937	0.914	0.946	0.854
SR3	0.939			

Table 4
Discriminant validity (Forner-Lurcker Criterion Matrix)

	AU	**BI**	**PEOU**	**PU**	**SID**	**SIT**	**SR**	**ST**
AU	***0.887***							
BI	0.616	***0.903***						
PEOU	0.596	0.844	***0.933***					
PU	0.555	0.814	0.813	***0.908***				
SID	0.567	0.810	0.724	0.655	***0.930***			
SIT	0.599	0.744	0.662	0.595	0.783	***0.896***		
SR	0.516	0.751	0.653	0.659	0.721	0.774	***0.924***	
ST	0.596	0.810	0.742	0.696	0.834	0.739	0.758	***0.915***

Table 3 shows that all items in the research instrument had more than 0.8 outer loading value, indicating a strong representation within their respective constructs. All constructs in the model also showed CA and CR value of more than 0.7, indicating a strong reliability of the model. The AVE value of all variables were also greater than 0.5, indicating a very good convergent validity. Table 4 further strengthen the model's validity as the cross value of a similar construct was greater than the cross value of a construct with other constructs in the Forner-Lurcker criterion matrix (see the bold and italic value, compare to the other values in the same column), indicating a strong discriminant validity. These tables confirmed that the model used in this study is valid and reliable, and therefore it can be used for a further assessment of its path relationship to answer the research question.

Furthermore, Hair *et al.* (2019), suggested that a model robustness and predictive power in SEM PLS must be measured in a structural model analysis. The first assessment in this regard is to check the collinearity issue using its VIF value. If the model is clear from collinearity issue, the model robustness would then assessed using its R^2 and Q^2 values.

Table 5
Collinearity Measurement (VIF Value)

	Actual Usage	Behavioral Intention	Perceived Ease of Use	Perceived Usefulness
Actual Usage				
Behavioral Intention	1.000			
Perceived Ease of Use		2.945		
Perceived Usefulness		2.945		
Social Identification_			4.120	4.120
Social Interaction			3.398	3.398
Social Reciprocity			3.075	3.075
Social Trust_			3.959	3.959

Table 6
Model's predictive power (R^2 and Q^2_predict values)

	R Square Adjusted	Q^2_predict
Actual Usage	0.378	0.339
Behavioral Intention	0.760	0.701
Perceived Ease of Use	0.594	0.586
Perceived Usefulness	0.527	0.512

The ideal value of VIF to be considered free from collinearity issue is less than 3. However, the value of less than 5 is acceptable (Hair *et al.*, 2019). The VIF values of all constructs in table 5 were less than 5, indicating that the model is not facing collinearity issue. Furthermore, the predictive power of the model can be seen in table 6, which all dependent variables in the model had more than 0.3 in R^2 value, indicating that the model has a strong explanatory power. Moreover, the Q^2 value indicated a high predictive accuracy as most of the dependent variables in the model had more than 0.5 value of Q^2.

Main Hypothesis Testing Result

The main hypothesis in this study were developed to measure the impact of TAM constructs (PU and PEOU) on the Behavioral Intention of digital payment adoption in the agricultural society's setting. Moreover, the role of social capital constructs such as ST, SID, SIT, and SR as antecedent variables for PU and PEOU were also measured in this study. The result is displayed in table 4.

Table 7
Hypothesis Testing Result

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Decision
H1: PU → BI	0.377	0.386	0.067	5.622	0.000	Supported
H2: PEOU → BI	0.538	0.529	0.068	7.860	0.000	Supported
H3: BI → AU	0.616	0.616	0.044	14.036	0.000	Supported
H4: ST → PU	0.351	0.347	0.086	4.061	0.000	Supported
H5: ST → PEOU	0.370	0.367	0.089	4.170	0.000	Supported
H6: SID → PU	0.172	0.189	0.106	1.626	0.105	Not Supported
H7: SID → PEOU	0.257	0.268	0.098	2.630	0.009	Supported
H8: SIT → PU	-0.017	-0.027	0.078	0.219	0.827	Not Supported
H9: SIT → PEOU	0.106	0.097	0.071	1.500	0.134	Not Supported
H10: SR → PU	0.282	0.281	0.077	3.671	0.000	Supported
H11: SR → PEOU	0.105	0.106	0.068	1.552	0.121	Not Supported

The original path constructed from TAM, represented by H1 and H2, all resulted significant relationship in the model as they had P value of (0.000<0.05), thus the hypothesis were supported, further confirm the robustness of those classic TAM model in the context of digital payment adoption among Indonesian farmers. This result align with studies by Malaquias and Silva (2020) and Lema (2017) which suggested the significant positive impact of PU and PEOU on digital payment adoption among rural inhabitants. Moreover, the impact of BI on AU (H3) was also supported as it had a P value of (0.000<0.05), confirming the result of research conducted by Sivathanu (2017) in India and Migliore *et al.* (2022) in China and Italy.

Furthermore, the impact of social capital constructs on PU and PEOU were varied. ST was found to have significant and positive impact toward PU and PEOU with both relationship had P values of (0.000<0.05) and path coefficient of 0.351 and 0.370 respectively, thus H4 and H5 were supported. The path coefficient values in H4 and H5 were the highest among all of the relationship of social capital constructs and the PU and PEOU in this study's model. On the contrary, SIT showed insignificant impact toward PU and PEOU, as it had P Values of (0.827 > 0.05) and (0.134 > 0.05) respectively, indicating that H8 and H9 were both rejected or not supported. In addition, SID was found to be significant in impacting PEOU with a P value of (0.009 < 0.05) and path coefficient of 0.257, indicating that H7 was supported. However, the impact of SID on PU was found to be not significant as it had a P value of (0.105 > 0.05), thus, H6 was not supported. Finally, SR was found to be significant in affecting PU (P value of 0.000 < 0.05) while it was insignificant in affecting PEOU (P value of 0.121 > 0.05). Thus, H10 was supported while H11 was not supported.

Moderating Role of Education

The moderating role of education in this study was measured by conducting a Multi Group Analysis (MGA) in the SmartPLS. This analysis provides insight on the differences of effects between groups in the research model. For the purpose of this study, the social capital constructs were ignored in the MGA, ensuring the original analysis on the role of education in the classic TAM model within the context of digital payment adoption among Indonesian farmers. SmartPLS provides several version of MGA results, including the original MGA (Henseler and Fassot, 2010), parametric MGA, and Permutation MGA. If data distribution of the study is significantly different across the measured groups in MGA, Cheah *et al.* (2023) recommended to use the original MGA results that was developed from Henseler and Fassot (2010). The result of the original MGA can be seen in table 9, while the bootstrapping result for each group can be seen in table 8.

Table 8
The Impact of TAM Constructs in Different Level of Education

	All		Elementary Education		Secondary Education		Higher Education	
	Path Value	P-Value	Path Value	P Value	Path Value	P Value	Path Value	P Value
BI -> AU_	0.616	0.000	0.677	0.000	0.650	0.000	0.459	0.000
PEOU -> BI	0.537	0.000	0.509	0.000	0.413	0.000	0.646	0.000
PU -> BI	0.378	0.000	0.462	0.000	0.491	0.000	0.220	0.059

The table shows that the relationship of PU on BI was significant in all segment of education level with P value of (0.000<0.05), except for farmers with higher education attainment that had a P value of (0.059 > 0.05). This indicates that H12a was not supported. In fact, the effect of PU on BI was higher among farmers with lower education attainment such as elementary education and secondary education. This result is contradicted with the conclusion made in studies by Akinyemi and Mushunje (2020) and Zhu *et al.* (2021) that clearly found the higher possibility of digital payment adoption among rural inhabitant with higher education status. The reasons for this anomaly could be related to a condition of over-informed and over-comfortable among the higher educated farmers. PU in this study measures how the use of digital payment could bring benefits to the agricultural business such as increase in productivity and efficiency. As the higher educated farmer group were previously active using digital payment in different context, they would continue to use it for their agricultural business whether or not there are certain values and benefits related to their agricultural business of using it.

Moreover, the effect of PEOU on BI and the effect of BI on AU were significant in all groups of farmers based on their level of education (P value of < 0.05). This indicates that there was no difference of the impacts on those relationship, suggesting that H12b and H12c were also rejected. The MGA analysis would further confirm this result as shown in table 6.

Table 9
Multi Group Analysis (MGA) result

	Higher Education Vs Elementary Education			Higher Education Vs Secondary Education		
	Path Coefficients-diff	**P-Value**	**Decision**	**Path Coefficients-diff**	**P-Value**	**Decision**
BI -> AU_	-0.218	0.138	Not Supported	-0.191	0.054	Not Supported
PEOU -> BI	0.136	0.413	Not Supported	0.233	0.125	Not Supported
PU -> BI	-0.242	0.148	Not Supported	-0.271	0.080	Not Supported

This table further confirmed that there was no differences on the effect of PU on BI, PEOU on BI, and the effect of BI on AU among farmers with different level of education attainment. All relationship in all segment of farmers level of education showed P value above 0.05, leading to a decision of Not Supporting the H12a, H12b and H12c. On the other hand, level of education was not moderating the effect of PU on BI, PEOU on BI, and BI on AU. The implication for this result is that, the effort of promoting the use of digital payment among farmers in Indonesia does not need to focus on certain segment of farmers based on their education. All farmers, despite their education level had a high possibility of using digital payment system as long as the technology is perceived to brings benefits and offers easiness of using.

Discussion

The results of this study reaffirm the robustness of TAM in explaining technology adoption behaviours, including in the context of farmers adoption behaviour of digital payment system. Both PU and PEOU were found to have significant positive effects on BI to use digital payment systems. These findings are consistent with a substantial body of previous research that has validated TAM in digital payment contexts (Munoz-Leiva *et al.*, 2019; Najib and Fahma, 2020; Khan *et al.*, 2023). This result also strengthen the findings of Malaquias and Silva (2020) and Lema (2017) that highlighted the significant role of PU and PEOU on BI within the context of rural and unbanked population. The result of this study underscores the generalizability and applicability of TAM in understanding the adoption of digital payment systems among farmers, highlighting that the perceptions of usefulness and ease of use are critical determinants of their intention to adopt such technologies.

The study also explored the influence of social capital on PU and PEOU, revealing that social capital has a partial effect. Among the various constructs of social capital examined, social trust emerged as the most influential factor affecting both PU and PEOU. This finding aligns with existing literature which suggests that trust within social networks can reduce anxiety of using new technology, leading to the adoption of those technology (Barton, 2013). The role of trust in reducing anxiety could improve farmers perception of the ease of using digital payment for their agricultural business. Ren *et al.* (2022), found that social trust promoted the benefits of adopting green control technology among farmers, indicating that social trust could improve PU in technology adoption.

Conversely, social interaction was not found to have a significant effect on either PU or PEOU. This result suggests that while social interactions facilitate the exchange of information and support, they may not directly translate into perceptions of usefulness and ease of use of digital payment systems. This finding diverges from some previous studies that highlighted the significant role of social interaction in technology adoption (Saptutyningsih *et al.*, 2020; Ogunleye *et al.*, 2021). This phenomenon might be caused by the types of interaction that the farmers in this study had among themselves. When farmers conduct their social interaction, they would be more interested to discuss about the technical aspect of their agricultural practices, instead of discussing transaction method, as indicated in many studies that measured social capital among farmers such as Bahtera and Hayati (2018) and (Dobbin and Smith, 2021)

One of the surprising findings of this study was the lack of support for the moderating role of education in the TAM model. The results indicated no significant differences in the effects of PU and PEOU on behavioural intention across different levels of education among farmers. This result is contradicted with the finding of (Akinyemi and Mushunje, 2020) and (Zhu *et al.*, 2021) that highlighted the significant moderating role of education on digital payment adoption. This result may suggest that factors other than education play a more pivotal role in shaping farmers' technology adoption behaviours in this context. It is possible that the specific knowledge and skills required to use digital payment systems can be acquired through practical experience and community support, irrespective of formal education levels. Additionally, the widespread use of mobile technologies in rural areas might have levelled the playing field, making the influence of education less pronounced.

These findings have important implications for policy-makers and practitioners aiming to promote the adoption of digital payment systems among farmers. Efforts should focus on building and enhancing social trust within farming communities, as this has a significant impact on the perceived usefulness and ease of use of such technologies. Moreover, the non-significance of education as a moderating factor suggests that digital literacy initiatives should be inclusive of all education levels, emphasizing practical training and community-based learning. Future research could further explore the roles of other potential moderating variables, such as age, gender, or previous experience with technology, to gain a more comprehensive understanding of the factors influencing digital payment adoption.

Conclusion

This study provides compelling evidence for the applicability of the Technology Acceptance Model (TAM) in understanding the adoption of digital payment systems among farmers in Indonesia. By confirming that perceived usefulness (PU) and perceived ease of use (PEOU) significantly influence farmers' behavioural intentions, this research aligns with and extends previous findings across various technological domains.

A noteworthy contribution of this study is the identification of social capital, particularly social trust, as a critical determinant of PU and PEOU. The results underscore that fostering trust within farming communities can significantly enhance farmers' perceptions of the usefulness and ease of use of digital payment systems, thereby promoting their adoption. However, contrary to expectations, social interaction did not have a significant impact, suggesting that the quality and nature of social relationships, rather than their mere frequency, are pivotal in

shaping technology adoption behaviours. Furthermore, the study reveals that the moderating role of education level in the TAM model was not supported. This finding challenges the conventional wisdom that higher education levels always facilitate technology adoption, highlighting the importance of practical, community-based learning and support in this context. It suggests that digital literacy and technology adoption can be effectively promoted across all educational levels through targeted, inclusive initiatives.

Recommendations

Based on our findings, policymakers should prioritize fostering trust within farming communities and designing inclusive digital literacy programs. Digital literacy initiatives should focus on practical, hands-on training accessible to all farmers, regardless of education level, to equip them with the necessary skills for effective technology use. Additionally, addressing practical barriers such as internet access and technical support is essential to ensure that farmers can translate their behavioural intentions into actual usage of digital payment systems.

Future research should explore the quality of social interactions and their impact on technology adoption. By understanding the specific mechanisms through which social capital influences technology adoption, we can develop more targeted and effective strategies. Policymakers and researchers must work together to create supportive environments that empower farmers to embrace digital innovations, ultimately driving economic development and improving their livelihoods. Through collaborative efforts, we can build a more digitally inclusive and prosperous future for the agricultural sector in Indonesia.

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