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Research Article

# BEYOND USEFULNESS AND EASE OF USE: THE MODERATING ROLE OF PERCEIVED SECURITY IN SHAPING MSME CONSUMERS' INTENTION TO ADOPT QRIS

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**Abstract**
The rapid adoption of QR code-based mobile payment systems reflects a broader shift toward contactless and digital financial transactions. In Indonesia, the Quick Response Code Indonesian Standard (QRIS) has been widely promoted. However, despite its growing use, existing studies largely focus on general technology acceptance factors while paying limited attention to the contingent role of perceived security in shaping user behavior. This gap is critical, as security concerns remain a key barrier in digital payment adoption. Therefore, this study aims to examine the determinants of user acceptance of QRIS by extending the Technology Acceptance Model (TAM) and explicitly incorporating perceived security as a moderating variable. This research employs a quantitative approach using a survey method, with data collected from 198 QRIS users in Indonesia. The data were analyzed using structural equation modeling to evaluate both direct and moderating relationships among variables. The results indicate that perceived ease of use and perceived usefulness significantly influence users' intention to adopt QRIS. More importantly, perceived security is found to significantly moderate these relationships, strengthening the effects of both perceived ease of use and perceived usefulness on adoption intention. These findings suggest that user acceptance of QRIS is not solely determined by functional and usability aspects, but also by the extent to which users perceive the system as secure. The study contributes to the development of TAM by highlighting the moderating role of perceived security in digital payment contexts.

Keywords: Mobile Payment, Perceived Security, QR Code Payment, QRIS, Technology Acceptance Model (TAM)



## INTRODUCTION

Economic transactions no longer rely exclusively on conventional cash-based payment models, whether in the form of coins or banknotes. Advances in technology have steadily reduced the frictions associated with market exchange, enabling the completion of commercial transactions without the need to carry physical money (Chaveesuk et al., 2021; Yuan et al., 2023). Alongside cashless developments, payment practices have diversified through the widespread adoption of debit and credit cards, as well as

digital wallets and QR code-based payment systems, which offer streamlined and user-friendly transaction mechanisms (Matemba & Li, 2018).

Within this evolving payment landscape, Visa and Mastercard continue to operate as leading players in the global payment industry (Amond, 2025). Although these firms do not directly issue credit or debit cards, they provide the underlying network infrastructure that facilitates transactions among banks, merchants, and consumers. This infrastructural role positions Visa, Mastercard, and comparable payment networks to capture significant value from transaction flows, as monetary circulation across jurisdictions increasingly depends on their systems.

Simultaneously, the rapid diffusion of card-based and digital payment technologies has encouraged several states to strengthen their domestic payment infrastructures and reduce their reliance on global network providers (Iyer, 2025; Khurana et al., 2025; Li et al., 2024). Indonesia offers a salient example through the development of the National Payment Gateway (Gerbang Pembayaran Nasional/GPN) and the Quick Response Code Indonesian Standard (QRIS), initiated under Bank Indonesia and supported by the Indonesian Payment System Association (ASPI). Notably, QRIS has rapidly expanded as a national digital payment system, and its growing penetration has gradually displaced the dominance of Visa and Mastercard within the Indonesian market (merdeka.com, 2025). According to ASPI, by late 2024 the monthly transaction value processed through QRIS reached IDR 82 trillion, amounting to 779 million transactions (ASPI, 2025b). Unlike card-based methods, QR code payments are integrated into smartphones, thereby enhancing convenience and reducing the need for physical payment cards.

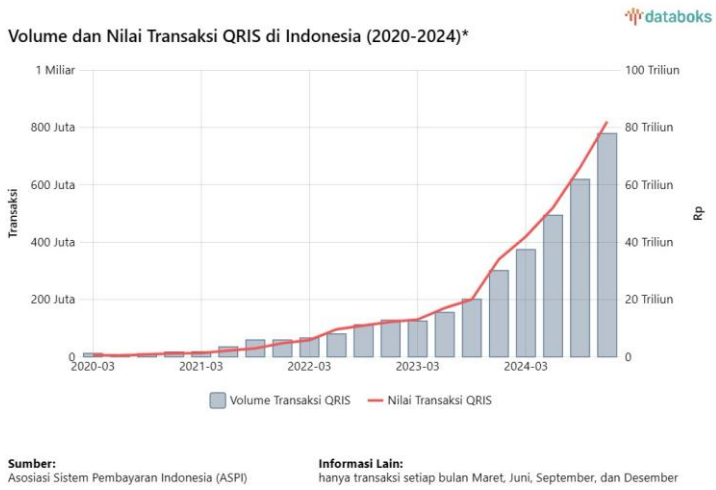


Figure 1. Transaction volume and value of QRIS in Indonesia, 2020–2024 (Source: ASPI, 2025)

As a payment system with the potential to keep monetary circulation within national borders, QRIS has been actively promoted for mass adoption, including through cross-border initiatives across ASEAN countries (Setkab RI, 2022). Nevertheless, QRIS implementation in Indonesia continues to face a number of constraints despite its positioning as a flexible and economically promising payment infrastructure. Notably, consumer uptake has shown signs of slowing down. The ASPI data on QRIS consumer growth indicate that in the last two quarters of 2024, the growth rate of QRIS consumers stagnated at 3% (ASPI, 2025a). This figure is considerably lower than that recorded in the previous year, when consumer growth reached 13.51% (ASPI, 2025a).

One explanation for the deceleration in QRIS consumer growth relates to uneven levels of digital literacy and persistent infrastructural disparities across regions in Indonesia. QRIS-based payments tend to be perceived as more accessible to younger cohorts—particularly millennials and Generation Z (Populix, 2025)—whereas older generations, such as baby boomers, are often less able or less willing to adopt emerging payment technologies (Tiovilda & Melissa, 2025). According to our preliminary interviews with baby boomer respondents, QRIS is frequently regarded as complicated to use, and characterized by lingering uncertainties regarding security. Consequently, cash payments remain the preferred option for this cohort. Meanwhile, respondents from Generation X and millennials tend to consider QRIS to be less beneficial in practice, largely because the technology has not yet achieved

sufficiently broad coverage. This concern is reinforced by Populix findings showing that street vendors' of QRIS remains relatively low (Populix, 2025), despite the significant scale of monetary circulation within Indonesia's informal sector.

Despite these challenges, the existing body of research on QRIS adoption is diverse and underscores the relevance of further scholarly inquiry, particularly in relation to financial system autonomy and the consolidation of domestic payment infrastructures (Hartanto et al., 2025; Kuswoyo et al., 2024; Widjaja & Legowo, 2025). However, prior QRIS studies have predominantly focused on merchants, especially micro, small, and medium-sized enterprises (MSMEs/UMKM), as providers of payment services. This strand of research examined how MSMEs adopt QRIS to enhance transaction efficiency and operational effectiveness (Kuswoyo et al., 2024; Nurqamarani et al., 2024; Rafiani et al., 2024; Wijaya et al., 2024). For example, Nurqamarani et al. (2024), drawing on the Technology Readiness Acceptance Model (TRAM), identify 'trust' as a key determinant of QRIS adoption among MSME actors. Similarly, Rafiani et al. (2024) reported that perceived usefulness, perceived ease of use, revenue considerations, and perceived risk significantly influence merchants' intentions to adopt QRIS.

By contrast, studies examining consumber-based QRIS adoption remain comparatively limited (Herwanto et al., 2025; Pakpahan et al., 2026), even though understanding consumer behavior is critical to sustaining the system's long-term implementation. Existing consumer-focused research generally discusses broad determinants of QR code payment adoption (Hamzah Muchtar et al., 2024; Sang, 2023; Sofwatunnisa et al., 2024; Tiovilda & Melissa, 2025; Usman et al., 2024). For instance, Usman et al. (2024), applied the TAM to identify key factors affecting QRIS use among consumers in the contect of MSMEs. However, empirical research that explicitly investigates consumer adoption behaviour remains scarce, particularly research that accounts for perceived security, an issue frequently raised as a barrier to adoption among older generations.

Therefore, a critical gap exists in the literature regarding how perceived security shapes consumer adoption of QRIS, particularly as a moderating factor within the Technology Acceptance Model (TAM). While prior studies acknowledge the importance of security, its role in strengthening or conditioning the effects of perceived ease of use and perceived usefulness remains underexplored, especially in the context of emerging digital payment systems.

Accordingly, this study aims to examine the determinants of MSME consumers' intention to adopt QRIS by extending TAM to include perceived security as a moderating variable. This approach is expected to provide a more comprehensive understanding of digital payment adoption behavior, particularly in developing economies where trust and risk perception remain critical concerns. Specifically, this study addresses the following research questions: (1) To what extent do perceived ease of use and perceived usefulness influence consumers' intention to adopt QRIS? and (2) How does perceived security moderate these relationships? Based on these questions, the study proposes that perceived ease of use and perceived usefulness positively influence adoption intention, while perceived security strengthens these relationships.

## LITERATURE REVIEW

### *Exploring the Intention to Use the QR Payment Method*

TAM is one of the most widely used frameworks for explaining users' acceptance of technology (Davis, 1989). It has also been complemented by subsequent models, notably the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2012). Within TAM, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) constitute the two primary determinants shaping users' attitudes toward technology and, ultimately, their behavioral intention to adopt and use new technologies.

In the context of QR code-based payment systems, TAM has been extended through integration with other theoretical approaches, including UTAUT (Ramayanti et al., 2025) and the Theory of Planned Behaviour (Astari et al., 2022; Tian et al., 2023). Such extensions confirm the continued analytical value of TAM in explaining adoption behavior and usage intention in QR code payment contexts.

Moreover, previous studies have highlighted Perceived Security (PS) as a critical factor in evaluating the adoption of new technologies, particularly in digital payment environments (Usman et al., 2024; Al-Shamali et al., 2025; Banerjee & Jhawar, 2025; Ramaiya et al., 2025; Siagian et al., 2022). This study integrates the core TAM constructs (PEOU and PU) with Perceived Security (PS) to develop a more

robust understanding of consumers' intention to use QRIS as a cashless payment method. This conceptual extension is expected to generate a more comprehensive account of the determinants that facilitate or constrain the adoption of digital financial technologies.

### *Intention to Adopt*

Individuals' intention or willingness to adopt technology in the future frequently drives by their use of thecnology. Adoption intention can be defined as the degree to which an individual is willing and prepared to use a given technology in subsequent periods. Individuals tend to form judgments and intentions regarding their future technology use (Nangin et al., 2020). Such intentions are based on behavioral tendencies and personal predispositions towards technology use (Al-Okaily et al., 2020).

In the context of digital payment technologies—such as e-wallets and QRIS—intention reflects the extent to which an individual is motivated to continue using the system as part of routine transactions. Common indicators used to capture adoption intention include the following: (1) willingness to use the technology, (2) efforts to use it consistently in the future, and (3) commitment to sustained usage over time (Usman et al., 2024).

### *Perceived Ease of Use (PEoU)*

In digital payment systems, Perceived Ease of Use (PEOU) refers to the degree to which users believe that a technology can be operated easily and without substantial effort (Liao et al., 2009). PEOU is expected to exert a direct influence on PU in extended TAM formulations, as users typically perceive a system to be more useful when it is simple and intuitive to operate (Belmonte et al., 2024; (George, 2018; Hou, 2025). The more straightforward and user-friendly a digital payment system is, the more likely users are to experience satisfaction and maintain continued usage (Alhassan et al., 2020).

Prior research consistently demonstrated a significant relationship between PEOU and consumers' intention to use QR payment technologies (Wan Nawang & Syabil Nazhan Ahd.Moess, 2023; Zhong & Moon, 2022). In the QRIS context, PEOU is commonly operationalized through individuals' interaction with the payment interface (e.g., digital wallets) (Basoglu et al., 2014; Mayuga et al., 2026; Pham Thi et al., 2024), particularly whether the system is easy to understand, learn, and use (Chawla & Joshi, 2019; Garrouch, 2021).

Based on the above discussion, the following hypothesis is proposed:

**H1: PEOU is positively associated with the intention to adopt QRIS.**

### *Perceived Usefulness (PU)*

Perceived Usefulness (PU) represents a core construct within TAM and plays an essential role in shaping individuals' decisions to adopt new systems and technologies (Hong et al., 2002). PU refers to the extent to which an individual believes that using a technology enhances performance and delivers tangible benefits (Ahn & Park, 2023; Davis, 1989). In the context of QR payment, consumers' perceived benefits are central to their decision-making. Users are more likely to adopt and continue using the technology when they perceive that QR-based payments offer services aligned with their needs—while also increasing convenience and transaction efficiency (Eren, 2024; Hairani et al., 2021; Türker et al., 2022; Zhong & Moon, 2022).

Accordingly, this study anticipates that higher perceptions of usefulness will translate into a stronger intention to use QRIS. Therefore, the following hypothesis is formulated:

**H2: PU is positively associated with the intention to adopt QRIS.**

### *Perceived of Security (PS)*

Perceived Security (PS) refers to individuals' assessment of a technology's security, including concerns, uncertainty, and perceived vulnerability in its use (Oliveira et al., 2016). Security is particularly important in digital payments because transactions involve financial services and personal data, which can substantially shape an individual's decision to adopt the technology (Liébana-Cabanillas et al., 2018).

Existing research indicates that PS can significantly moderate the relationships between TAM variables and usage intention in digital payment contexts (Kusumastuti et al., 2023). In addition, PS may independently influence both PEOU and PU, as safety perceptions can shape whether a system is judged as comfortable to use and beneficial in practice (Lallmahamood, 2007).

On this basis, the following hypotheses are proposed:

**H3: Perceived Security moderates the relationship between PEOU and the intention to adopt QRIS.**

**H4: Perceived Security moderates the relationship between PU and the intention to adopt QRIS.**

Based on the above operationalization, the following conceptual research model summarizes the hypothesized relationships.

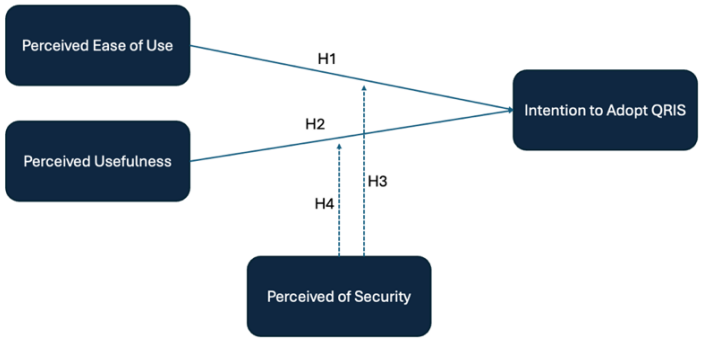


Figure 2. Research Model

## RESEARCH METHOD

### *Research Design*

This study adopts a quantitative research design, with purposive sampling being used for sample selection. This approach ensured that the selected respondents were relevant to the target population and meet the inclusion criteria of the study. Following the recommendation of Hair et al. (2019), the minimum sample size should range between five and ten times the number of measurement items. Based on this guideline, approximately 198 respondents were targeted.

### *Research Target/Subject*

In addition, the adequacy of the sample size was evaluated in terms of statistical power. Referring to Hair et al. (2019) and Cohen (1992), a minimum sample size of 100–150 is generally sufficient to detect medium effect sizes ($f^2 = 0.15$) with a statistical power of 0.80 in PLS-SEM models. Therefore, the sample size of 198 respondents in this study exceeds the recommended threshold, indicating sufficient statistical power to detect significant relationships among constructs and ensuring the robustness of the analysis. The sample was restricted to individuals who met the following criteria: (a) MSME (UMKM) consumers; (b) residing in the Greater Jakarta area; and (c) being aware of or having previously sought information about QRIS. Importantly, respondents were not required to have actively used QRIS; however, they were expected to have at least a basic awareness of QRIS and to have previously searched for related information..

### *Research Procedure*

Procedures need to be described according to the type of research. How the research is carried out and the data will be obtained, needs to be described in this section.

For experimental research, the type of design (experimental design) used should be written in this section.

### *Instruments, and Data Collection Techniques*

Data were collected using a structured questionnaire employing a four-point Likert scale (1 = strongly disagree; 4 = strongly agree), which was chosen to reduce neutral or ambiguous responses and encourage more definitive assessments (Nadler et al., 2015). A cover letter was included to inform respondents the confidentiality of data and the voluntary nature of participation. The survey achieved a response rate of 100%. Several strategies were implemented before and after data collection to mitigate non-response bias, including assurances of anonymity and confidentiality to encourage participation.

To enhance the transparency and rigor of the measurement, this study employed a data collection instrument grid that links each construct to its respective indicators and measurement items. The questionnaire was developed based on established scales from prior studies and adapted to the QRIS context. Each construct—Perceived Ease of Use, Perceived Usefulness, Perceived Security, and Intention

to Adopt—was operationalized into multiple indicators, as presented in Table 1. This grid ensures content validity by clearly mapping theoretical constructs to observable variables.

The questionnaire comprised two main sections. In the first section, demographic information, including gender, age, education level, and income, was collected. The second section measured constructs adapted from TAM, including Perceived Usefulness, Perceived Ease of Use, and Perceived Security as a moderating variable influencing intention to use QRIS as a cashless payment methods.

### *Data analysis technique*

For data analysis, this study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4.0. The use of PLS-SEM is justified for several reasons. First, PLS-SEM is suitable for exploratory and predictive research models that extend existing theories, such as TAM (Hair et al., 2019). Second, it is appropriate for relatively small to medium sample sizes and does not require strict normality assumptions. Third, PLS-SEM is particularly effective for analyzing complex models that include moderating effects, such as the role of perceived security in this study.

Table 1. Questionnaire Items

| Variabel | Kode | Questions | References |
|---|---|---|---|
| Perceived of Ease of Use | PEoU1 | Learning to use digital payment methods (e.g., QR code payments) would be easy for me | Liao et al., 2009; Alhassan et al., 2020; Belmonte et al., 2024; Garrouch, 2021 |
| | PEoU2 | I would have no difficulty using QRIS; I believe it would operate smoothly | |
| | PEoU3 | I believe that QRIS would be easy to use as a payment method | |
| | PEoU4 | The steps required for QRIS payments easy to follow | |
| Perceived of Usefulness | PU1 | I believe that QRIS is a useful payment method | Venkatesh and Davis, 2000; Türker et al., 2022; Zhong & Moon, 2022 |
| | PU2 | Using QRIS would make it easier for me to complete payment transactions | |
| | PU3 | Using a digital wallet would improve my financial transaction efficiency and speed | |
| | PU4 | Using a digital wallet would increase the effectiveness and flexibility of my financial transactions | |
| Perceived of Security | PS1 | I believe that QR code payment services are secure for making transactions | Türker et al., 2022; Liébana-Cabanillas et al., 2018; Kusumastuti et al., 2023 |
| | PS2 | I believe that using QRIS is secure because it complies with applicable data security regulations/standards | |
| | PS3 | I believe that the risk of information misuse (e.g., credit card number, bank account data) is low when using QR code mobile payments | |
| | PS4 | I believe that the risk of unauthorized third parties monitoring the payment process is low when using QR code payments. | |
| Intention to Adopt | IU1 | I would consider using QRIS payment services in the near future. | Venkatesh and Davis, 2000; Türker et al., 2022; Zhong & Moon, 2022; Eren, 2024 |
| | IU2 | I am willing to use a QR code-based mobile payment system in the near future | |
| | IU3 | I intend to use QRIS whenever I have the opportunity to do so | |
| | IU4 | I prefer using QRIS over traditional cash payments | |

## RESULTS AND DISCUSSION

Data analysis using SmartPLS 4 indicates that both the measurement and structural model satisfy the established validity and reliability criteria. All indicator outer loadings exceeded the recommended threshold of 0.70, indicating adequate indicator reliability (Hair et al., 2019).

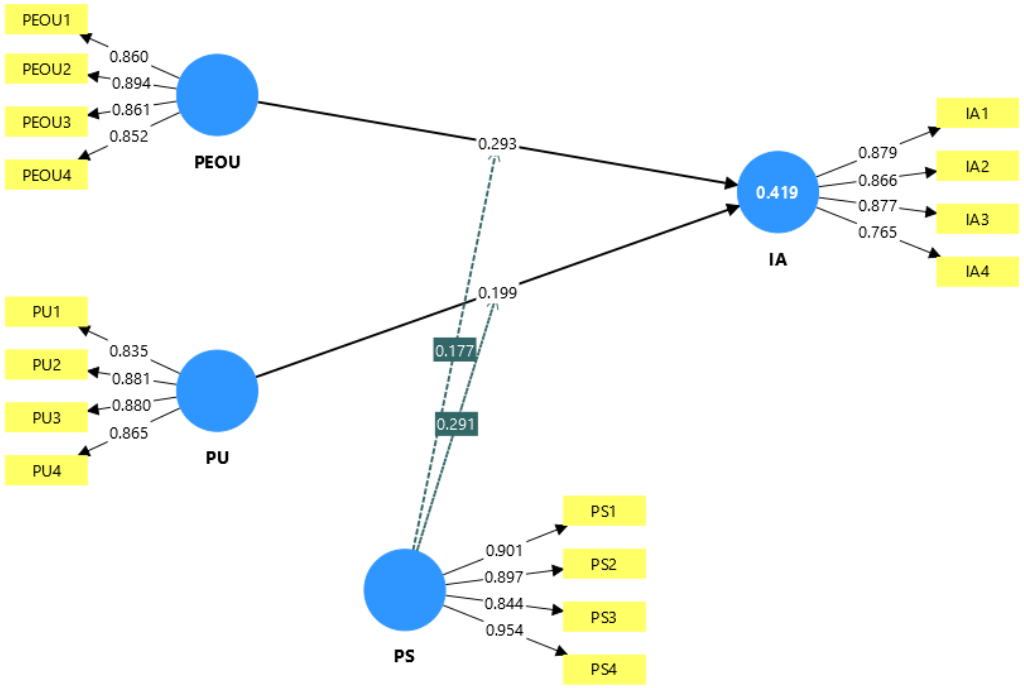


Figure 3. Outer Loading (Smart PLS Output, 2025)

The composite reliability (ρc) values for all constructs exceeded the recommended threshold of 0.70, indicating satisfactory internal consistency. Specifically, composite reliability was 0.924 for Perceived Ease of Use (PEOU), 0.923 for Perceived Usefulness (PU), 0.944 for Perceived Security (PS), and 0.911 for Intention to Adopt (IA). In addition, the Average Variance Extracted (AVE) values ranged from 0.719 to 0.809, confirming adequate convergent validity for all constructs (AVE > 0.50).

Table 2. Construct reliability and validity

| | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
|---|---|---|---|---|
| IA | 0.869 | 0.875 | 0.911 | 0.719 |
| PEOU | 0.890 | 0.897 | 0.924 | 0.751 |
| PS | 0.923 | 1.001 | 0.944 | 0.809 |
| PU | 0.889 | 0.899 | 0.923 | 0.749 |

Source: Smart PLS Output, 2025

Next, we assessed discriminant validity using the Heterotrait–Monotrait Ratio of Correlations (HTMT), which is recommended by Hair et al. (2019) as a robust statistical approach for examining whether latent constructs are sufficiently distinct from one another. This assessment ensured that each variable in the model captures a conceptually unique construct and does not exhibit substantial empirical overlap. The HTMT results indicate values below 0.85, indicating that discriminant validity is established and that no problematic overlap exists among the constructs.

Table 3. HTMT Analysis

| | IA | PEOU | PS | PU | PS x PEOU | PS x PU |
|---|---|---|---|---|---|---|
| IA | | | | | | |
| PEOU | 0.421 | | | | | |
| PS | 0.137 | 0.305 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| PU | 0.373 | 0.380 | 0.165 | | |
| PS x PEOU | 0.365 | 0.130 | 0.238 | 0.075 | |
| PS x PU | 0.496 | 0.092 | 0.074 | 0.036 | 0.342 |

Source: Smart PLS Output, 2025

Furthermore, the R-square ($R^2$) value of 0.419 for the dependent variable Intention to Adopt indicates that approximately 41.9% of the variance in consumers' intention to use QRIS is explained by Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Perceived Security (PS), and their moderating interaction effects. Based on Chin's (1998) criteria, this explanatory power can be classified as moderate, suggesting that the proposed model can account for a substantial proportion of MSME consumers' adoption intention in the Indonesian context.

Table 4. R-squared Value

| | R-square | R-square adjusted |
|---|---|---|
| IA | 0.419 | 0.404 |

Source: Smart PLS Output, 2025

Table 5 presents the hypothesis testing results. The estimated path coefficients indicate that Perceived Ease of Use (PEOU) has a significant positive effect on Intention to Adopt (IA) ($\beta = 0.293$; $t = 3.345$; $p = 0.001$). Similarly, Perceived Usefulness (PU) also exhibits a significant positive effect on IA ($\beta = 0.199$; $t = 2.545$; $p = 0.011$). Accordingly, H1 and H2 are supported. Furthermore, the moderating role of Perceived Security (PS) is statistically confirmed. The interaction effects are significant for both PS × PEOU ($\beta = 0.177$; $t = 2.447$; $p = 0.014$) and PS × PU ($\beta = 0.291$; $t = 2.144$; $p = 0.032$). In contrast, the direct effect of PS → IA is not significant ($\beta = 0.048$; $t = 0.476$; $p = 0.634$), suggesting that perceived security does not directly influence consumers' intention to use QRIS. Rather, PS functions as a strengthening (moderating) mechanism, amplifying the effects of perceived ease of use and perceived usefulness on adoption intention.

The results indicate a nuanced behavioral pattern in QRIS adoption. While perceived ease of use and perceived usefulness significantly drive intention, the non-significant direct effect of perceived security suggests that security is not a primary determinant when evaluated independently. Instead, consumers tend to interpret security as a complementary factor that enhances their confidence in already favorable system attributes. This finding aligns with the argument that security often operates as a hygiene factor rather than a motivator in technology adoption (Lallmahamood, 2007). In this sense, users are more likely to adopt QRIS because it is perceived as useful and easy to use (Davis, 1989; Venkatesh et al., 2012), while security functions as an enabling condition that reinforces these perceptions rather than directly driving behavioral intention.

Table 5. Structural Model Testing

| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | T statistics (\|O/STDEV\|) | P values |
|---|---|---|---|---|---|
| PEOU -> IA | 0.293 | 0.296 | 0.088 | 3.345 | 0.001 |
| PS -> IA | 0.048 | 0.035 | 0.100 | 0.476 | 0.634 |
| PS x PEOU -> IA | 0.177 | 0.166 | 0.072 | 2.447 | 0.014 |
| PS x PU -> IA | 0.291 | 0.274 | 0.136 | 2.144 | 0.032 |
| PU -> IA | 0.199 | 0.180 | 0.078 | 2.545 | 0.011 |

Source: Smart PLS Output, 2025

These findings confirm the continued the relevance of TAM in explaining the adoption behavior of digital payment technologies in Indonesia. Both perceived ease of use and perceived usefulness exert significant direct effects on consumers' intention to use QRIS. Importantly, this study extends TAM by incorporating perceived security as a moderating factor, which strengthens the relationships between PEOU and PU and usage intention. In other words, the higher the perceived security level, the stronger the effects of usability and functional benefits in shaping consumers' intention to adopt QRIS.

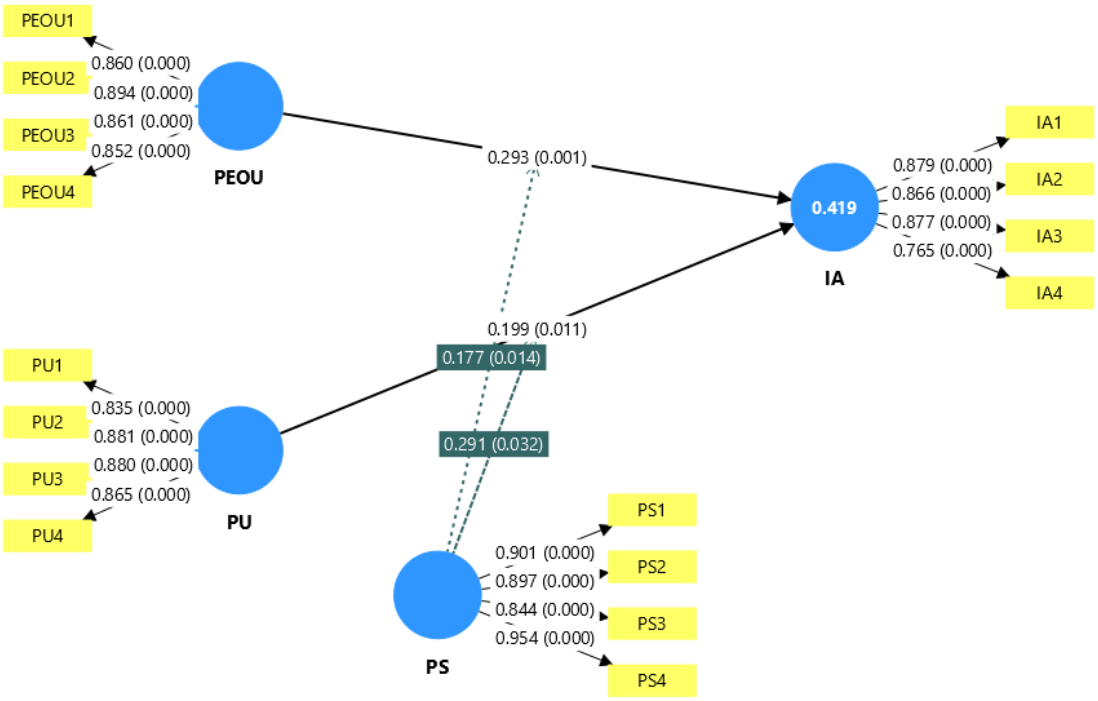


Figure 4. Model of Bootstrapping Analysis (Smart PLS Output, 2025)

This result is consistent with prior evidence from Belmonte et al. (2024) and Chawla & Joshi (2019), who demonstrated that ease of use plays a central role in shaping behavioral intention in digital payment systems. Likewise, studies by Eren (2024) and Türker et al. (2022) reinforced the argument that perceived usefulness directly influences consumers' decisions to adopt QR code payment methods. The moderating role of perceived security is further supported by Kusumastuti et al. (2023) and Lallmahamood (2007) further supported the moderating role of perceived security, emphasizing security perceptions and trust as key catalysts in the acceptance of digital financial technologies.

Compared to previous studies, these findings both confirm and extend existing knowledge on digital payment adoption. Consistent with prior research, perceived ease of use and perceived usefulness remain the dominant predictors of behavioral intention within the TAM framework (Usman et al., 2024; Zhong & Moon, 2022; Türker et al., 2022). However, this study diverges from earlier findings that position perceived security as a direct determinant of adoption behavior (Liébana-Cabanillas et al., 2018; Oliveira et al., 2016). Instead, the present results demonstrate that perceived security plays a moderating role, strengthening the effects of usability and usefulness on intention. This shift may reflect contextual factors in emerging digital ecosystems, where institutional trust and regulatory frameworks reduce the salience of security as a standalone concern (Kusumastuti et al., 2023). Therefore, this study suggests that in more mature or regulated digital payment environments, security tends to function as a conditional factor that amplifies existing adoption drivers rather than initiating them.

Overall, the proposed model suggests that technological simplicity and functional are usefulness serve as the primary drivers of adoption intention, whereas security assurance is a critical mechanism that translates these favorable perceptions into adoption behavior. Figure 4 illustrates the significant interaction paths of PS × PEOU and PS × PU on intention to adopt, thereby supporting the proposed moderation hypotheses (H3 and H4).

These findings offer several important implications. Theoretically, this study contributes to the extension of the Technology Acceptance Model by demonstrating that perceived security operates more effectively as a moderating variable rather than as a direct predictor in digital payment contexts, thereby enriching the explanatory power of TAM in line with recent extensions (Venkatesh et al., 2012; Ramayanti et al., 2025). Practically, the results suggest that policymakers and fintech providers should not only focus on enhancing system functionality and usability but also strategically integrate and communicate security features to strengthen user confidence. Prior studies have emphasized that trust and

perceived safety significantly influence user engagement in financial technologies (Liébana-Cabanillas et al., 2018; Kusumastuti et al., 2023). Therefore, embedding security within user experience design and communication strategies is likely to accelerate adoption, particularly among more risk-averse user groups.

A deeper examination of perceived security reveals that its role extends beyond a mere statistical moderator to a critical psychological assurance mechanism in digital payment adoption. In line with trust-based adoption theories, users tend to evaluate financial technologies through a dual lens of performance and risk mitigation (Oliveira et al., 2016; Liébana-Cabanillas et al., 2018). In this study, the insignificant direct effect of perceived security suggests that users may assume a baseline level of security due to institutional guarantees provided by regulators such as Bank Indonesia, thereby reducing its salience as a primary adoption driver. However, when interacting with perceived ease of use and perceived usefulness, security becomes a reinforcing signal that reduces uncertainty and perceived risk, which are key barriers in financial technology adoption (Kusumastuti et al., 2023). This finding is particularly relevant in emerging markets, where digital trust is still evolving, and users rely heavily on perceived system reliability to justify continued usage. Therefore, perceived security should be understood not as an isolated determinant, but as a latent confidence-building factor that activates and strengthens the effects of core TAM constructs in shaping behavioral intention.

Despite its theoretical and practical contributions, this study has several limitations. First, the data were collected using a cross-sectional design and were limited to MSME consumers in the Greater Jakarta area. The findings may not fully capture behavioral variation across other regions of Indonesia, particularly rural areas where digital literacy and payment infrastructure differ substantially. Second, perceived security in this study was operationalized as a single construct, without distinguishing between specific dimensions, such as technical security, transaction privacy, and data integrity. Subsequent studies could develop a multidimensional model of security to identify the aspects that exert the strongest influence on adoption intention. Overall, this study provides important empirical and conceptual insights to support strategies for strengthening the adoption of digital payment in Indonesia. By highlighting the roles of ease of use, perceived usefulness, and security assurance, the findings contribute to ongoing efforts to accelerate the transition toward an inclusive, secure, and sustainable digital economic ecosystem.

## CONCLUSION

This study demonstrates that Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) are the primary determinants of consumers' intention to adopt QRIS. However, their effects are significantly strengthened by Perceived Security (PS), which functions as a moderating variable rather than a direct predictor. These findings indicate that while usability and functional benefits initiate adoption intention, security plays a crucial role in reinforcing user confidence, thereby enabling these perceptions to translate into actual behavioral intention. Theoretically, this study extends the Technology Acceptance Model (TAM) by positioning perceived security as a conditional mechanism that amplifies the effects of core cognitive constructs. This suggests that in digital financial contexts particularly in developing economies technology adoption is not solely driven by perceived performance, but also by the extent to which users feel protected from potential risks. Accordingly, this study proposes that the integration of cognitive (PEOU, PU) and affective (PS) dimensions provides a more comprehensive explanatory framework for digital payment adoption behavior.

From a practical perspective, the findings imply that efforts to accelerate QRIS adoption should not only focus on improving system usability and functionality, but also on strengthening and effectively communicating security features. Policymakers and fintech providers, including Bank Indonesia, need to ensure that security mechanisms are both robust and visible to users, as this will enhance trust and reduce perceived risk, particularly among more cautious user groups. Despite its contributions, this study is limited by its cross-sectional design and geographically concentrated sample. Future research is encouraged to incorporate additional variables such as trust, digital literacy, and perceived risk, as well as to employ longitudinal or comparative approaches to better capture the dynamic nature of digital payment adoption across different contexts. Therefore, future research should extend the geographical and demographic scope to enhance the generalizability of the results. In addition, longitudinal designs would be valuable for capturing how security perceptions evolve over time and how such changes shape continuance intention in QRIS use

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## AUTHOR CONTRIBUTIONS

The author contributions to the paper as follows: study conception and design: Marlin, Panji, Artha; data collection: Marlin & Panji; analysis and interpretation of results: Marlin, Panji, Artha. All authors reviewed the results and approved the final version of the manuscript.

## CONFLICTS OF INTEREST

The authors declare no conflict of interest in this research.

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