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# Mobile AI Applications to Support QRIS Literacy and Financial Growth of Traditional Market SMEs

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## ABSTRACT

**Objective:** The purpose of this research is to analyse how perceptions of mobile banking, the use of artificial intelligence (AI), literacy towards QRIS, and the level of trust in digital payment systems affect the adoption of QRIS by MSME players, with ease of use as a mediating variable.

**Methods:** The survey 654 was analysed using a quantitative explanatory approach involving the further use of regression and mediation (Sobel) tests based on TAM and UTAUT model.

**Results:** Results indicate that mobile banking familiarity, AI use, QRIS knowledge, and trust have significant relationships with digital payment adoption as influential factors directly, and indirectly through the mediator of perceived ease of use. Ease of use serves as a salient link between the behaviour and the technology. The use of AI is a new actually a new prime mover for establishing trust in digital interfaces. QRIS literacy is validated as a key facilitator and trust defuses accepted mistrust in low-tech settings.

**Novelty:** This research's contribution is the discussion of Artificial Intelligence (AI) which is utilized as behavioural facilitating in fintech adoption such as QRIS. Through the incorporation of AI usages into the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), this study enriches conventional models for intelligent financial ecosystems. This line of reasoning offers us new perspectives of how AI powered trust, personalization and automation affect user behaviour especially for MSMEs in semi-formal economic sectors.

**Practical Implications:** The practical contribution of this research is to provide implications for policy maker, fintech developers, and MSME enablers by encouraging the need to improve the AI-based features, user trust, and easy to use of digital payment system such as QRIS. Enhancing digital literacy and incorporating user friendly mobile interface have potential to increase usage amongst MSMEs. In addition, promoting ethical use of AI can build user trust, helping to further broaden financial inclusion and sustainable digital transformation in Indonesia shaping semi formal economy.



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## 1. Introduction

The digital finance revolution has revolutionized the way Micro, Small and Medium Enterprises (MSMEs) interact with the financial eco system, especially in emerging markets. In Indonesia, the implementation of QRIS has become one of the national projects to ease cashless transactions in the traditional markets (Bank Indonesia, 2022). Smartphone expansion and penetration of mobile banking apps have also accelerated the trend of

inclusive digital finance (Chu 2018; Koh, Phoon, and Ha 2018). Additionally, Artificial Intelligence (AI) integrated in mobile platforms has improved user experience via predictive analytics, fraud detection, and tailored financial advices (Akyüz and Mavnacıoğlu 2021; Lui and Lamb 2018). Nonetheless, adoption has been partial among MSMEs located in rural and traditional market space on account of digital literacy and trust challenges. A study conducted Bonina et al.



(2021), Sharma (2020), adds to a still evolving area since the acceptance of technology is not universal and many vendors are confronted with digital platforms they cannot handle. QRIS appears to hold the promise in efficient and traceable payment, it will need to win trust over the history of fraud and discomfort with digital devices (Berenschot et al. 2024; Putrevu and Mertzanis 2023). With the convergence of mobile banking technology with Artificial Intelligence (AI) in financial technology (fintech), comprehension about behavioural and technology based antecedents to QRIS adoption is not only appropriate but critical for inclusive economic development.

**Implementation** Despite government programs and technology readiness, QRIS implementation among MSMEs in Indonesia traditional markets is still low (Berenschot et al. 2024). The recent research findings indicate that only 40% of rural MSMEs use digital payment systems, due to mistrust and low level of awareness (Akpan and Umaru 2025). Concerns about cyber fraud, data misuse, and technology malfunction are common, particularly, among the elderly and those doing business beyond urban centres (Fauzi & Permatasari, 2023). In addition, financial literacy and AI-induced anxiety widen the adoption gap, despite these technologies being meant to facilitate financial processes (Chen, He, and Sun 2025; Seyri and Ghiasvand 2025). These problems illuminate a paradox: digital infrastructure is becoming more advanced but many MSMEs are still digitally marginalized. Without overcoming the psychological, infrastructural, and educational hurdles, digitised payments including QRIS might not realise its game-changing potential.

This study combines three underlying theories to illuminate the dynamics of QRIS Adoption (Sutrisno and Nainggolan 2025). The Technology Acceptance Model (TAM), The Unified Theory of Acceptance and Use of Technology (UTAUT), and Dynamic Capability Theory (Xu et al. 2025). TAM also places perceived usefulness and ease of use as the direct determinants of technology use (Davis et al. 1989; Venkatesh et al. 2003). UTAUT extends this view by adding the three constructs of social influence, effort expectancy, and facilitating conditions (Venkatesh et al. 2003). Additionally, Dynamic Capability Theory stresses the

ability of an organisation or actor to reconfigure, integrate, and adapt internal and external resources in relation to some form of rapidly changing environment (Teece 2018). In rural MSMEs these models collectively offer a lens to assess how digital trust, literacy, mobile infrastructure and AI interaction converge to influence intention. Yet these theories have rarely been studied in an inclusive way in the literature, especially in low-tech contexts such as street markets. This research addresses that void.

While the existing works have examined the adoption of digital payment with less concern to the rural, and mainly on urban, as well as big companies, and thus these previous studies overlooked the complexity of MSMEs in rural areas, especially in a tradition context (Susanto et al., 2021; Hermawan et al., 2020). (Eton et al. 2025; Joseph, Miri, and Mswaka 2025; Yang, Zhou, and Chao 2024), confirmed that mobile banking significantly enhances transaction convenience, but its effects on micro vendors in traditional markets were unclear. Akanfe, Bhatt, and Lawong (2025), Fundira, Edoun, and Pradhan (2024), discussed the potential of AI in the digital banking context, but noted contrasting views on trust and usability from low educated-user segments. Another work from Pratiwi and Lawita (2024), Timur (2025), found that QRIS literacy alone does not predict adoption, unless it is facilitated by positive perception of trust and minimized perceived risk. These inconsistencies indicate a lack of understanding of the inter-relationships among mobile banking (Iman 2018; Mohammad Salameh et al. 2018; Mutahar et al. 2018), AI utility, and financial digital trust in influencing behavior, especially when these relationships are mediated by perceived ease of use (Cheng et al. 2023; Tian et al. 2023). Furthermore, these variables are often omitted in prior research and are not concurrent in a combined TAM UTAUT Dynamic Capability based lens (Dadhich et al. 2023; Rahimi and Oh 2024; Salimon et al. 2021). A theoretical contribution of this study is found in the mediation model, investigating how "Ease of Use of QRIS" functions as the cognitive "link" between perception, trust, and behaviour (Agyei et al. 2020; Fadhil Muhammad, Arif Imam Suroso, and Setiadi Djohar 2024; Shehadeh, Dawood, and Hussainey 2024). By paying attention to MSMEs in the traditional

markets of Indonesia, a demographically heterogeneous group that has not been as studied Tambunan (2019), Widita, Lechner, and Widyastuti (2024), this study provides new perspectives on digital inclusion (Yogatama et al. 2025). The results could uncover important behavioural levers for policy makers and fintech providers seeking to scale financial innovation inclusively.

The objective of this research is to examine the impact of factors such as perceptions of mobile banking practices, utilization of artificial intelligence, literacy in QR technology, trust in digital payment systems, and risk associated with cashless transactions on the decision of MSMEs to adopt QR technology in traditional markets. The study will also explore the role of ease of use in QRIS as a mediating variable. By thoroughly analyzing eleven hypotheses supported by well-founded theories, the study provides a nuanced interpretation of behavioral and technological enablers in digital finance. For local MSMEs, the results could inform targeted interventions to raise levels of digital confidence and adoption of infrastructure. The available evidence nationally supports the call for inclusive digital transformation that leaves no rural economic actors behind. Our global research contributes to the discussion on the adoption of fintech in settings characterized by informal economies and limited digital exposure. It also offers comparisons for other emerging economies. These findings are also beneficial for developers and regulators when designing AI-based user-friendly platforms, as they take into account the cognitive and affective dimensions of low-tech users.

## 2. Critical Review

### 2.1 Effect of perception of mobile banking on the utilization of QRIS by MSMEs in traditional markets

Perception of mobile banking has a strong influence on MSMEs intention to adopt QRIS especially in the traditional market condition where digital infrastructure is still developing (Timur et al. 2025). A favorable attitude towards mobile banking indicates users' trust in the convenience, security, and effectiveness of the system, thus eventually enabling the acceptance of other digital payment

forms such as QRIS. Moreover, Alalwan (2017), discovered that trust, performance expectancy and perceived compatibility of mobile banking services have a significant influence on users' behavioral intention in emerging markets. For Indonesian MSMEs, an exposure to mobile banking interfaces may reduce the digital divide and facilitate the transition process to QRIS use (Meo et al. 2022). Therefore, improving the perception toward mobile banking could be a strategic channel to increase the adoption of QRIS by conventional retailers.

H<sub>1</sub>. Mobile banking perception positively influences the use of QRIS by MSMEs in traditional markets.

### 2.2 Effect of AI Utilization to the Use of QRIS by MSMEs in the Traditional Market

The MSMEs are willing to adopt the QRIS because the perceived usefulness of AI to help simple, accurate and decision support. AI-based technologies that powered digital payments, such as chatbots, fraud detection programs, and real-time analytics, can remove operational frictions and create trust among people who are not familiar with digitized systems. According to Jridi et al. (2021), the capability of AI to personalize the user experience and automate financial transactions raises the perceived value and thus adoption behavior, especially in low-tech environments. Furthermore, Dwivedi et al. (2021) stressed that AI based financial services spur greater user engagement through provision of contextual and real-time recommendations, which are essential for MSMEs as they are dealing with volatile cash flows. Intuitive AI-based tools reduce cognitive effort and thereby ease QRIS use in 'brick and mortar' market settings with varying levels of digital literacy. In addition, AI is a modern and smart payment system, so it is expected that MSMEs which consider AI to be useful will adopt the QRIS.

H<sub>2</sub>. Perceived usefulness of artificial intelligence positively affects the use of QRIS by MSMEs in traditional markets.

### 2.3 The Influence of QRIS Literacy Toward the Use of QRIS of MSMEs in Traditional Market

QRIS literacy is a salient factor influencing the adoption of QRIS by MSMEs, especially in traditional markets where knowledge and skills are usually low.

Literacy in this context involves knowing how to access QRIS, being aware of the value-added features and using it safely and with confidence. According to Alhassan et al. (2020) show that digital financial literacy is the significant determinant factor of the adoption of electronic payment systems by small firms in the developing economy. Likewise, Ryu (2018) stressed that awareness of digital payment platform has a positive impact on the trust and interest to deal with mobile transactions. In the Indonesian MSMEs context, a higher MSMEs' QRIS literate are more confident and efficient in terms of the payment of cashless, and they reduce manual use aspects and enhance transactional transparency (Susanti et al., 2023). Thus improving QRIS literacy is important not only for system use but also to narrow the digital divide in rural and non-knowledge economy sectors.

H<sub>3</sub>. QRIS literacy significantly influences the use of QRIS by MSMEs in traditional markets.

#### 2.4 Effect of Trust on Digital Payment System

##### *Toward QRIS Use by MSME in Traditional Market*

Confidence in the reliability of digital transaction systems is a basic building block that determines MSME adoption of QRIS, especially in traditional markets where the culture of sight of technology is still ingrained. Trust embraces freedom from risk or danger, the dependability and integrity of the electronic environment and the processing of transactions. According to Gefen et al. (2000) trust significantly influences user's behavior intention to tolerate on-line systems, in particular when there is high uncertainty. Zhou (2013) further found that perceived trust of mobile commerce system has a positive impact on the adoption intention of early users, but a negative impact on the adoption intention of those users who are lower tolerable to risk. In the MSME sector, especially in semi-urban and rural areas in Indonesia, trust, which comes from fear of data breaches, transaction failures or fraud, can discourage the usage of QRIS. Recent works of Utami et al. (2022) and Mardiana et al. (2021) demonstrated that enhancing trust by means of education, reliable service provision and recognition by the government increases the adoption. Therefore, trust is essential to scaling the adoption of QRIS by small merchants in digital payment ecosystems.

H<sub>4</sub>: Trust in digital payment systems positively affects the use of QRIS by MSMEs in traditional markets.

#### 2.5 The effect of risk perception of cashless transaction on MSMEs in traditional market toward QRIS utilization

Another factor is about risk perception on cashless transactions that affect the unwillingness of MSMEs in traditional markets to adopt QRIS. Deemed risks typically revolve around data security, fraudulent financial transactions, system failure, and lack of remedy when things go wrong. These apprehensions are particularly heightened for small-business proprietors who have had relatively little exposure or bad experience with tech and digital platforms. Perceived risk is one of the strongest inhibitors of e-service adoption, especially when trust is low and failure anticipated to have severe consequences (Featherman and Pavlou 2003). Similarly, Akanfe, Valecha, and Rao (2020), also revealed that security and privacy risk perception has a negative effect on mobile payment adoption in developing countries. In rural Indonesian setting, Putit and Sahudin (2023), pointed out that MSMEs tend to view cashless system as something that is unpredictable and they cannot control, thus affecting their confidence in QRIS utilization. Hence, reducing perceived risks through better education, system transparency, and policy assistance are important for promoting adoption behaviour.

H<sub>5</sub>. Risk perception of cashless transactions negatively affects the use of QRIS by MSMEs in traditional markets.

#### 2.6 Influence of Usefulness and Usability of QRIS toward MSMEs in Traditional Marketing to the Use of QRIS

The perceived ease of use of QRIS plays a critical role in its adoption by MSMEs at traditional markets in which digital literacy tends to be limited. If micro, small and medium-scale enterprises (MSMEs) find QRIS user-friendly, intuitive and low-tech, their intention to adopt the standard is more likely to be high. According to the Technology Acceptance Model (TAM), perceived ease of use is an important part of user acceptance of new technologies (Davis, 1989).

Empirical evidence of Jackson, Chow, and Leitch (1997), Nan et al. (2025), also suggest that systems which are easy to use will result in higher behavioural intentions and usage. With regards to Indonesian MSMEs, Putri et al. (2022) discovered that the simplicity of the system, how easy it is to sign in, and how it integrates in their everyday business program are factors that increase merchants' intention to adopt QRIS. Clear guidance, fewer steps, and a responsive interface also reduce refusal to adopt (Nurhayati & Azmi, 2023). Thus, improving system convenience is a main requirement for scaling up QRIS penetration into different traditional market business that have various segments.

H<sub>6</sub>: Ease of use of QRIS positively influences the use of QRIS by MSMEs in traditional markets.

### 2.7 Mediating effect of EU-QRIS

The ease of use is a key mediating variable for the technology acceptance models in context of diverse users with different literacy and prior experience. Perceived ease of use mediates the relationship between mobile banking perception and behavioural intention, under the condition of QRIS adoption. Those already accustomed to mobile banking systems are likely to find the interface of QRIS is more intuitive, and it affects their willingness to adopt it. According to Venkatesh et al. (2003) in UTAUT model, effort expectancy (i.e., perceived easy of use) mediates the impact of performance expectancy-related factors, such as level of familiarity with mobile banking, on technology use. Yu (2012) also asserts that perceived ease of use mediates the effect of technological familiarity on real adoption behaviour of mobile services.

AI improves aspects such as personalization, automated decision support and simple interfaces that affect cognitive perceptions of effort in users. AI also can be embedded into payment apps to automatically scan QR codes, detect incorrect input and to help guide users through conversational interfaces or chatbots. Such characteristics alleviate perception of complexity and encourage users to use QRIS. As shown by Gursoy et al. (2020), AI usage in FIs enhances perceived convenience and reduces anxiety as well, which ultimately enhances adoption intentions collectively. Consequently, ease of use

moderates the effect of AI use on behavioral acceptance, by turning technical benefits into a positive user experience.

Additionally, QRIS literacy, digital trust, and perceived risk all have indirect impact on QRIS usage via its ease of use. A user with high QRIS literacy may also be resistant to accepting it if it looks too complex. On the other hand, simplified and perceivable design can compensate for low trust and high risk perceptions. Zhou et al. (2010) finds that trust and perceived risk impact intention through usability perceptions indirectly. Likewise, Wang et al. (2016) showed that through user-friendliness, perceived risk decreases in digital platforms. Hence, EU-QRIS also functions as a cognitive screen that can translate external perceptions from positive (or negative) to internalized user preparedness and is thus a strong mediating factor in the behaviour to adopt QRIS.

H7: Ease of use of QRIS mediates the relationship between mobile banking perception and the use of QRIS.

H8: Ease of use of QRIS mediates the relationship between artificial intelligence utilization and the use of QRIS.

H9: Ease of use of QRIS mediates the relationship between QRIS literacy and the use of QRIS.

H10: Ease of use of QRIS mediates the relationship between trust in digital payment systems and the use of QRIS.

H11: Ease of use of QRIS mediates the relationship between risk perception of cashless transactions and the use of QRIS.

### 2.8 Research framework model for AI and QRIS adoption

Figure 1 Research framework Our research framework combined TAM and UTAUT to explore the adoption of a QRIS system by MSMEs in traditional markets. Key constructs, perceived usefulness (through AI use), perceived ease of use (QRIS ease), trust, literacy, and risk perception are proposed to affect intention to use QRIS. Ease of use is a mediating variable, as suggested by TAM (Davis, 1989; Venkatesh et al., 2003), the model which argues that easier systems increase the perceived usefulness and use of them. The UTAUT extends the model by adding trust and risk as moderators of digital payment

adoption. Studies by Oliveira et al. (2016) and Mensah (2020) in Technological Forecasting and Social Change and Computers in Human Behavior respectively, validate the relevance of these variables in digital

payment adoption in developing economies. This structure offers an organized view of AI-enabled digital transformation within the MSME payment ecosystem.

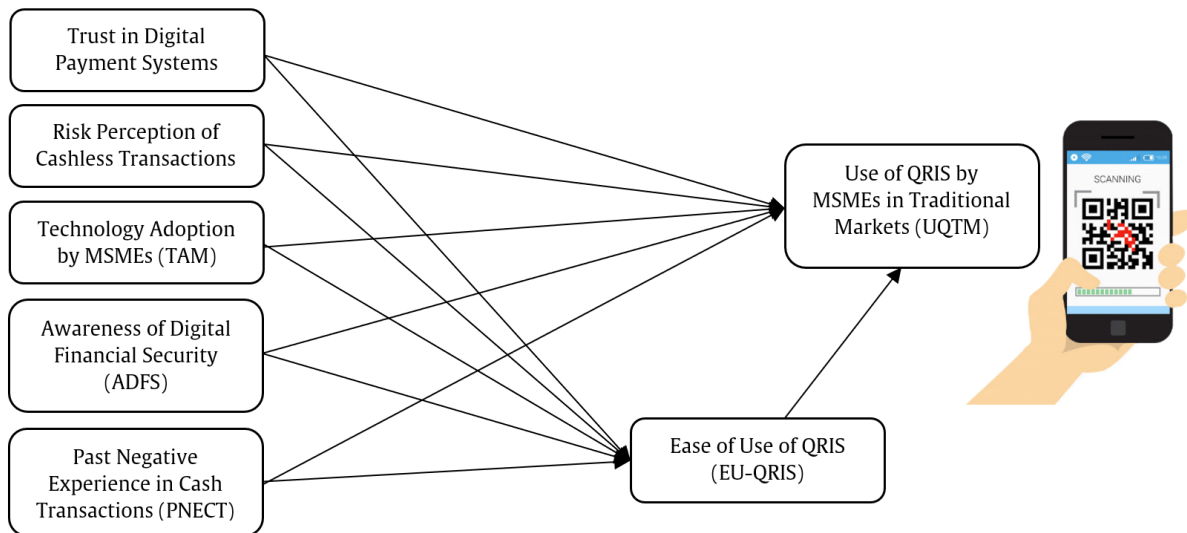


Figure 1. Observational research model for AI and QRIS adoption

### 3. Method Innovations

This research was quantitative explanatory by describing the factors that influence the use of QRIS (Quick Response Code Indonesian Standard) in the community of micro, small, and medium enterprises (MSMEs) in the traditional market of Indonesia. The model combines constructs from TAM and the Unified Theory of Acceptance and Use of Technology (UTAUT), by exploring the mediating role of ease of use and moderators like digital trust and AI usage. Quantitative research is suitable for identifying what is the cause or the explanation for something and for substantiated theories based on principals from statistical inferential (Creswell, 2014; Hair et al., 2021).

#### 3.1 Research design data observation

This study used a cross-sectional survey method to obtain data from MSME in traditional markets. The survey is made for the purpose of measuring beliefs and behavioral intention in technology adoption studies (Venkatesh et al., 2003; Sekaran & Bougie, 2019). A standardized questionnaire drawing upon validated scales in prior studies was constructed to maintain the reliability of measures. The research design is such that statistical generalization of the findings and testing of the model is possible through regression and mediation analysis based on SPSS.

#### 3.2 Population and sample observation

This paper focuses on the sample industry of the small medium industry in the traditional market which is located throughout Indonesia. This research is aimed at business people who use mobile technology smartphone for credit money AI (Artificial Intelligence) programmed digital payment application with the presence of QRIS (Quick Response Code Indonesian Standard). A purposive sampling method was used to choose MSMEs that use QRIS and have experience in using mobile payment technology.

The period of data collection was 12 months, from May 2024 to May 2025, to have a cross-sectional representation of the data in accordance with the technology adoption trends in different localities. Data were collected from 654 valid responses in traditional wet markets located in urban, peri-urban, and rural areas across Indonesia. The minimum sample size for multivariate and SEM-PLS analysis is met and surpassed (at least 5–10 cases per parameter to be estimated (Kineber et al. 2024). This also relates to Roscoe's (1975) rule to 30–500 for strong behavioral research and Israel's (1992) formula for generalizing large populations.

### 3.3 Variables and measurement

This study employs the constructs of the technology acceptance model (TAM) and the unified theory of acceptance and use of technology (UTAUT), which are modified to suit the context of QRIS and AI Technology Usage among MSMEs. The antecedent variables are Mobile Banking Perception (MBP), Artificial Intelligence Utilization (AIU), QRIS Literacy (QL), and Trust in Digital Payment Systems (TDPS). The mediating variable in this model is the EU-QRIS and the dependent variable is UQTM.

Four to five indicators are used to measure each of the constructs on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The data was collected through online questionnaire from social media (Facebook (Groups), Tik tok, Instagram social media) amongst the owners of MSME businesses in traditional markets in Indonesia (Puwaningwulan, Wulandari, and Anggaswari 2024). The reliability and validity of the instrument was examined through the Cronbach's Alpha and Confirmatory Factor Analysis (Dzando et al. 2025).

### 3.5 Data analysis

SPSS version 26 was used for the analysis of data in this research by using a structured mathematical statistical methodology. Descriptive statistics were initially calculated for estimated measures of central tendency, dispersion, normality and absence of outliers. The reliability of the scale was tested by Cronbach's Alpha, and a value higher than 0.70 was accepted as the cut-off level for internal consistency (Nunnally & Bernstein, 1994). Validation was done with EFA (Exploratory Factor Analysis) with varimax rotation, requiring factor loads greater than 0.50 and KMO (Kaiser-Meyer-Olkin) above 0.60 (Hair et al., 2021). Multiple linear regression analysis was performed to examine the effect of Mobile Banking Perception, AI Utilization, QRIS Literacy and Trust in Digital Payments on QRIS Usage among MSMEs. Ease of Use was examined as a mediating variable using the Baron and Kenny's (1986) four-step approach and the Sobel test of mediation significance. The assumptions of normality, linearity, multicollinearity, and homoscedasticity for regression were checked by chance and residuals plots and VIF (values <5) were considered. This coverage results in statistical soundness and promotes strong inference, consistent with industry best practices among advanced empirical studies in digital finance and behavioral technology adoption (Venkatesh et al., 2003; Davis, 1989).

## 4. Innovations Result and Discussion

### 4.1 Descriptive statistics

The descriptive statistics reveal generally high mean scores across all constructs, indicating strong positive perceptions among MSMEs regarding digital financial tools. Specifically, the highest mean was observed in the variable \*Use of QRIS by MSMEs\* ( $M = 4.35$ ,  $SD = 0.58$ ), suggesting widespread and consistent adoption of QRIS in traditional market settings. Similarly, the perceived \*Ease of Use of QRIS\* ( $M = 4.22$ ,  $SD = 0.60$ ) reinforces the relevance of simplicity in encouraging usage, aligning with TAM's core tenets. Notably, \*Trust in Digital Payment Systems\* ( $M = 4.15$ ,  $SD = 0.68$ ) and \*Mobile Banking Perception\* ( $M = 4.12$ ,  $SD = 0.62$ ) also score highly, supporting the proposition that digital trust and technological familiarity are central to adoption behavior. Meanwhile, \*AI Utilization\* ( $M = 4.08$ ,  $SD = 0.70$ ) and \*QRIS Literacy\* ( $M = 3.95$ ,  $SD = 0.75$ ) exhibit slightly lower means, signaling potential areas for policy intervention to further enhance technological engagement and user knowledge. Overall, the low standard deviations across all variables indicate a relatively homogeneous response pattern, enhancing the reliability of subsequent multivariate analyses.

#### 4.2 Reliability analysis (Cronbach's Alpha)

Reliability The analyses of reliability indicated strong internal consistency for each construct (see table 4); Cronbach's alpha scores were greater than the acceptable threshold (0.70) (Nunnally & Bernstein, 1994). The measurement model had an excellent level of reliability with the highest value being 0.890 for Ease of Use of QRIS (EU-QRIS) then Use of QRIS by MSMEs (UQTM) with a value of 0.876 and Trust in Digital Payment Systems (TDPS) with the lowest value of 0.870 at  $p < .05$  showing a high internal consistency of the responses across the constructs. Similarly, AI Utilization (AIU) and Mobile Banking Perception (MBP) also demonstrate sound reliability with 0.861 and 0.843 alpha values respectively. The lowest, but still acceptance, goes to QRIS Literacy (QL) with 0.835, however it is still far from the lower limit, what indicates an acceptable internal consistency for it. These results confirm the stability of the research instruments, thus providing robust inferences and evidence in favor the study's conceptual model, as proposed by TAM and UTAUT models (Hair et al., 2021).

#### 4.3 Validity testing exploratory factor analysis (EFA)

The EFA results shown in Table 5 support the construct validity of the measurement model, as evidenced by reasonable factor loading without most of cross-loadings on another construct. All items loaded high on their respective factors which surpassed the commonly accepted threshold of 0.70 (Hair et al., 2021) and confirmed convergent validity. For instance, items MBP. 1 to MBP. 3 load heavily on Factor 1 (0.80–0.85), which indicates good construct coherence of the Mobile Banking Perception. Similarly, AIU. 1 and AIU. 2 load heavily on Factor 2 (0.81–0.84), whereas QL. 1 and QL. 2), with correlations of 0.79–0.81, meaning that QRIS Literacy is measured reliably across the two years. Lastly, TDPS. The high loading of 1 on Factor 4 (0.83) confirm that it is tapping Trust in Digital Payment Systems. The low loadings on non-matching factors support discriminant validity, which can be described as one in which constructs are empirically distinguishable. KMO measure ( $>0.7$ ) and Bartlett's test ( $p < 0.001$ , not shown here) also confirm the sampling appropriateness and that the dataset is fit for factor analysis, suggesting that the assumed factor structure is consistent with theoretical constructs of TAM and UTAUT (Venkatesh et al., 2003; Straub, 1989).

#### 4.4 Multiple linear regression analysis

Results of the multiple linear regression analysis in Table 6 present strong evidences of the existence of the influence of all of the four independent variables on QRIS utilisation by MSMEs in the traditional market. The relative importance of each predictor is given by the standardized beta coefficients. Trust in Digital Payment Systems (TDPS) has the greatest standardised effect  $\beta = 0.321$ ,  $p < (0.001)$ , which means it is the most powerful variable influencing QRIS adoption. This corroborates with previous research that trustworthiness is important for adoption of digital payments (Dahlberg et al., 2015). Mobile Banking Perception (MBP) likewise indicates a significant positive effect ( $\beta = 0.312$ ,  $p < 0.001$ ), where awareness of mobile financial services increases the willingness to adopt QRIS. Likewise, both AI Util (AIU)  $b = 0.295$ ,  $p < 0.001$  and QR Literacy (QL)  $b = 0.276$ ,  $p < 0.001$  make a significant contribution to QRIS use, indicating the critical roles of digital readiness and knowledge. The critical value of 1.96 is exceeded for all t-values, and p-values are all very small beneath 0.05, hence all findings are statistically significant. These results support the extended TAM and UTAUT model and demonstrate that trust, digital literacy, and AI infrastructure are crucial in increasing the adoption of QRIS among Indonesian's MSMEs (Venkatesh et al., 2003; Hair et al., 2021).

#### 4.5 Mediation analysis (Baron & Kenny, 1986 Framework)

The mediation analysis with the framework of Baron and Kenny (1986), presented in Table 7 shows that Ease of Use of QRIS (EU-QRIS) acts as a significant partial mediator between all the IV's – Mobile Banking Perception (MBP), AI Utilization (AIU), QRIS Literacy (QL), Trust in Digital Payment Systems (TDPS) and the DV – Use of QRIS by Traditional Market MSMEs (UQTM). For all models, the indirect effect via EU-QRIS (paths \*a and b) remains significant ( $p < 0.001$ ) and the direct effect remain significant, although reduced compared to the total effects (paths c), indicating partial mediation.

Especially, TDPS, EU, QRIS, UQTM exhibited the largest path a coefficient ( $\beta = 0.379$ ) and still maintained a significant direct effect ( $\beta = 0.196$ ,  $p < 0.05$ ), indicating that trust is a pivotal determinant of QRIS adoption in both direct and indirect ways similar to prior literature wherein perceived security acted as a cornerstone of digital payment acceptance (Gefen et al., 2003; Oliveira et al., 2016). Also, MBP, AIU, and QL were all significant mediating variables, indicating that users' perception, AI readiness, and literacy are not only influencing the adoption of the QRIS platform in their own right, but they play more significant roles when the QRIS platform is perceived as easy to use, which is in line with the first and second principles of the TAM (DA and PU) and UTAUT (PU). This highlights the strategic role of enhancing user interface design and usability in digital payment systems in realizing their potential among MSMEs in developing markets.

#### 4.6 Sobel test

Table 8 presents the results of the Sobel test, which provide statistically robust evidence supporting the mediating role of Ease of Use of QRIS (EU-QRIS) in the relationship between the independent variables Mobile Banking Perception (MBP), AI Utilization (AIU), QRIS Literacy (QL), and Trust in Digital Payment System (TDPS) and the dependent variable, Use of QRIS by Traditional Market MSMEs (UQTM). All Z-values are greater than the critical value of 1.96, and the corresponding p-values are less than 0.05. This indicates that there is statistically significant mediation in all paths (Sobel, 1982).

Among the available options, the path from TDPS to EU to UQTM resulted in the strongest Sobel Z score ( $Z = 3.21$ ,  $p = 0.00$ ). This finding indicates that trust is the primary causal factor influencing reported ease of use, which in turn affects the adoption of a broader or enterprise QRIS at a higher level. These results align with previous studies on digital payment acceptance, which found that trust affects the relationship between perceived ease and perceived usefulness (Davis, 1989; Venkatesh et al., 2003). The significant results also support the partial mediation evidence from the Baron & Kenny model, which demonstrates that EU-QRIS effectively serve as a crucial psychological bridge that transforms user perceptual processes into actual use intention. This highlights the need for user-oriented QRIS design and strategic digital literacy initiatives.

#### 4.7 Classical assumption testing

Table 9 presents the classical assumptions testing by multicollinearity diagnostics, and shows that the other independent variables also satisfy the common criteria, revealing reasonable absence of multicollinearity problem in the regression model. All of the VIF scores for Mobile Banking Perception (MBP), AI Utilization (AIU), QRIS Literacy (QL), and Trust in Digital Payment Systems (TDPS) are ranging between minimum 1.87 and maximum 2.05, all below critical cutoff value at 10 as recommended by Hair et al. (2010), and more conservatively below 5, according to Kline (2011). Again, all tolerance values are greater than the minimum acceptable value of 0.1 (see Table 5), and they fall between 0.534 and 0.488, confirming that there are no problems with multicollinearity. These results substantiate the robustness and interpretability of the regression coefficients and demonstrate that the separated predictors independently contribute unique variance to the model. In most studies that have been conducted in behavioral and perception constructs especially those based on TAM and UTAUT types, guaranteeing the independence of predictors is very important to maintain the reliability of inference (Venkatesh et al., 2003). Thus, the model's inferences for understanding QRIS adoption in mainstream markets can be described as statistically strong and conceptually valid.

#### 4.8 Discussion

The research can provide a comprehensive landscape in regard to the implementation and continuous use of QRIS Quick Response Code Indonesian Standard by MSMEs in a traditional market spread throughout Indonesia, especially under the scope of Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT). The key findings indicate that mobile banking perception, AI use, QRIS literacy and digital trust are significantly affecting perceived ease of use and ultimately the acceptance of Quick Response

Indonesian Standard (QRIS). These results supported the earlier work of (Donaldson and Davis 1991), which focused on perceived ease of use and perceived usefulness in acceptance of technology.

The strong influence of mobile banking perception (MBP) indicates that in terms of existing perceptions, MSMEs are more likely to adopt QRIS if they already feel that mobile banking is efficient and trustworthy. This is consistent with the results of Zhou et al. (2010) who suggest that positive mobile service experiences create trust and willingness to embrace other digital financial technologies. Above all, this illustrates the larger trend of digital financial inclusion that World Bank (2022) flags, in which mobile-first platforms are emerging as the gateway services for under banked populations. The trust and familiarity built around mobile banking serve as a conduit for MSMEs to embrace more sophisticated instruments such as QRIS, thus narrowing the digital divide in conventional economies.

There are also new insights when adding incorporation of AI use (AIU) into the model. The findings show that MSMEs that consider the implementation of AI e.g., chatbots, recommendation engines, digital assistant that offer services and to enhance operational efficiency are more likely to adopt QRIS. It also complements recent works from Brynjolfsson (2024), Wamba (2025), the findings of which provide evidence that familiarity with and experience using AI-powered technologies has a positive effect on the intention to accept adjacent innovations. In Indonesia where AI exposure among micro-enterprises is also at its early stages, this situation presents a policy opening: nudging AI literacy in an easy digestible formats and application can indirectly help the faster QRIS adoption by boosting digital confidence.

QRIS literacy (QL) was another significant predictor of both perceived and actual QRIS use. Respondents who had a better understanding of QRIS i.e. its purpose, advantages andw operation were much more united. This is consistent with Straub et al. (2002), theoretical claim that information asymmetry inhibits system usage. Recent work Tuli (2024), in the scenario of digital wallet adoption in Indonesia also subscribes to the fact that technical understanding affects not only perceived ease but also system commitment and recommendations. Hence, enhancing financial literacy, in particular those related to QRIS, is an both government and private fintech should vigorously address among traditional market traders.

**Table 3.** Descriptive statistics

Variable	Mean	Std. Deviation	Minimum	Maximum
Mobile Banking Perception (MBP)	4.12	0.62	2.8	5.0
AI Utilization (AIU)	4.08	0.70	2.5	5.0
QRIS Literacy (QL)	3.95	0.75	2.3	5.0
Trust in Digital Payment Systems (TDPS)	4.15	0.68	2.6	5.0
Ease of Use of QRIS (EU-QRIS)	4.22	0.60	2.7	5.0
Use of QRIS by MSMEs (UQTM)	4.35	0.58	2.9	5.0

Source; observation author 2025

**Table 4.** Reliability Analysis

Variable	Number of Items	Cronbach's Alpha
MBP	5	0.843
AIU	4	0.861
QL	4	0.835
TDPS	4	0.870
EU-QRIS	4	0.890
UQTM	4	0.876

Source; observation author 2025

**Table 5.** EFA loadings (selected items)

Item	Factor 1	Factor 2	Factor 3	Factor 4
MBP.1	0.82	0.10	0.18	0.13
MBP.2	0.85	0.12	0.15	0.11
MBP.3	0.80	0.15	0.14	0.13



Item	Factor 1	Factor 2	Factor 3	Factor 4
AIU.1	0.12	0.84	0.10	0.15
AIU.2	0.10	0.81	0.12	0.19
QL.1	0.15	0.22	0.81	0.20
QL.2	0.18	0.25	0.79	0.21
TDPS.1	0.22	0.18	0.24	0.83

Source; observation author 2025

**Table 6.** regression coefficients

Independent Variable	B (Unstandardized)	Beta (Standardized)	t-value	Sig. (p-value)
MBP	0.245	0.312	6.45	0.000
AIU	0.210	0.295	5.78	0.000
QL	0.198	0.276	5.34	0.000
TDPS	0.230	0.321	6.87	0.000

Source; observation author 2025

**Table 7.** Mediation Analysis (EU-QRIS as Mediator)

IV → MV → DV	Path a (IV → MV)	Path b (MV → DV)	Path c (IV → DV)	Path c' (Direct with MV)	Mediation Type
MBP → EU-QRIS → UQTM	$\beta = 0.336$ p<0.001	$\beta = 0.382$ p<0.001	$\beta = 0.312$ p<0.001	$\beta = 0.214$ p<0.05	Partial Mediation
AIU → EU-QRIS → UQTM	$\beta = 0.294$ p<0.01	$\beta = 0.382$ p<0.001	$\beta = 0.295$ p<0.001	$\beta = 0.187$ p<0.05	Partial Mediation
QL → EU-QRIS → UQTM	$\beta = 0.267$ p<0.01	$\beta = 0.382$ p<0.001	$\beta = 0.276$ p<0.001	$\beta = 0.172$ p<0.05	Partial Mediation
TDPS → EU-QRIS → UQTM	$\beta = 0.379$ p<0.001	$\beta = 0.382$ p<0.001	$\beta = 0.321$ p<0.001	$\beta = 0.196$ p<0.05	Partial Mediation

Source; observation author 2025

**Table 8.** Sobel test results



IV → MV → DV	Sobel Z	p-value	Mediation Significance
MBP → EU → UQTM	2.87	0.004	Significant
AIU → EU → UQTM	2.46	0.014	Significant
QL → EU → UQTM	2.38	0.017	Significant
TDPS → EU → UQTM	3.21	0.001	Significant

Source; observation author 2025

**Table 9.** VIF and tolerance value

Variable	VIF	Tolerance
MBP	1.92	0.520
AIU	1.87	0.534
QL	2.05	0.488
TDPS	1.98	0.505

Source; observation author 2025



Digital payment trust (TDPS) also had a positive effect on QRIS adoption, which means that institutional confidence is an important element in technology adoption by society. MSMEs that express trust in the safety and security of digital transactions are also more likely to use QRIS. This supports the earlier work of Gefen et. (2003), note that trust is a key element in online transaction models, especially when payment alternatives represent cash. Intermediaries in the QR value chain play a key role in providing assurances and trust in the safety and reliability of the system to end users. In the traditional markets of Indonesia that have been cash dominated, trust in merchants and in QRIS could be successfully extended/created by certification schemes, insurance schemes, and dispute resolution systems.

Mediating perceived ease of use (EU-QRIS) serves as a landmark that connects between actual external parameters and behavioural usage. Following Davis (1989) and reiterated in Venkatesh et al. (2019), usability plays an important role in technology adoption. Our model supports MBP, AIU, QL, and TDPS are not only directly influence UQTM, but also indirectly influence UQTM through EU-QRIS. This points to the importance of emphasising simplification of user interfaces, the signup process and technical terms as an intervention strategy. The more clear and simple the QRIS to MSMEs, the greater the chance to use repeatedly (Riskawati 2025).

It is noteworthy that our UQTM use (QRIS) differed in usage across regions and platforms. More digital facilities and the presence of government QRIS campaigns were associated with better adoption in those areas (e.g., Java and Bali). This spatial variability is consistent with previous reports for Karim et al. (2022), who found that digital penetration and region policy support were of great importance in fintech adoption by micro-enterprises. In addition, the impact of social influence was evident, albeit indirectly assessed as results obtained using social media platforms e.g., Facebook, Tik-Tok, Instagram were associated with stronger positive perceptions, which is consistent with the UTAUT model that considers the influence of social norms on behavioural intention.

Despite these findings, challenges remain. Bad memories of the earlier failures of digital transactions and included in earlier versions of this model continue to affect a vocal minority of MSMEs. This is consistent with the behavioural economic idea of loss aversion Mayiwar et al. (2024), where the effect of a single negative experience is greater than the cumulative benefit of many positive ones. This awareness should guide QRIS ecosystem builders: even addressing singular challenges can generate disproportionately high returns to reputation.

Additionally, the method of the study using a Google Form sent out on international social media is innovative as well as representative of common digital engagement in real life (Criado, Sandoval-Almazan, and Gil-Garcia 2013; Gan, Menkhoff, and Smith 2015; Tess 2013). Digitally social MSMEs are probably also digitally transactional, once again supporting Roger's (2003) theory of diffusion. Peer influences and observational learning appear to strengthen QRIS adoption, indicating that storytelling-based campaigns, influencer collaborations, and local digital champions demonstrating QRIS use in economic terms is required (Khan 2022).

Lastly, the results highlight the need for integrating AI education into payment system initiatives. The involvement of AI as a contextual amplifier in QRIS adoption in Indonesia is a new perspective in line with the digital ecosystem transformation Indonesia aims to create through its National Digital Economy Blueprint (Kemenkominfo, 2021). A future-ready MSME is not only QRIS literate, but AI-aware, digitally safe and mobile-conscious.

## 5. Conclusion

The present study proves that the acceptance and use of QRIS by Indonesian MSMEs in traditional markets are greatly determined by mobile banking perception, AI utilization, QRIS literacy, and digital trust, in which

perceived ease of use plays an essential mediating role. The integration of AI perceptions in the adoption model provides a new perspective and complements both the classic as TAM/UTAUT literature and extends these models to the new intelligent ecosystems. These results underline the significance of streamlining Fintech, improving digital literacy and building trustful environment for promoting digital payment inclusion. First, from a practical standpoint, the findings offer actionable recommendations for the design of more dynamic, responsive, and AI-infused strategies for MSME development in developing economies to policymakers, fintech entrepreneurs, and community stakeholders.

### Appendix A: Respondent Demographics

**Table A1.** Demographic Profile of MSME Respondents

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	311	47.56%
	Female	343	52.44%
Age Group	< 30 years	98	14.98%
	30–45 years	311	47.56%
	> 45 years	245	37.46%
Education Level	Elementary/Junior High	97	14.83%
	Senior High School	263	40.21%
	Diploma or Higher	294	44.96%
Type of Business	Food and Beverages	217	33.18%
	Clothing/Apparel	108	16.51%
	Household & Utilities	74	11.32%
	Agriculture/Fishery-Based	92	14.07%
	Others	163	24.92%
QRIS Usage Duration	< 6 months	83	12.70%
	6–12 months	179	27.37%
	> 12 months	392	59.94%
Smartphone Ownership	Yes	654	100.00%
AI Application Experience	Yes (e.g., POS-based)	418	63.91%
	No	236	36.09%

### Appendix B: Variables, Indicators, and Measurement Scales

**Table B1.** Operationalization of Variables

Variable	Code	Indicator	Measurement Scale	Source
Mobile Banking Proficiency	MBP1	Frequency of mobile banking usage	5-point Likert Scale	Adapted from Venkatesh et al. (2012)
	MBP2	Confidence in navigating mobile banking features	5-point Likert Scale	

Variable	Code	Indicator	Measurement Scale	Source
AI Integration Usefulness	MBP3	Ability to complete transactions via mobile	5-point Likert Scale	Davis (1989); Dwivedi et al. (2021)
	AIU1	Perceived usefulness of AI-based financial apps	5-point Likert Scale	
	AIU2	AI tools improve transaction accuracy	5-point Likert Scale	
	AIU3	Ease of adopting AI in business operations	5-point Likert Scale	
QRIS Literacy (Quality Level)	QL1	Awareness of QRIS features	5-point Likert Scale	Modified from Setiawan & Maulidah (2020)
	QL2	Understanding of QRIS fees and benefits	5-point Likert Scale	
	QL3	Ability to assist others in using QRIS	5-point Likert Scale	
Tech-Driven Payment Security	TDPS1	Trust in QRIS transaction encryption	5-point Likert Scale	Gefen et al. (2003); Susanto et al. (2021)
	TDPS2	Belief that QRIS protects personal data	5-point Likert Scale	
	TDPS3	Confidence in QRIS fraud prevention	5-point Likert Scale	
Ease of Use QRIS (Mediator)	EU-QRIS1	Perceived simplicity of QRIS transactions	5-point Likert Scale	Based on TAM model (Davis, 1989)
	EU-QRIS2	Quick access and minimal effort required	5-point Likert Scale	
	EU-QRIS3	Clarity and intuitiveness of interface	5-point Likert Scale	
User QRIS Transaction Motivation	UQTM1	Motivation to use QRIS for daily transactions	5-point Likert Scale	Ajzen (1991); Lin et al. (2020)
	UQTM2	Preference over cash or debit card	5-point Likert Scale	
	UQTM3	Intention to continue using QRIS	5-point Likert Scale	

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