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EVALUATING USER ADOPTION OF QRIS AS A GATE IN THE PAYMENT SYSTEM IN JAKARTA MRT

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Abstract
This study evaluates the user adoption and perceived usability of the QRIS payment system when implemented as a gate in method for Jakarta MRT. The research adopts a modified UTAUT2 framework that incorporates additional constructs of Trust and Convenience, with Usability Perception as the final outcome variable. A structured online survey was distributed to MRT passengers, and the data were analyzed using the SEM-PLS technique. The model demonstrates a high explanatory power, with the constructs collectively explaining 82.3 percent of the variance in Behavioral Intention to Adopt and 50.7 percent of the variance in Usability Perception. The results reveal that Facilitating Conditions serve as the most influential determinant of users intention to adopt QRIS, followed by Trust, Convenience, and Social Influence. Performance Expectancy and Effort Expectancy also show positive but relatively smaller effects. Furthermore, Behavioral Intention strongly contributes to the perception of usability, indicating that users who are more willing to adopt the QRIS gate in system tend to perceive it as more practical and efficient. These findings highlight the crucial roles of infrastructure readiness and user trust in driving the acceptance of QR-based gate in payments in public transportation. Practical implications are offered for operators and regulators to improve service reliability, user trust, and system integration as Indonesia advances toward a fully digital transportation ecosystem.
Keywords: *QRIS, UTAUT2, SEM-PLS, MRT Jakarta, Usability*

INTRODUCTION

The digitalization of payment systems has become a critical enabler of sustainable urban mobility, particularly in metropolitan areas where public transportation must accommodate high passenger volumes with minimal friction. Beyond convenience, digital payments in public transport function as access-enabling infrastructures that directly influence passenger flow, service efficiency, and overall travel experience. As cities increasingly pursue cashless ecosystems, the effectiveness of digital payment systems at transport entry points has emerged as a strategic concern for both regulators and transport operators.

In response to this global shift toward interoperable and cashless payment ecosystems, Bank Indonesia introduced the Quick Response Code Indonesian Standard (QRIS) as a national framework for digital payment interoperability, aiming to simplify transactions and encourage a cashless society [6]. In line with this initiative, QRIS Tap has been implemented as a gate in payment system across multiple transportation modes, including the MRT, LRT, and TransJakarta, as part of the expansion of QR-based payments into public service infrastructure [7]. This initiative supports the Blueprint Sistem Pembayaran Indonesia (BSPI) 2025, which promotes the acceleration of digital payment transformation and broader financial inclusion [8].

According to data from the Jakarta Statistics Bureau (BPS DKI Jakarta), the number of MRT passengers in March 2025 reached 3,197,089 [7]. This rapid increase underscores the growing need for efficient gate-in systems capable of minimizing congestion and enhancing service experience. The implementation of QRIS Tap is expected to accelerate access time and reduce long queues at ticket gates, thereby improving operational efficiency and passenger satisfaction [8], [9]. Moreover, this initiative aligns with Bank Indonesia's policy to expand QRIS utilization across strategic sectors, particularly transportation, while maintaining transaction cost free services for users [6], [9].

Despite these anticipated benefits, the success of QRIS adoption in public transportation depends heavily on user perception and behavioral intention. Prior studies on digital payment adoption consistently report that factors such as perceived ease of use, trust in transaction security, and system usability significantly influence users' willingness to adopt new payment technologies [2], [4], [5]. Research on QR based payment systems has further emphasized that transaction speed and perceived convenience play critical roles in shaping adoption behavior, particularly in high-frequency usage environments [10], [13]. However, most of these studies predominantly examine retail, e-commerce, or general fintech contexts, offering limited insight into adoption behavior within public transportation systems that demand high reliability, rapid interaction, and seamless system integration.

Theoretical explanations of technology adoption behavior have frequently relied on the Unified Theory of Acceptance and Use of Technology (UTAUT), originally proposed by Venkatesh et al. [1], which identifies performance expectancy, effort expectancy, social influence, and facilitating conditions as key determinants of behavioral intention. The UTAUT framework and its extensions have been widely applied to financial technologies such as mobile banking, e-wallets, and QR-based payments [2], [3]. In the Indonesian context, Hamzah et al. [4] demonstrated that UTAUT constructs significantly influence QRIS adoption, while other studies highlighted trust as a critical factor affecting satisfaction and continued usage [5]. Nevertheless, the applicability of UTAUT based models in infrastructure-dependent and time-sensitive environments such as public transportation gate in systems remains underexplored.

Empirical evidence from international contexts suggests that the integration of QR based payment systems in public transportation can improve passenger experience and operational efficiency [11], [12]. However, adoption outcomes are highly contingent on perceived system reliability, trustworthiness, and ease of use. In Indonesia, research explicitly examining QRIS adoption within mass transit systems such as Jakarta MRT is still limited, particularly in understanding how trust, convenience, and usability interact with established UTAUT constructs in shaping adoption behavior.

Addressing these gaps, this study investigates user adoption of QRIS as a gate-in payment system in Jakarta MRT by extending the UTAUT2 framework with Trust and Convenience to reflect the security sensitive and frictionless-entry requirements of public transportation payments. Furthermore, this study examines the relationship between adoption intention and usability perception, conceptualizing usability as a post-adoption evaluation shaped by users commitment to and experience with QRIS enabled gate access. Using empirical data collected from 406 MRT users and analyzed through a SEM-PLS approach [14],[16], this research aims to provide a more comprehensive understanding of QR-based payment adoption in time-critical public transportation environments.

By positioning QRIS as a standardized access mechanism rather than merely a payment tool, this study contributes to technology adoption literature by contextualizing UTAUT2 within mass transit systems, while offering actionable insights for transport operators and policymakers seeking to enhance gate reliability, passenger flow, and digital payment integration in urban public transportation.

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METHOD

This study adopts a quantitative, explanatory research design to evaluate the factors influencing the adoption of QRIS as a gate in payment system in Jakarta MRT. The study applies the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) framework, extended with two additional constructs Trust and Convenience and introduces Usability Perception as the outcome variable. The research aims to identify determinants of users' Behavioral Intention to Adopt (IA) and examine how this intention affects Perceived Usability (UP).

A structured questionnaire was distributed online using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The survey was designed to measure each construct through multiple indicators adapted from prior validated studies on digital payment adoption.

Population and Sampling

The target population comprises Jakarta MRT users who have experienced or are aware of the QRIS gate in feature. The sampling technique employed was purposive sampling, focusing on respondents who met the usage criteria. A total of 406 valid responses were collected for the MRT subset from a broader sample that covered multiple transportation modes. The demographic composition includes a balanced distribution of gender, with most respondents aged between 18 and 35 years, representing the dominant commuter segment.

The sample size satisfies the minimum requirement for SEM-PLS, exceeding the recommended 10 times rule based on the maximum number of structural paths directed at a latent variable, thus ensuring adequate statistical power for analysis.

Measurement Model and Constructs

This study adopts a theoretical framework based on the Unified Theory of Acceptance and Use of Technology (UTAUT), which was simplified and applied in the research of Hamzah et al. [4]. Their study evaluated users' intention to adopt QRIS-based payment systems, a focus that aligns closely with the present context of adopting QRIS as a gate in method for urban public transportation. The UTAUT model was selected because it has been widely recognized as a robust framework for explaining consumer technology adoption, particularly within financial technology systems.

Accordingly, the variables used in this study include Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), and Behavioral Intention to Adopt (IA).

As an enhancement to previous models, this research introduces three additional constructs:

- Usability Perception (UP)

Adapted to measure users' perceptions of efficiency, ease, comfort, and practicality of using QRIS as a gate in system. This variable extends the original UTAUT framework by integrating usability as a key indicator of technology acceptance in the public transportation sector, providing actionable recommendations for service providers and regulators.

- Trust (TR)

Adapted from Herlina et al. [5], who found that user trust significantly affects satisfaction and adoption of QRIS-based payment systems. In public transportation, trust is a critical factor as users must feel confident that QRIS transactions are secure, reliable, and free from risks such as financial loss or technical failure.

- Convenience (CON)

Adapted from Yamin & Abdalatif [13], who demonstrated that perceived convenience has a strong influence on user attitudes and adoption intention toward QR code payments. In this context, convenience is essential because passengers demand a fast, easy, and practical gate in method without technical barriers.

Therefore, this study combines the core constructs of UTAUT with the additional variables of trust and convenience, and introduces usability perception as the final dependent variable. This theoretical framework provides a more comprehensive understanding of the behavioral factors influencing users' intention to adopt QRIS as a gate in payment method in public transportation.

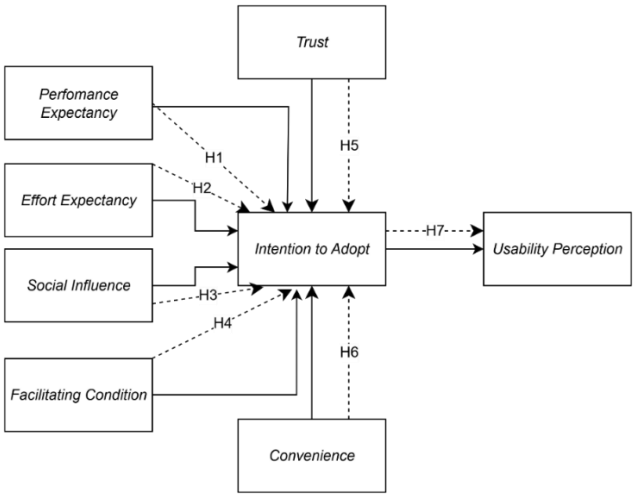

Fig. 1: Conceptual framework of QRIS adoption based on modified UTAUT model

The conceptual framework developed for this study is illustrated in Fig. 1. The model integrates the core constructs of UTAUT Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions with two additional factors, Trust and Convenience, and includes Usability Perception as the final dependent variable influenced by Behavioral Intention to Adopt.

All constructs were measured using reflective indicators with statements adapted from the aforementioned studies. Respondents rated their agreement on a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The following table summarizes all constructs, measurement codes, and question statements used in this study.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
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Table 1 Measurement Items and Indicators

Construct	Code	Question Statement
Performance Expectancy	PE1	Using QRIS helps me access the MRT more quickly.
	PE2	QRIS makes it easier for me to enter the station compared to using a card.
	PE3	Using QRIS improves my commuting efficiency.
Effort Expectancy	EE1	Learning to use QRIS for MRT entry is easy for me.
	EE2	The process of scanning QRIS is simple and understandable.
	EE3	Overall, I find QRIS easy to use at the MRT gate.
Social Influence	SI1	People important to me think I should use QRIS for MRT access.
	SI2	My friends or colleagues recommend using QRIS for gate in.
	SI3	I feel influenced by others who already use QRIS at the MRT.
Facilitating Conditions	FC1	I have the resources (smartphone, internet, e-wallet) needed to use QRIS.
	FC2	MRT facilities support QRIS transactions effectively.
	FC3	I can get assistance if I face issues using QRIS.
Trust	TR1	I believe QRIS transactions at the MRT are secure.
	TR2	I trust that QRIS protects my personal and payment information.
	TR3	I believe QRIS operates reliably during transactions.
Convenience	CON1	Using QRIS at the MRT gate saves me time.
	CON2	The QRIS payment process is simple and practical for daily use.
	CON3	QRIS allows me to enter the MRT without the hassle of carrying a card or cash.
Intention to Adopt	IA1	I intend to continue using QRIS for MRT access in the future.
	IA2	I would recommend QRIS gate in payment to other passengers.
	IA3	I plan to rely on QRIS as my primary method for entering MRT stations.
Usability Perception	UP1	QRIS is a practical and efficient gate in method.
	UP2	Using QRIS improves my overall commuting experience.
	UP3	I find QRIS easy to use and responsive when entering MRT stations.

Research Hypothesis

Based on the proposed conceptual framework, the following hypotheses were formulated to examine the relationships among constructs within the modified UTAUT model:

- H1: Performance Expectancy (PE) positively influences Behavioral Intention to Adopt (IA).
- H2: Effort Expectancy (EE) positively influences Behavioral Intention to Adopt (IA).
- H3: Social Influence (SI) positively influences Behavioral Intention to Adopt (IA).
- H4: Facilitating Conditions (FC) positively influence Behavioral Intention to Adopt (IA).
- H5: Trust (TR) positively influences Behavioral Intention to Adopt (IA).
- H6: Convenience (CON) positively influences Behavioral Intention to Adopt (IA).
- H7: Behavioral Intention to Adopt (IA) positively influences Usability Perception (UP).

These hypotheses reflect the extended UTAUT structure that integrates contextual factors of trust, convenience, and usability perception in evaluating user adoption of QRIS as a gate in payment method in public transportation.

Data analysis Procedure

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (SEM-PLS) with SmartPLS 4.0 software. SEM-PLS was chosen for its suitability in predictive and exploratory research, particularly when analyzing complex models with multiple latent constructs. The analysis followed a two-stage approach as recommended by Hair et al. [14]:

1. Measurement Model Evaluation (Outer Model)

   This step aimed to assess the reliability and validity of the constructs.

   - Convergent validity was examined through indicator loadings (expected > 0.7) and Average Variance Extracted (AVE > 0.5).
   - Reliability was assessed using Cronbach's Alpha and Composite Reliability (CR > 0.7).
   - Discriminant validity was verified through the Fornell–Larcker criterion and cross-loadings.

2. Structural Model Evaluation (Inner Model)

   After confirming the measurement model, the structural model was tested to evaluate causal relationships among constructs.

   - Coefficient of determination (R^2) was used to determine the proportion of variance explained in the endogenous constructs.
   - Predictive relevance (Q^2) was assessed using the blindfolding procedure to ensure model predictability.
   - Path coefficients were estimated using the bootstrapping method with 5,000 resamples to evaluate the significance and strength of hypothesized relationships.

The analysis focused specifically on the MRT subsample consisting of 406 valid respondents, allowing for a concentrated evaluation of QRIS adoption within a single transportation mode. The results for validity, reliability, and hypothesis testing are presented in next section.

MSW MANAGEMENT -Multidisciplinary, Scientific Work and Management Journal
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RESULT

This section presents the empirical results of the study based on the proposed research model and hypotheses. The analysis focuses on evaluating the measurement model to ensure construct validity and reliability, followed by an assessment of the structural model to examine the relationships among the variables. Using the SEM-PLS approach, the results provide insights into the factors influencing users' intention to adopt QRIS as a gate in payment system in Jakarta MRT, as well as the effect of adoption intention on perceived usability. The findings are presented systematically to support subsequent discussion and interpretation.

Measurement Model Evaluation

The measurement model was evaluated to ensure the validity and reliability of the constructs. All indicator loadings exceeded 0.7, confirming convergent validity. The Average Variance Extracted (AVE) values were all above 0.5, while Cronbach Alpha and Composite Reliability (CR) values exceeded 0.7, establishing strong internal consistency for each construct.

Furthermore, the discriminant validity was confirmed using the Fornell–Larcker criterion, as the square root of each construct AVE was higher than its correlations with other constructs. These results confirm that all latent constructs in the model are both reliable and valid for further structural analysis.

Structural Model Evaluation

After confirming the measurement model, the structural model was assessed to test the hypothesized relationships among constructs. The model's explanatory power is considered substantial, with R^2 for Behavioral Intention to Adopt (IA) equal to 0.823 and R^2 for Usability Perception (UP) equal to 0.507. These results indicate that the exogenous constructs collectively explain 82.3% of the variance in users' adoption intention and 50.7% of the variance in usability perception.

The model also shows good predictive relevance, as indicated by Q^2 values of 0.821 for IA and 0.489 for UP, both exceeding the threshold of 0, suggesting strong predictive capability accuracy and relevance for the MRT. The structural model estimated using SmartPLS is presented in Fig. 2, which displays the standardized path coefficients and the R^2 values for the endogenous constructs.

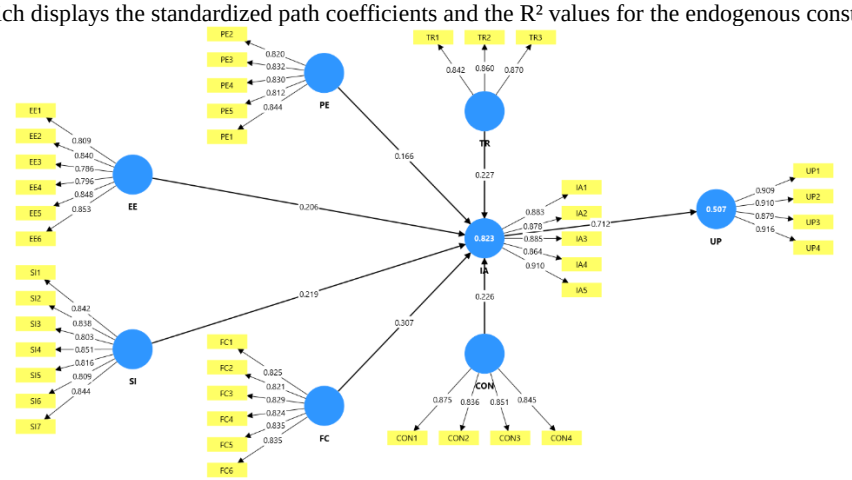

Fig. 2: Structural model results for MRT sample (SEM-PLS analysis)

The path coefficients and hypothesis testing results are summarized in Table II.

Table 2 Path Coefficients and Hypothesis Testing Results (MRT Sample)

Hypothesis	Path	Coefficient	t-Statistic	p-Value	Result
H1	PE → IA	0.166	6.903	< 0.001	Supported
H2	EE → IA	0.206	8.705	< 0.001	Supported
H3	SI → IA	0.219	9.417	< 0.001	Supported
H4	FC → IA	0.307	11.425	< 0.001	Supported
H5	TR → IA	0.227	8.903	< 0.001	Supported
H6	CON → IA	0.226	8.595	< 0.001	Supported
H7	IA → UP	0.712	16.516	< 0.001	Supported

The significance of each path was assessed using the bootstrapping procedure with 5,000 subsamples in SmartPLS, yielding t-statistics well above the critical threshold is equivalent to $t > 3.29$, $p < 0.001$.

DISCUSSIONS

This study examined user adoption of QRIS as a gate in payment system in Jakarta MRT by extending the UTAUT2 framework with Trust and Convenience and by incorporating usability perception as a post adoption outcome. Overall, the findings demonstrate that adoption intention in a public transportation gate in context is shaped primarily by infrastructural and operational considerations, rather than by attitudinal or social factors alone. In addition, the strong relationship between adoption intention and usability perception highlights the dynamic nature of user evaluation in time-critical transport environments.

The results indicate that Facilitating Conditions (FC) are the most influential determinant of users intention to adopt QRIS for MRT gate in transactions. This finding underscores the critical role of infrastructural readiness in public transportation settings, where payment systems are embedded within physical access control mechanisms. Unlike retail payment contexts, MRT gate in transactions are highly time-sensitive and queue-dependent, requiring consistent system availability, fast response times, and reliable network connectivity. Consequently, users adoption intentions are strongly influenced by their confidence in the operational reliability of gate infrastructure, including QR reader performance, system integration, and on-site technical support. This finding extends UTAUT2 by demonstrating that facilitating conditions assume a heightened importance in infrastructure-dependent and standardized payment systems, such as national QR-based transit payments.

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Trust (TR) and Convenience (CON) also exhibit substantial effects on adoption intention, reinforcing the importance of perceived security and efficiency in gate-in payment systems. The significant role of trust suggests that users are particularly sensitive to transaction accuracy and system reliability when QRIS is used as an access mechanism rather than merely a payment tool. In gate in environments, transaction failures may result in denied entry or service delays, thereby increasing perceived risk and elevating the importance of trust in system security and error handling processes. Similarly, the influence of convenience reflects users preference for frictionless entry, minimal interaction steps, and quick transaction confirmation, all of which are essential in high-frequency commuting contexts. These findings are consistent with prior studies on digital payment adoption, while further highlighting that trust and convenience carry stronger operational implications in public transportation than in conventional payment settings.

Although Social Influence (SI), Effort Expectancy (EE), and Performance Expectancy (PE) remain statistically significant, their comparatively lower coefficients suggest that these factors play a secondary role in shaping adoption intention within the MRT gate in context. This indicates that while social encouragement, perceived usefulness, and ease of use contribute to adoption decisions, they are outweighed by concerns related to infrastructure reliability and transactional assurance. This pattern suggests that adoption in public transportation systems is less driven by social norms or perceived performance gains and more constrained by system-level readiness and operational dependability.

Importantly, the findings reveal a strong positive relationship between adoption intention (IA) and usability perception (UP), indicating that users with stronger intentions to adopt QRIS tend to evaluate the system as more usable after continued exposure. This result suggests that usability perception in gate in payment systems functions not only as a pre-adoption assessment but also as a post-adoption experiential evaluation shaped by users commitment to using the system. In the context of MRT gate in transactions, users who intend to rely on QRIS may develop familiarity with scanning procedures, adjust expectations, and adapt usage behaviors, leading to more favorable perceptions of system usability over time. This finding advances technology adoption literature by linking behavioral intention to post-use usability evaluation, offering a more dynamic perspective on user-system interaction in time-critical transportation environments.

From a theoretical perspective, this study contributes to the extension of UTAUT2 by demonstrating its applicability within standardized national payment systems deployed in public transportation infrastructure. The prominence of facilitating conditions emphasizes the need to reconsider the relative weight of infrastructural factors in adoption models applied to access-controlled environments. Moreover, by conceptualizing usability perception as an outcome influenced by adoption intention, this study moves beyond intention-centric frameworks and provides insights into post-adoption cognitive evaluation processes in mass transit systems.

From a practical standpoint, the findings suggest that MRT operators and policymakers should prioritize the reliability and consistency of gate in infrastructure to support large scale QRIS adoption. Investments in responsive QR readers, stable network connectivity, and clear transaction feedback mechanisms are essential to strengthen user confidence and minimize access disruptions. In addition, transparent communication and accessible on-site assistance can further enhance trust and reinforce positive usability perceptions, supporting the long term sustainability of QRIS implementation in public transportation.

The findings of this study provide both theoretical and practical implications. From a theoretical perspective, this research extends the UTAUT2 framework by demonstrating that Trust and Convenience play a central role in technology adoption within infrastructure-dependent and time-critical payment environments, such as public transportation gate in systems. Furthermore, the inclusion of Usability Perception as a post-adoption construct contributes to technology adoption literature by linking behavioral intention with users' experiential evaluation, suggesting that adoption intention not only precedes usage but also shapes perceived system usability over time.

From a practical perspective, the results indicate that transport operators and regulators, including MRT Jakarta and Bank Indonesia, should prioritize infrastructural reliability, transaction speed, and system integration to support seamless gate access. Strengthening network stability, providing clear on-site assistance, and communicating transaction security transparently can enhance user confidence and perceived convenience, ultimately supporting sustainable adoption of QR-based payment systems in urban public transportation.

CONCLUSION

This study demonstrates that the successful adoption of QRIS as a gate in the payment system in Jakarta MRT is strongly shaped by infrastructural readiness and users' confidence in system reliability. The findings indicate that in time-critical public transportation environments, adoption decisions are driven less by perceived performance or ease of use and more by the availability of supporting facilities, seamless system integration, and trust in transaction security. This confirms that digital payment adoption in mass transit contexts follows a distinct behavioral pattern compared to general consumer payment settings.

By extending the UTAUT2 framework with Trust, Convenience, and Usability Perception, this research highlights the importance of post adoption evaluation in understanding technology acceptance within public transportation systems. The significant relationship between adoption intention and usability perception suggests that sustained usage intention plays a critical role in shaping users' experiential assessments of QR-based gate access. From a practical perspective, these results emphasize the need for transport operators and regulators to prioritize infrastructure reliability, system stability, and user trust when implementing digital payment solutions at transit entry points. Future research may explore longitudinal usage behavior or compare QR based systems with alternative contactless technologies to further enrich the understanding of digital payment adoption in urban mobility systems.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest and that this research received no external funding.

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Grady Fane contributed to the conceptualization, formal analysis, data curation, methodology, visualization, and writing of the manuscript. Tanty Oktavia contributed to supervision, validation, review, and conceptual refinement. Both authors participated in the interpretation of the findings and approved the final version of the manuscript.

Data openness and transparency. To facilitate further research, the dataset used in this study has been made publicly available at https://doi.org/10.5281/zenodo.17524338 . Data supporting this study originate from survey responses collected for evaluating QRIS adoption in Jakarta MRT and are stored securely under restricted access. Due to confidentiality and respondent privacy, data sharing is subject to approval and a data-sharing agreement.

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